
BOOK REVIEWS

Soil Ecology

2001. Patrick Lavelle and Alister V. Spain. Kluwer Academic Publishers, Dordrecht, The Netherlands, 654 pp., \$ 295.00

IN writing *Soil Ecology*, Lavelle and Spain have tried to integrate the large body of knowledge from all the various areas that make up soil ecology. And, by and large, they have succeeded at this challenging task.

The book is divided into four substantial chapters: I. Internal Environment, Microclimate, and Resources; II. Soil Formation; III. Soil Organisms; and IV. Functioning of the Soil System. With chapters of this magnitude, good organization is a must, something the authors have accomplished through the generous use of descriptive subheadings.

Chapter I includes classical descriptions of the soil in terms of physical characteristics, structure, soil atmosphere, heat and water fluxes, and organic and inorganic nutrient sources. Each section contains a large amount of information, and this encyclopedic approach can sometimes make it difficult to see the forest for the trees. Although the book appears to have been written mainly for an audience literate in soil science and/or ecology, the level of detail provided is sometimes puzzling. For example, the subsection on clay and clay minerals is really a mini-treatise on the subject, touching on everything from the basics of cation exchange capacity to specific surface area of phyllosilicates to comparisons of CEC values of soils from different orders. There are many opportunities in this chapter for making the connection between fundamental soil properties and soil ecology, but these are mostly deferred to later chapters. By contrast, the authors do a good job of integrating the soil micro- and macrobiota into descriptions of the genesis and breakdown of soil aggregates. Organisms are placed in an appropriate temporal and spatial context, such that their role in aggregate dynamics is clearly explained. Similarly, the section on soil resources provides an excellent description of the speciation and spatial and temporal distribution of nutrient elements, and of their impact on the structure and function of the soil ecosystem.

Nevertheless, Chapter I is really an introduction to the basic concepts soil science (and a pretty good one), with some emphasis on the ecological aspects of soil.

The importance of soil biota as a soil-forming factor has gained prominence in the last few decades. This is partly the result of a better understanding of the range of conditions under which organisms (especially bacteria) can thrive, an improved ability to detect microorganisms, and of the wide diversity of processes carried out by soil organisms. In this context, it is logical that a chapter (Chapter II) would be dedicated to soil formation. The chapter addresses topics in soil genesis ranging from very basic (horizon designations) to advanced (e.g., ferrallitisation). The authors do a much better job of placing the information in this chapter within the context of soil ecology. For example, the direct and indirect effects of biological activity in chemical weathering processes, particularly the contrasting roles of invertebrates in preventing (earthworms) and promoting (arthropods) chemical weathering of mineral structures, are described within the context of weathering and soil formation. Similarly, examples of the role of bioturbation as an important mechanism for soil formation are clear, well documented, and provide the reader with a detailed account of the contribution of rodents, earthworms, termites, and ants to pedogenesis.

Chapter III is dedicated to soil organisms and is divided into sections on microbial communities (viruses, bacteria, actinomycetes, fungi), invertebrate communities (protozoa, nematodes, collembolan, acari, enchytraeids, earthworms, termites, ants), and roots. Within each subdivision are found basic descriptions of the biology of the main members of each community, as well as discussion of the population density, species richness, community structure, and spatial and temporal distribution of groups of organisms. The section on roots describes their morphology and biology in good detail, and the information is discussed in the context of the soil environment. There is limited discussion of interactions of roots with other organisms in this chapter; however, the section on the rhizosphere in Chapter IV covers most of the important topics in this

area. The information provided in Chapter III is generally solid, with a number of interesting, contemporary hypotheses regarding the turnover and distribution of soil organisms discussed. For example, the authors describe the "Sleeping Beauty Paradox," put forth by Lavelle et al., to explain certain aspects of microbial community dynamics. It involves macroorganisms acting as "Prince Charming," changing environmental conditions to "wake up" a largely dormant microbial population ("Sleeping Beauty"). In addition, the section on invertebrate communities has a very interesting discussion of the adaptive strategies of soil invertebrates, including the physical and physiological constraints on their activities, as well as controls on their temporal and spatial distribution in the soil at different scales.

The last chapter of *Soil Ecology* is entitled "Functioning of the Soil System." The subsections within it are "Decomposition," "The Litter System," "Rhizosphere," "The Drilosphere," and "The Termitosphere." This chapter is where much of the information presented in the first three chapters is integrated, describing how the interplay among soil organisms and their physical environment brings about many of the unique transformations of matter that take place in the soil. The section on decomposition introduces the reader to its dynamics and the factors (e.g., climatic, edaphic, resource quality, interactions between decomposing organisms) that govern its rate and extent. This leads to an introduction of the various "spheres" within which interactions among resources, microorganisms, and macroorganisms occur, and a discussion of microbial foodwebs. For each "sphere," the physical characteristics and composition of the system are described, as are the decomposer communities involved. The processes (e.g., comminution, nutrient uptake, mineralization) that take place within a particular sphere are described, as are the ecological interactions (e.g., grazing, symbiotic N₂ fixation, inhibition of nitrification). These activities are placed within the context of the cycling of nutrients both at the "sphere" and larger scales. Of particular interest to this reviewer were the sections involving ecosystem engineers: the drilosphere and termitosphere. The authors have done an outstanding job of integrating the interaction among resources, micro- and macroorganisms within the context of the structures built by these organisms, providing an excellent synthesis of the ecosystem ecology involved in nutrient cycling within these "spheres." In addition, the relevance of these activities to the productivity and

functioning of agricultural and natural ecosystems is well described.

Books of this magnitude are bound to contain errors of fact, and *Soil Ecology* certainly has its share. However, they tend to be of the minor, forgivable variety, and generally do not get in the way of the message. The book is generally well illustrated with black and white pictures and clear line diagrams. Descriptions and discussions are supported by a considerable amount of data displayed in clear figures and tables. Many of the examples used are from areas that the authors are familiar with (the tropics and Western Europe), but in general the authors provide even coverage of geographic areas, as well as a large number of comparisons across geographic areas. The book is thoroughly referenced and indexed effectively.

Lavelle and Spain's *Soil Ecology* synthesizes the current understanding of the ecology of soils and places it in proper perspective. Its encyclopedic approach to the subject is generally successful. This book should appeal to a broad audience, from those seeking detailed information about soil ecological processes to those wanting to understand the broader context within which soil ecological interactions take place. Unfortunately, its price (\$295.00) puts it out of the reach of many potential readers.

I suspect that many readers of this book will be perusing a library copy.

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Techniques in Mycorrhizal Studies

2002. K. G. Mukerji, C. Manoharachary, and B. P. Chamola. *Kluwer Academic Publishers*, 554+ pp., U.S. \$202.

THE editors have included 24 chapters by 33 experts, with chapters ranging in length from 12 to slightly over 200 pages, and the number of references range from a few to more than 200 per chapter. Of the 33 authors, 31 are from India and 2 are from Canada. As stated by the editors, "the aim of this book is to describe the various techniques used to study the mycorrhizal biology."

The book is divided into five major sections. Chapters 1 to 5 cover basic knowledge of soil and root microflora with emphasis on mycorrhizal fungi. Chapters 6 to 8 deal with ectomycorrhizal fungi. Chapters 9 to 17 focus on AM/VAM fungi. Chapters 18 to 21 review ericoid, orchidoid, and

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