



Book reviews

D. R. Nielsen and O. Wendroth. 2003. **Spatial and Temporal Statistics. Sampling Field Soils and their Vegetation.** Catena Verlag, Reiskirchen, Germany. 416 pages, many illustrations. Paperback. ISBN 3-923381-46-6. Price: 50 EUR.

This is a new member of a new series, “*GeoEcology Textbooks*”, most certainly welcome by all people interested in the application of statistics to geology, environmental sciences and related fields. This book is a result of a considerable effort to summarize all relevant information from the subject in a fairly straightforward manner. Nevertheless, the reader becomes somewhat disappointed after reading the first pages. The subtitle of the book implies perhaps that at least an introduction to sampling theory and technical details is included, but the discussion is scattered throughout the book (e.g., there is a 2-page subsection on the selection of sampling interval, and another one on plot size in Chapter 2). The first chapter starts „in medias res” with descriptive statistics, i.e., from a point where the data are already available. Perhaps it would have been useful to begin with an introductory chapter on sampling designs and related issues. As a compensation, however, the reader finds many questions relevant to sampling in the beginning of each chapter and answers to these questions embedded into the text.

The book falls into eleven major chapters, plus a postscript, an appendix and an index. The chapters have similar structure: after the discussion of theoretical and practical details, the reader finds an overview on potential research topics, a summary of references and several exercises. This makes the book a real text, undoubtedly useful for lecturers and students. A limitation is that almost all examples come from soil science and agriculture, with interest only in the production of one particular plant, i.e., the „vegetation” mentioned in the subtitle of the book should always be understood as a monoculture. Chapter 1 is a review of descriptive statistics and elementary statistical methods such as linear regression. The next chapter introduces the central concept of geostatistics, that is spatial autocorrelation. The readers will find this summary very illuminative and comprehensive. This holds true for the next chapter as well in which the concept of autocorrelation is extended to the relationship between two vari-

ables, i.e., to cross correlation. Semivariograms are introduced in Chapter 3; in these cases differences between pairs of observations play the central role in depicting spatial variability. Spatial interpolation is the subject matter of the next chapter, with emphasis on one particular method, kriging. Its extension to pairs of variables is given in Chapter 6 (Crossvariograms and Cokriging). The study of periodic variation in space or time is possible with spectral analysis, the subject matter of Chapter 7. Its natural extension to the comparison of two properties is cross spectral analysis, the subject matter of Chapter 8. Autoregressive and moving average functions of the next chapter are useful in making predictions. State-space analysis and models represent the most advanced topics and are discussed in the concluding two chapters.

In summary, the techniques discussed in the book are mostly of uni- or bivariate in nature, and are the geostatistical extensions of classical biostatistics. As such, the procedures are most appropriate to crop and soil science, and to ecological studies in which interest is restricted to few variables. Truly difficult problems, that is variation in a multispecies community and its evaluation are usually of primary concern in community ecology but they are clearly beyond the scope of Nielsen and Wendroth’s text. Nevertheless, the style is clear and the argumentations are fairly easy to follow even for the beginners. I can recommend the book to all researchers and students interested in learning fundamental aspects of spatial variation and in the analysis of spatial independence.

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Y. Gutterman. 2002.: **Survival Strategies of Annual Desert Plants (Adaptations of Desert Organisms).** Springer-Verlag, Berlin, Heidelberg, New York. xx + 348 pages. Hardcover. ISBN: 3-540-43172-1. Price: 159.00 EUR, 111.50 GBP, 179.00 USD.

Annual desert plant species of unrelated taxa in the Negev Desert of Israel have developed complementary sets of adaptations and survival strategies as equivalents

during the different stages of their life cycles. The author, Y. Gutterman gives a broad view of - and a fundamental introduction to - this topic, after about 40 years of research in hot deserts. Living for 25 years in the central part of the Negev Desert, he had the opportunity to observe closely the different environmental factors that may affect the emergence and survival of plants in this region. This book had its genesis as a part of the pioneering series 'Adaptations of Desert Organisms' with the previous volume 'Seed Germination of Desert Plants' written by the same author.

The volume is divided into eight chapters (with taxonomic and subject index, respectively). The Chapter 1 expands our knowledge about the desert biome (the environmental factors in deserts and arid zones), especially about the Negev Desert (e.g., rain and runoff water, the role of the biotic activity in the water distribution and plant succession, and the microclimate). Additionally, survival adaptations and strategies of annual plant species living here are summarised (types of their life cycles, seed dispersal and seed germination strategies), as well as the role of seed collectors (seed consumption).

