BOOK REVIEW

Life in the Cerrado. Vol. I. Origin, Structure, Dynamics and Plant Use. By G. Gottsberger & I. Silberbauer-Gottsberger. Abteilung Systematisch Botanik und Okologie und Botanischer Garten Universität Ulm, Germany. 2006. 277 pp. ISBN 3-00-017928-3. Price 49 euros (not including postage). Information about purchase of the book at http://www.cerrado.eu/avail.html.

Life in the Cerrado. Vol. II. Pollination and Seed Dispersal. By Gerhard Gottsberger, & Ilse Silberbauer-Gottsberger. Abteilung Systematisch Botanik und Okologie und Botanischer Garten Universität Ulm, Germany. 2006. 383 pp. ISBN 3-00-017929-1. Price 59 euros (not including postage). Information about purchase of the book at http://www.cerrado.eu/avail.html.

It is not often that I am able to so thoroughly enjoy and learn so much by reviewing a book, but this is one of those times. The two-volume *Life in the Cerrado* by Gerhard Gottsberger and Ilse Silberbauer-Gottsberger captured and held my attention for the following reasons. In the first place, Gerhard and Ilse arrived in Brazil in the late 1960s and studied *cerrado* mostly in the state of São Paulo until 1982. I lived in Bahia from 1978 to 1980 and became very much aware of their work, first by hearing about them at Brazilian botanical congresses and then by reading their papers as they became available. It is especially gratifying to read their book because they are among the few botanists that have so effectively summarized what they have learned from their career-long research interest in *cerrado*. In the second place, *cerrado* covers most of the *planalto* of Brazil, a country which occupies one-half of all of South America, and is a major ecosystem of that continent. Thus, it is of interest to all who study neotropical plants and animals, as I have done throughout my career. Finally, I value this book because it provides a wealth of data about plant/animal interactions that is applicable to similar interactions in tropical vegetation throughout the world, including the Amazonian and Guianan rain forests that I study.

Life in the Cerrado is separated into two volumes: Vol. I. Origin, Structure, Dynamics and Plant Use and Vol. II: Pollination and Seed Dispersal. The first volume includes chapters dealing with the definition of *cerrado*, geography, geology, soil, physiognomy, relationships with different vegetation types, origin, floristic diversity, community structure, physiognomy, tree age, tree growth, water balance, fire, frost, seasonality, seed germination, useful plants, conservation, human inhabitants, and the future of *cerrado*. The second volume is dedicated to plant/animal interactions and includes information about reproductive biology, generalist pollination, small and medium-sized bee pollination, large bee pollination, pollination of Bignoniaceae, pollination systems of *Jacaranda* (Bignoniaceae), the bee *Oxaea flavescens*, buzz pollination, oil flowers, bees in general, fly pollination, pollination of palms, beetle pollination, pollination of Annonaceae and *Philodendron* (Araceae) by beetles, butterfly pollination, moth pollination, pollination of Vochysiaceae, bat pollination, hummingbird pollination, wind pollination, pollination of all plants in 1 ha of *cerrado*, sex expression and breeding systems, plant predation, ants and termites, animals as seed dispersers, the study of seed dispersal, field work methods, principal dispersal modes,

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dispersal of grasses, modes of zoochory, dispersal modes and fruiting times, comparison of dispersal in *cerradão* and *cerrado*, and distribution pattern in relation to dispersal mode. Almost every topic related to *cerrado* has been covered in these two volumes and, thus, this book is a must for all botanical libraries and most researchers studying tropical ecology. I have provided an extensive list of what is in these two volumes because I want the reader to know how complete this discussion of *cerrado* is.

Life in the Cerrado is based, to a large extent, on the research of Gerhard and Ilse, but it also includes an exhaustive review of the literature, which is essential for a book of this type. It is especially significant that the authors are fluent in at least German, Portuguese, and English which has enabled them to include most of the major publications on *cerrado*, the majority of which are in Portuguese. They are also close friends of George Eiten who is one of the leading *cerrado* ecologists of all time, and they most certainly benefited from their interaction with him as evidenced by numerous citations of his papers, especially in the first volume.

The abundant line illustrations, graphs, and superb photographs in both volumes are great additions to this book. They range from the lucid depictions of the different types of *cerrado* described in volume one to the marvelous flower and pollinator images of volume two. Before reading a chapter, I would peruse the drawings and photography which, by themselves, gave me a very good idea of what was covered in the chapters and allowed me to visualize what I was reading. It practically took my breath away as I turned the pages to see one stunning image after another.

Life in the Cerrado provides a wealth of original information, not only in the text and images, but also in the numerous tables that provide data about such things as the life forms of different species, uses of various species, common names of plants used by Indians, pollinator and dispersal syndromes, lists of species and their pollinators, and lists of species and their dispersal agents. These lists allow other botanists to easily compare their studies with the studies of *cerrado* described in this book.

In short, I truly enjoyed reading these volumes and learned a great deal from taking the time to do so. Thus, I am able to recommend *Life in the Cerrado* without reservation to those with a passion for tropical ecology, and I am sure that many will want to read both volumes from cover to cover. However, I would like to address two points to consider while reading the book.

The concept of *cerrado* has always puzzled me because it is not a single vegetation type but, in my opinion, actually a continuum of vegetation types ranging from forest to prairie. *Cerrado* is very clearly defined by Gerhard and Else in Chapter 7, *Vegetation Physiognomy*, in the first volume. In this Chapter 5 different vegetation types are included under the concept of *cerrado*. Ranging from the most to the least arborescent form they are *cerradão* (= forest), *cerrado s. s.* (= low forest), *campo cerrado* (= savanna), *campo sujo* (= savanna), and *campo limpo* (= prairie). Nearly all vegetation types grade into one another so this situation is not unique to what is called *cerrado* in central Brazil. Ecologists elsewhere have not felt the need to lump them all into one vegetation type. I feel that treating *cerrado* as a single vegetation type creates a great deal of confusion when trying to equate *cerrado* to other vegetation types of the world. The authors did not convince me that lumping forest, savanna, and prairie into a single "vegetation type" called *cerrado* allows for consistent naming of vegetation types.

The second volume provides a wealth of data about pollinators and dispersal agents but does not place the discussions in a phylogenetic context. For example, the scenario for floral evolution of the Vochysiaceae in Chapter 19 is based on speculation that does not adequately take into account the evolutionary relationships of the genera discussed. In particular, the evolution of the actinomorphic flowers of *Salvertia convallariodora* from zygomorphic-flowered *Vochysia*-like ancestors as suggested by the authors does not seem likely because evolution most often proceeds from actinomorphic to zygomorphic flowers.

In addition, all possible outgroups of Vochysiaceae have actinomorphic flowers, suggesting that the flowers of *Salvertia* are less advanced than those of *Vochysia*. Nevertheless, Gerhard and Ilse have developed a hypothesis that can be tested as phylogenies of the family become available.

Life in the Cerrado represents a very important contribution to botanical science, and, judging from other reviews of it that I have read, other botanists agree with this conclusion. —Scott A. Mori, Institute of Systematic Botany, The New York Botanical Garden, Bronx, New York 10458–5126