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# REVIEW

*Introduction to California Soil and Plants. Serpentine, Vernal Pools, and Other Geobotanical Wonders*. By ART R. KRUCKEBERG. 2006. University of California Press, Berkeley, CA. 280 pp. $18.95. ISBN-13, 978-0-520-23372-0.

*Serpentine Geoecology of Western North America. Geology, Soils, and Vegetation*. By EARL B. ALEXANDER, ROBERT G. COLEMAN, TODD KEELER-WOLF, AND SUSAN P. HARRISON. 2007. Oxford University Press, New York, NY. 512 pp. $124.50. ISBN-13, 978-0-19-516508-1.

## GEOECOLOGICAL EXTREMISM—OBSESSING ON GREEN ROCKS AND KOOKY SOILS

Serpentinite is the State Rock of California, a mineral associated with serpentine (Benitoite) is the California State Gem, the chromium and nickel in our drinking water and the asbestos in our air find their source in serpentine, something like 13% of California endemic plants are more or less restricted to serpentine soils, and now it turns out that the San Andreas fault may be sliding along a serpentine bed. This strange, rare, and often green product of the earth's mantle has a disproportionate influence on the environment that surrounds us. It is also beginning to have a disproportionate influence on the literature that surrounds us: a quick (and admittedly unscientific) search in Google Scholar turned up 36 hits for "serpentine" between 1950 and 1990, 5240 between 1991 and 1995, 8980 between 1996 and 2000, and 14600 between 2001 and 2005. The growing inventory of serpentine literature has been recently augmented by two new books treating the "geoecology" of serpentine rocks, soils, and biota in western North America: one for the layperson by the indomitable Art Kruckeberg, the other for the scientist, written by an all-star cast.

Kruckeberg's *Introduction to California Soil and Plants* is one of the latest supplements (Number 86, with six more already published since) to the venerable California Natural History Guides series published by UC-Press, and it is a worthy addition. It is the first of the series to treat soils, but it does so from a decidedly botanical viewpoint. This ends up skewing the book's pedologic treatment very strongly toward azonal (what Robert Ornduff called "kooky") soils, especially those developing on serpentine substrates. There is also consideration of—among other things—carbonates, dunes, and high water tables, but Kruckeberg's legendary expertise in serpentine geoecology leads unavoidably to a bias in this direction. If one is looking for a basic, even-handed treatment of different soils in California, this book will not fill the need. However, if one is looking for a lively and very engaging discussion of the very strong effects "kooky" soils can have on a region's flora, one would be hard-pressed to find a better, more readable, or more portable source.

For the most part, *Introduction to California Soil and Plants* is a pared-down reprise of Kruckeberg's classic *Geology and Plant Life*, published in 2002 by the University of Washington Press, but cheaper, in a sturdy pocketbook-sized paperback, and with color plates and photos (129 of them!). Obviously, it is also focused on California *per se*. I reviewed *Geology and Plant Life* for Madroño, and I have largely the same praise and criticisms for both books. For example, in this book as in his last, Kruckeberg still ignores the largely European roots of geoecology (what he calls "geoedaphics"); he continues to (proudly!) fly the flag of "geologic primacy" in driving species distributions, when nearly everyone else on the planet has settled on "climatic primacy"; and he relies primarily on older literature ($< 15\%$ of the literature cited was published in the last ten years). Like the last book, I love the focus on tabular and graphic presentation of information, and I enjoy Kruckeberg's informal writing style—it conveys the author's absolute infatuation with the subject and it pulls the reader blissfully along—but every once in a while it can tie itself in knots. For example, from page 22: "A final word on the taxonomic status of rare or distinctive variant plant populations is the situation for edaphic races of mostly widespread species." Tighter editing could have cleared these things up, and one can hardly blame the author for a few first-draft shiners making it through.

*Introduction to California Soil and Plants* contains six chapters and an Introduction. As in *Geology and Plant Life*, I found certain chapters to be very good and others to be a tad unsatisfying. Perhaps I unfairly compare the current pocketbook contribution to its hardcopy "father", but I often found myself craving a little more explanation. Given the space constraints of the UC Natural History Guide format, this would have required reduction of other text, but this could have been accomplished with better editing. As in *Geology and Plant Life*, Kruckeberg's treatment of landform effects on plant life (Chapter 1) leaves something to be desired (in particular, there is too much listing of

species and too little discussion of causal processes), but his chapters on serpentine (Chapter 3) and "other strange soil-plant relationships" (Chapter 4) are good, concise summaries of the topics. Chapters 2 and 5 are short treatments of the soil-plant system ("geoedaphics") and historical biogeography, respectively. At the end of the book, Kruckeberg deals with human influences (Chapter 6) and then provides a short (10 page) annotated list of interesting places to view geoedaphics under the sun. For the layperson with an interest in serpentine soils and flora and a fancy for other geoecological novelties, *Introduction to California Soil and Plants* is a great buy ($18.95 in paperback), especially for planning roadtrips!

In *Introduction to California Soil and Plants,* Kruckeberg laments that conservation of serpentine habitats in California is "low to nonexistent". This concern is belied by information in *Serpentine Geoecology of Western North America*, which lists about 50 conservation areas on serpentine in California in Appendix F (and the list is incomplete). This is somewhat exemplary of the relationship between these two books—the first is wonderfully passionate and perhaps a tad too concise, the second is wonderfully dispassionate and—in places—a bit long-winded. Alexander et al.'s *Serpentine Geoecology of Western North America* was intended to appeal to the more scientific side of the serpentine audience, and it fills this role well. There is an amazing amount of information in this book: including some repeats (due to multiple reference sections), there are almost 41 pages of references, making this the most complete serpentine bibliography I have seen.