Chapter 2 surveys the topic of the flowering adaptations and strategies of perennial and annual plants of the selected habitats. The characteristic species of the one-seasonal winter annuals (including facultative long-day response for flowering, FLD, and day length independent response for flowering, DIF), of the single-season summer annuals, and of the bi-seasonal plants (including long day response for flowering, and facultative short days response for flowering at high temperatures) are discussed in detail.

Chapter 3 deals with the survival strategies of phenotypic plasticity of germination during seed development and maturation. It shows the environmental factors affecting phenotypic germination plasticity (e.g., day length, light quality, water and temperature stresses), and how the seed position on the mother plant during seed development and maturation affects seed germination (position effect).

Chapter 4 covers dormancy after seed maturation (as a strategy of phenotypic plasticity of germination). Details are given on how the post-maturation environmental influences (e.g., length of periods of storage of dry seeds at high temperatures, day length, changes in relative humidity) affect dry seed primary dormancy (after ripening), as well as the role of the "bet hedging" germination (seed bank in soil).

Chapter 5 describes the relationship between seed consumption and seed dispersal adaptations and strate-

gies. It deals with seed dispersal seasons in the case of one-season winter annuals, and with seed dispersal by wind in the case of bi-seasonal annuals. These survival strategies have developed in two main but extreme opposite directions in order to reduce seed predation: the 'escape' or 'opportunistic' germination strategy against the 'protective' one.

Chapter 6 discusses the germination adaptations (of local genotypes), strategies and influences on germination during seed wetting. The germination of the seeds in the soil seed bank may be regulated by environmental factors including range of temperatures, length of wetting, amount of rain, relative humidity, habitat location, light, and germination inhibitors.

Chapter 7 deals with the embryo and seedling survival and plant development. First, the embryo and seedling drought resistance is introduced, but there is a disturbing confusion of the desiccation tolerance with the drought tolerance. The role of amounts of water (irrigation or precipitation) affecting seedling survival is described regarding the interspecific and intraspecific competition of seedlings.

Chapter 8 is a summary of the complementary sets of survival strategies of some common species of the Negev Desert. The complementary adaptation and survival strategies at each stage may contribute to increasing the chances of survival of a species, even under extreme desert conditions.

The well-illustrated book contains 184 (black-and-white) figures (e.g., many scanning electron microscope photos) and 71 tables (in the tables the references are indicated, so the reader can easily check the data). A general understanding of the terminology of biology is assumed. Although not the most recent (up to 2001), the more than 460 references can help researchers to become immersed in the theme. Relatively great number of references is written by the author, Y. Gutterman. The subject index with more than 500 keywords and the taxonomic index with 180 taxa are useful for orientation. A comparatively weak point of the volume is that relatively more is devoted to experimental data, figures and tables from observed case studies than to conclusions. The final outline of possible foci for future research work is missing at the end of the volume, too.

Due to the highly specialised topic, this book is recommended to experts as well as to others with interest in plant sciences (physiology, ecology, conservation biology or botany). A most valuable trait of the book is the comprehensive summary of our actual knowledge on the adaptations and survival strategies of annual desert plants,

what was not as yet available. Aided by analysis of numerous experiments and case studies observed in the Negev Desert (assessing critically the importance of the experimental systems available for investigation), the author demonstrates that these plants are not just interesting exceptions, but one of the greatest survivors of their habitat. For this reason, the book is deploying valuable new information even for the researchers in the field. Taken together, the price for the book is moderate.

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P. S. Johnson, S. R. Shifley and R. Rogers. 2002. **The Ecology and Silviculture of Oaks**. CABI Publishing, Wallingford, UK. 503 pages. Hardback. ISBN 0 85199 570 5. Price: 85.00 GBP, 149.00 USD.

This book is an attempt to synthesise a wealth of information into an holistic framework of knowledge. Even though only the oaks of the United States are discussed in the book, the vast and diverse body of literature on them made this attempt a daunting task. Yet, as the authors point out, silviculture is the synthesis of everything that is known on forests, it is thus necessary for forest managers to master the holistic approach. This book, with much success, helps by presenting the essence of the necessary most up-to-date knowledge, both theoretical and practical, in a well-structured way.

The ten chapters of the book are divided into three parts, but, in fact, can be grouped into two: Ecology and other background information, and Silviculture. After an introduction to the taxonomy and geographical distribution of oaks, the first chapter, Oak-dominated Ecosystems, describes the main oak regions of the United States. Each region is characterized by the following information: geographic extent; climate, physiography and soil, forest history, and oaks as components of the region's forests.

