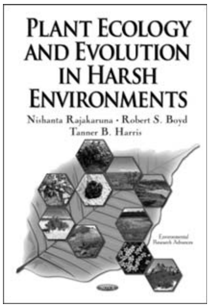
REVIEW



Plant ecology and evolution in harsh environments. By Nishanta Rajakaruna, Robert S. Boyd, and Tanner B. Harris (Eds.). Nova Publishers, Hauppauge, NY. 426 pp. ISBN 9781633219557. Price $250.00 (ebook).

Around the world, considerable plant diversity and endemism are hosted by environments in which plant productivity is sharply limited in some way. In many cases these special environments stand out as ''islands'' of unique, small-statured plants surrounded by seas of lusher, climatically determined vegetation. If it sounds to you like I am writing about Californian serpentines, there's a reason for that; our state is blessed with one of the world's best-studied special edaphic floras, about which many articles and several entire books have been written (including a few by me). However, Rajakaruna, Boyd, and Harris have set themselves the ambitious task of synthesizing current scientific knowledge about a much broader spectrum of harsh environments for plants: unusual bedrocks (gypsum, carbonate rocks, serpentine), saline soils, metal-contaminated settings, and even – to a relatively small extent – fire-prone and climatically challenging environments. The result is a wide-ranging collection of recent scientific work on how plants adapt to stress, and how stress shapes higher-order outcomes in evolution, ecology, and conservation.

Similarly to a recent edited volume on serpentine (Harrison and Rajakaruna 2011), and in contrast to several previous treatments of regional or global edaphic floras, the emphasis here is strongly on new scientific developments. Recent ''-omics'' techniques are being used to understand the physiological mechanisms by which plants and microbes adapt to various forms of stress, the genetics underlying these adaptations, and the phylogenetic relationships among adapted lineages; several chapters describe these techniques and the current status of the results. Some chapters focus on particular settings, such as gypsum soils or arctic-alpine climates, and provide multidisciplinary overviews of evolutionary-ecological research in these environments. Other chapters focus on particular taxonomic groups facing particular stresses, for example bryophytes in dry climates, lichens on metal soils, and the amazing genus *Mimulus* in its several extreme settings (copper mines, saline soils, serpentine). Still other chapters take a problem-centered approach, asking, for example, whether mycorrhizae play a special role on harsh soils, or whether plants on infertile soils face unique challenges with respect to conservation, restoration, and/or climate change.

Recurring questions throughout the book, well synthesized in the final chapter, include: is stress tolerance labile or conserved within lineages; are species tolerant through ecotypes or plasticity; is stress avoidance an alternative to tolerance; how does adaptation to one stress affect adaptation to another one; what role does stress adaptation play in the origin of new species? At the risk of partiality, one of my favorite chapters was Chapter 9 (''The Evolutionary Ecology and Genetics of Stress Resistance Syndrome Traits'' by von Wettberg, Ray-Mukherjee, D'Adesky, Nesbeth, and Sistla), because it poses the theoretical question fundamental to this book – what is stress and is there a general way that plants adapt to it? – and brings to bear an impressive array of recent techniques to address, if not fully answer, this question. As in all scientific syntheses, the unresolved questions outnumber the neat take-home messages.

Readers beware: this is not a natural history book; it is a roadmap into the scientific literature rather than out into the field. It also necessarily leaves many subjects thinly covered. As one outstanding example, carbonate rock floras need more synthetic work, comparable to what's been done on gypsum and serpentine. Fire-prone and harsh climates as plant stresses both richly deserve 16-chapter edited volumes of their own. Nonetheless, anyone interested in how the world's more challenging terrestrial environments contribute to biological diversity will find much to enrich their knowledge in this book.

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Literature Cited

Harrison S. and N. Rajakaruna. 2011. Serpentine: evolution and ecology of a model system. University of California Press, Berkeley, CA.