

The book is well produced. The few errors I noted are trivial with one exception: reference is made on p. 164 to Fig. 4.3 when Fig. 4.5 was intended, and this may confuse readers unfamiliar with the models used.

Besides being a major advancement in our knowledge of free-ranging kangaroos, this book also contributes important new insights into how a system can respond predictably to an unpredictable driving variable. There is much in this book

for a wide range of theoretical and applied ecologists, and I recommend it highly.

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MICROBIAL ECOLOGY IN AN ECOSYSTEM CONTEXT

Richards, B. N. 1987. **The microbiology of terrestrial ecosystems.** Longman Scientific and Technical, copublished with John Wiley and Sons, New York. xvi + 399 p. \$44.95 (paper).

Though the world is not lacking good microbial ecology texts, very few focus specifically on terrestrial communities; fewer still (in fact, only this one?) approach the subject from an ecosystems perspective. In this text Richards updates and expands upon his earlier *Introduction to the soil ecosystem* (1974. Longman, New York) in a reasonably successful attempt to narrow the gap between soil microbiology and plant ecology via a detailed examination of plant-microbe interactions in the context of natural ecosystems.

The book is organized into eight major sections. The first two set the stage: in Chapter 1 we are presented with nutshell reviews of ecosystem structure, soil classification, and the taxonomy of the major groups of soil organisms, and in Chapter 2, with an overview of the food and nutrient resources available to these organisms. Chapters 3–5 provide much of the ecosystem context: Chapter 3 (*Pattern and Process in the Soil Ecosystem*) covers the concepts of limiting factors, ecological succession, and the types of microbial interactions present in soils, Chapter 4 covers energy flow, and Chapter 5 considers nutrient cycling. The final three chapters are more specific to direct plant-microbe interactions: Chapter 6 examines the rhizosphere and Chapters 7 and 8 describe mycorrhizal and nitrogen-fixing symbioses respectively.

As one might suppose from the breadth of material covered in the two introductory chapters, they are rather dense and perhaps best traversed with the help of either a solid background in ecosystem ecology, soil science, and microbiology, or a capable lecturer who has access to ancillary texts and a well-developed flair for distilling entire disciplines into ten-penny paragraphs. The soil taxonomy section suffers the additional problem of being of little use to North American audiences as it all but ignores the soil classification scheme now used by U.S. soil scientists.

Virtually none of the remainder of the book suffers from such faults. Though the text does bog down at times with lengthy lists of terms to define, throughout most of the book the explanations of both ecological and microbiological concepts are lucid, concise, and well-illustrated. A case in point is Chapter 3, which contains a very nice, up-to-date discussion of plant succession that ties in beautifully with a subsequent and thorough discussion of microbial succession, the colonization and successive replacement of organisms on organic substrates such as leaf litter. Few microbial ecologists have had the background or inclination to tie soil microbiology into general ecological theory in such a way, and this linkage is long overdue.

Other major strengths of this work include Richards' discussions of organic matter dynamics (the composition and availability of organic matter to various groups of organisms), and—betraying his own major research interests—his treatment of symbioses, especially those involved in nitrogen fixation. Richards' coverage of other microbial processes, however, is a bit weaker. Nitrification, for example, is portrayed as a process that occurs rarely in low pH soils, and the discussion of nitrification in secondary succession is several years out of date. Nevertheless, no major microbial processes in soils are ignored and a reasonable bibliography—containing a number of interesting historical references—supplies ample opportunities for readers to delve into the primary literature on their own.

In sum, Richards has achieved well what he set out as his primary task: to present terrestrial microbial ecology in an integrated ecosystem context. I would not use this book as an undergraduate course text without substituting material from other sources for the first two chapters, but apart from this reservation I would expect this volume to fill a niche among existing ecology texts that has for too long gone unfilled.

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