Chapters two and three cover the body of knowledge that may well be the most crucial to silviculture: how oaks regenerate themselves. Chapter two, Regeneration Ecology I: Flowering, Fruiting and Reproduction Characteristics, may seem to be of relevance to researchers only. However, the understanding of what and how affects acorn production may greatly influence harvest and regeneration regimes if oak is to regenerate naturally. Likewise, root and shoot growth are to be considered for successful regeneration, especially in relation to those of

competing species, and to disturbance effects. These issues, along with many others are discussed in Chapter three, Regeneration Ecology II: Population dynamics.

Chapter four, Site productivity, is the shortest chapter, giving a broad overview on the topic with many examples and data on oaks. Note that this chapter addresses productivity, rather than tree growth, and can be regarded as part of ecology that influences stand development, regeneration and other ecological processes.

Chapter five, Development of Natural Stands, is a clear and well demonstrated summary of a very complex phenomenon: how forests change over time as a result of events originating from inside and outside the forest. Given that even-aged stands are by far the most known in this respect, most of the chapter is devoted to the development of these stands. However, disturbances and disturbance-recovery cycles are also discussed, again with examples for oaks.

Chapter six, Self-thinning and Stand Density, is a more silviculture-oriented description of some aspects of stand development, which rank among the most important concepts in traditional forest ecology and silviculture. After providing the necessary theoretical background, the chapter describes stand density diagrams and other diagrams, which can be of great help to the practicing silviculturalist.

The next three chapters are the core sections on silviculture. Chapter seven, Even-aged Silvicultural Methods, gives an overview of what-to-do and how-to-do in the oak dominated stands from regeneration (whether natural or artificial) through intermediate cuttings, reducing insect and disease impacts to how to consider economic, environmental and social issues. With ample examples, the text inherently demonstrates how ecological background is necessary to take sound silvicultural actions while also respecting many other aspects of silviculture.

The next chapter, Uneven-aged Silvicultural Methods, is not simply another chapter in the book. It explains the most complex silvicultural systems, how they can be applied in oak forests, and what their possibilities and limitations may be. It points out that the long-term sustainability of the single-tree selection method in oak forests remains to be verified in practice, as well as that documented applications of group selection method to oak forests are limited and restricted to inconclusive or undemonstrated long-term results.

Chapter nine, Silvicultural Methods for Multi-resource Management, includes examples when the pri-

mary objective of the management is not timber production. The need for managing savannas and old growth, or managing for acorn production and aesthetic values prove how diverse oak forests are, and how multiple services oaks can provide us with. The chapter demonstrates well the experience gained in these special, but not rare management situations.

Finally, the chapter on Growth and Yield provides useful information to foresters on many growth characteristics of oak trees and stands, and modelling growth and yield. In addition, it presents examples which could be interpreted as ecologically important, such as survival rates, relative growth of various species, and responses to thinning. Thus, this chapter could have been placed well in Part I, Ecology.

Throughout the book, the authors think about oak forests as responsive ecosystems. Since these ecosystems are complex, and the consequences of human interventions are long-term, it is wise to take actions only if the functioning and reactions of these ecosystems are well understood. With 201 figures and photos, 36 tables, and seven useful Appendices, the book is of great help in this understanding. Therefore, this book is a must for everybody responsible for managing oak forests.

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J. Belnap and O. L. Lange (eds.) 2003. **Biological Soil Crusts: Structure, Function, and Management** (Ecological Studies, Vol. 150). 1st edition, revised 2nd printing. Springer-Verlag, Berlin, Heidelberg, New York. xviii + 503 pages. Softcover. ISBN: 3-540-43757-6. Price: 49.95 EUR, 35.00 GBP, 59.95 USD.

In arid and semiarid lands throughout the world, where the cover of vegetation is sparse or absent, the open ground is not bare but generally covered by a community of small, highly specialized organisms. This soil-surface community consists of cyanobacteria, algae, lichens, bryophytes and microfungi, aggregating soil particles to form a coherent skin - the biological soil crust. Although these crusts occur in all regions of the world, and may constitute more than 70% of the living cover, they have only recently been recognized as having a major influence on terrestrial ecosystems. This topic was last reviewed in detail in 1999, but apparently contradictory information on the role of these crusts has often been published. The main aim of this volume is to summarize our actual

knowledge on the composition and functioning of different soil-crust types, and their impact on landscape hydrology, soil stability, nutrient cycles, and land management, to explore worldwide and regional patterns of these crusts, considering possible foci for future research work. To achieve this goal, as many as 29 contributors from seven countries (the world's leading specialists in soil-crust research) have written the volume dealing with the different aspects of biology of soil crusts, attempting to avoid repetition of detail. This book had its genesis as a part of the series 'Ecological Studies' published by Springer. The volume is a thoroughly revised 2nd printing of the successful first edition.