*Serpentine Geoecology of Western North America* includes an Introduction and 24 chapters organized into five parts: *Geology and Hydrology, Soils and Life in Them, Plant Life on Serpentine, Serpentine Domains of Western North America,* and *Social Issues and Epilogue.* There are also seven appendices. The authors' pedigrees are unassailable: Alexander is one of the most experienced field pedologists in the western United States, Coleman is the widely-recognized dean of serpentine geology, Keeler-Wolf is *the* expert in California vegetation classification, and Harrison may be the most published researcher in serpentine ecology worldwide. *Serpentine Geoecology of Western North America* sets out to assume the role of the go-to source for everything serpentine, and it does an admirable—if somewhat unbalanced—job.

Part I, which treats the geology and hydrology of serpentine in three chapters, is—for me—disappointingly brief. The geologic story of ultramafic rocks, their origins, and their improbable presence on the continents forms the fascinating core of the serpentine story, but Alexander et al. only dedicate two pages of text to this topic. More detail is provided in the chapters on mineralogy-petrology and water, but the total length of Part I is still only about 1/4 the length of the ensuing section on soils (34 vs. 122 pages). Some of the writing in Part I is awkward and difficult to follow, and there are many terms without adequate definition: e.g., Alpine-type serpentinites, crustal thinning, rootless slabs. Part I falls in that middle ground where laypeople may have trouble following the story, but experts will likely go elsewhere for more detail.

In contrast, Part II—*Soils and Life in Them*—is very long and very dense. Part II sometimes reads more like a soils textbook than a treatise on serpentine soil ecology: some of the information presented lacks a demonstrable link to the serpentine story, and a number of long tables could easily have been reduced or dropped. For example, the information in Table 5-1 (3 pages of soil carbon values) is duplicated in a subsequent figure and could have been dropped. Table 8-5 comprises seven pages of elemental concentrations in plants that could easily have been halved (and the clarity of presentation increased) by presenting means plus ranges for each species treated. The language of Part II also assumes a familiarity with soils terms, concepts and naming conventions that many readers won't have: if ochric epipedons and Xeric Kanhaplohumults are part of your parlance you'll cruise right through, but otherwise Chapters 5 and 6 will be a slow (if informative) read. Chapters 7 and 8 are better written and more to the point. Chapter 7 deals with animal, fungi, and microorganisms and provides the best review of serpentine-animal relationships that I have seen; the information on serpentine mycorrhizae is also well-aimed, although it lacks reference to many recent studies from Portugal and Spain, other Mediterranean-climate areas with clear applications to the California situation. Chapter 8—*Serpentine Soils as Media for Plant Growth*—is also very good and covers soil water and soil fertility in (sometimes overly) great detail.

For me, Part III—*Plant Life on Serpentine*—is the best written and best organized part of the book, especially in its treatment of individual plant responses (Chapter 9). It begins with well-done sections on ecological reasons for tolerance and intolerance to serpentine, and then (too) briefly treats evolution of serpentine endemism. This is one area where I would have liked more elaboration—a lot of interesting and important research has used serpentine as a model system to study basic evolutionary processes, and Alexander et al.'s short treatment does not do the topic justice. Chapter 10 presents a succinct overview of plant community ecology on serpentine, providing a nice outline of what we know about biotic and abiotic drivers of vegetation patterns

on ultramafics. Part III finishes with two chapters providing (Chapter 11) an overview of the basic physiognomic types one encounters on serpentine (a minor peeve: a number of species are incorrectly identified in this chapter as serpentine endemics, including *Aspidotis densa*, *Hesperevax sparsiflora*, and *Castilleja minor*), and (Chapter 12) a 46 page summary of the vegetation Alliances thus far "recognized" on serpentine soils in the western US. The Alliances are described using the American ("Daubenmire") method, which relies heavily on canopy dominants rather than considering all species in its classification. Perhaps unavoidably, Chapter 12 reads a bit like a laundry list, but it is certainly useful information.

Part IV—*Serpentine Domains of Western North* America—is the longest in the book (153 pages), and leads the reader on a virtual fieldtrip along the West Coast, beginning in Baja California and finishing in northern Alaska, providing background on geology, soils and vegetation for a total of 112 different serpentine sites. Coverage of the sites is uneven, but at any level this is a stupendous compilation of information and would have been worth publishing in its own right. The book finishes with a short Part V, which outlines land use and human health concerns associated with serpentine, and then concludes with a final "synthesis" chapter.

Overall, *Serpentine Geoecology of Western North America* is in a class by itself, as no other book treats this multifaceted topic in this kind of detail. I have a few general complaints: for example, the glossary should be expanded and glossary words in the text should be identified in bold type, and the book could have been molded into a more balanced, "cleaner" read by stronger editing (and internal inconsistencies—which are common in tomes written by multiple experts—could have been avoided). These issues don't detract from the value of the book however, and—the price notwithstanding—anyone with a serious interest in the geology, soils, and vegetation of serpentine will want *Serpentine Geoecology of Western North America* on their shelf.

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