This book includes eight multichapter parts (with subject and taxonomic index, respectively). Every chapter is written by different authors. Part I discusses the taxonomic composition, ecology and biogeography of the crust types. First, the problems of their classification, species identification and sampling are presented (Chapter 1). The characteristic soil-crust organisms and typical crust habitats throughout the world are depicted by beautiful coloured photographs. Thereafter, the communities of organisms forming soil crusts and the different crust types are described for different geographical regions: in the major vegetation types of North and South America (Chapter 2 and 3), arctic Greenland (Chapter 4), Alps (Chapter 5), European temperate and mediterranean regions (Chapter 6), Asia (Chapter 7), Middle East (Chapter 8), Africa (Chapter 9), Australia (Chapter 10), and Antarctica, respectively (Chapter 11), illustrated with distribution maps. This part is centered on how species composition and dominance of crustal organisms vary with the different local environmental factors. The synthesis in Chapter 12 compares the observed patterns on a continental and global scale, dealing with their world distribution, biodiversity and floristic similarity.

Part II reports on how serve the biological soil crusts as an environment for heterotrophic soil organisms such as invertebrates and microfungi. Chapter 13 describes the fungi-crust associations, while Chapter 14 surveys the crusts as food source for other soil food web components: bacteria, protists, fungi, nematodes and arthropods.

Part III deals with the fine structure of soil crusts, using light and electron microscopy, comparing the physical and biological soil crusts (Chapter 15), surveying the environmental controls on crust composition and structure on a small scale (Chapter 16), and on a local, regional scale (Chapter 17), respectively.

Present knowledge of crust photosynthesis and nitrogen fixation is summarized in the ecophysiological chap-

ters of Part IV, discussing the biological soil crusts as an ecosystem component. Chapter 18 describes the photosynthesis and respiration of soil-crust biota depending on environmental factors. Chapter 19 and 20 discuss the nitrogen fixation of crusts and the ecosystem nitrogen and carbon dynamics. Chapter 21 is concerned with the influence of soil crusts on soil environments and on dispersion, germination and survival of vascular plants.

Part V is devoted to the effects of soil crusts on soil stability and hydrology (water runoff, infiltration, evaporation) e.g. in the Negev Desert (Chapter 22), in Australian (Chapter 23) or North American deserts (Chapter 24), and on wind erosion (Chapter 25). Chapter 26 explores regional and global patterns to explain the role of crusts in different soil types.

Part VI reports on how can the disturbance of soil crusts impact ecosystems. Chapter 27 surveys the effect of native and non-native ungulates, recreation, fire (Chapter 28), and other soil-surface disturbances on species composition, biomass, and physiological parameters of soil crusts, and the possible ways of recovery.

Part VII describes the strategies of crust management and monitoring, considering human impact or recommended livestock grazing management strategy (Chapter 29). The possible effects of invasive species, elevated CO₂, global climate changes are also discussed (Chapter 30). Use of remote sensing (with different reflectance methods) for soil crust monitoring and mapping is described in Chapter 31. How to monitor and integrate soil crusts into ecosystem management on a landscape scale is outlined comparing different management strategies in Chapter 32.

Finally, Part VIII synthesizes the material presented in the volume, and outlines future research needs.

The authors use amazing original pictures to show the structure, the extraordinary diversity and the natural beauty of the biological soil crusts. The volume contains 141 figures (64 in colour, e.g., photos, distribution maps, diagrams, scanning electron micrographs) and 30 tables. The bibliography is very rich and up-to-date; 1400 references help students and researchers to become immersed in the theme. Due to space restrictions, only a fraction of relevant literature is referenced in this volume. However, one of the editors, J. Belnap maintains a web-based database of publications (over 3000 references) concerning biological soil crusts (www.soilcrust.org). The extensive taxonomic index with 1100 taxa and the subject index with 570 keywords provides quick access to various topics and problems.

Written by leading experts, this book is a comprehensive presentation and the first global synthesis of the biology of soil crusts and their importance as an ecosystem component. Summing up, the volume can be recommended to a wide readership: it should be accessible to all research groups interested in botany, plant physiology, ecology or conservation biology. Considering the large number of good colour illustrations, the price of the book is not high at all.

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