

Book Reviews

Time Scales of Biological Responses to Water Constraints

J. Roy, J. Aronson and F. di Castri (eds).
SPB Academic Publishing, Amsterdam; Kugler
Publications bv. 1995. ix + 243 pp. Hardback.
Dfl. 125.00. ISBN 90-5103-107-6.

In the present volume, resulting from the fifth 'Pan-mediterranean meeting' held in Montpellier, special emphasis is given to water constraints and responses of biota at different scales. Overall, 25 authors contributed to 14 chapters, arranged under four sections: (i) Time-scale interactions in physiological processes; (ii) Consequences of interannual rainfall variability; (iii) Evolutionary responses to summer drought; and (iv) Past and future mediterranean climates.

The first section deals with physiological processes. I do not understand why a volume about mediterranean biota starts emphasizing studies on water stress in *Spinacia oleracea* (chapter 2). More adequate is the modelling approach (chapter 3), aiming at understanding how instantaneous fluxes of water flow and storage in plants produce slower daily processes, as well as the problem of upscaling from daily transpiration to a seasonal water balance (chapter 4).

I was pleased to see the impact of interseasonal and interannual rainfall variability treated in several chapters of section II. Chapter 5 examines to what extent rainfall variability during a decade determined plant community composition along an environmental gradient in Australia. The impact of unusual episodic rain events on a variety of ecosystem types is reconstructed in chapter 6; large-scale phenomena can cause significant local changes. In chapter 7 a comparative study is presented dealing with the climatic risk of arid zones in rural Africa north and south of the Sahara, in view of stability and resilience concepts of the early 70s. Unfortunately, this study on agricultural systems does not in any way refer to Fox's results on more natural ecosystems. How can Floret and co-authors conclude that research should be directed towards selecting properly adapted cultivars, while a few chapters earlier the topic of species richness (of, e.g. ephemerals and grasses) was thoroughly discussed in relation to seasonal and interannual rainfall variability?

Evolutionary convergence among plants in different mediterranean-climate ecosystems is reconsidered in chapter 9, with criticism on over-generalization about, e.g. sclerophylly and rooting patterns as adaptations. In chapter 10, it is interesting to see molecular biology, ecology and genetics of organisms linked in a study across a gradient of increasing levels

of aridity and ecological unpredictability. Aridity stress appears to be a major direct and/or indirect cause of natural selection.

In the final section the present-day mediterranean-climate regions are reviewed in a historical context. In Australia, the actual vegetation resulted from ecological adjustment and evolution of the higher temperature Tertiary flora rather than from recent invasions (chapter 13). Human activities have significantly amplified the consequences of the natural dryness of climate for at least the last 5000 years. For predicting the effects of global warming (chapter 14), an ecophysiological approach at the level of the plant community was adopted. Simulations lead to interesting results, dealing with the growth of plant communities, canopy structure, root growth, carbohydrate storage, and species richness. The rapidity of predicted global change is supposed to result in degradation of the vegetation.

The majority of the chapters provide a synthesis of earlier results. A few chapters present original results, e.g. Rambal's chapter 4 on optimal use of water and Fox's chapter 5 on the impact of rainfall variability. Most chapters deal with plants, a few chapters with animals (chapters 8 and 12). This book is a collection of topics to make a choice from while reading. The editors do not try and explain any coherence between the different chapters. Their contribution is as weak as they state it in the preface: In order to insure continuity and synthesis of research results, Mediterranean Conferences were and are being held on a regular basis since the first one some 20 years ago.

J. VAN ANDEL

Plants of Desert Dunes

Avinoam Danin.
Springer Verlag, Berlin. 1996. xii + 177 pp. 84 figs,
4 tables. Hardback. DM 128.00. öS 934,40;
sFr 123.00. ISBN 3-540-59260-1.

Danin adopted an 'ecomorphological viewpoint' as a background to arrange order in types of plant adaptations to desert dunes. Reactive growth displaying, more than many other attributes, the adaptations of a plant to its specific habitat, the characteristics determining this type of response play a major part in the classification. The book does not intend to search for the mechanisms of evolution of plant adaptations, it just orders the results of this process, some kind of an outcome of stress.

After a one page introductory chapter 1, Danin gives—in chapters 2, 3 and 4—a survey of sand deserts of the world (distribution of sand dunes, sand mobility), environmental stresses (substrate, moisture, nutrients), and habitat types (mobile and

stable dunes, sites of constant deflation, sand covering other substrates). These observations set the scene for the arrangement of ecomorphological types (chapter 5). This classification covers 80 pages of the overall 177 pages of the book, reactive patterns of growth and reproduction of individual species being the main topics. In chapter 6, Danin examines plant communities along environmental gradients, represented by a number of concrete transects, providing a spectrum of ecomorphological types of co-occurring species. In chapter 7 he deals with the topic of convergence (adaptations of different groups to similar habitats) of attributes of reactive growth, including dispersal. Finally, chapter 8 compares plants of desert dunes with plants from extreme desert and from coastal dunes.

Of particular interest are the sections about microbiotic crusts as a sand fixer, in addition to the dune topography resulting from plant growth. These crusts are characteristic of later stages of succession. In the course of succession, plants adapted to sand accretion decrease to zero, while plants adapted to stable sand (due to microbiotic crusts) show an opposite trend in occurrence.

Text and illustrations are in a nice balance, combining information density and comprehensibility. The issues are adequately ordered in the eight chapters. This coherence is one of the advantages resulting from single-author writing. Emphasis on the flora and vegetation of Israel and Sinai, which Danin knows best from his own experience, is properly balanced by information from additional sources about desert dunes in general.

J. VAN ANDEL

Heukels' Flora van Nederland

R. van der Meijden.

Wolters-Noordhoff bv Groningen. 1996. 676 pp. 22e druk; f 87.95. ISBN 90-01-58343-1.

For this new edition the much appreciated system of Cronquist (1981, *An Integrated System of Classification of Flowering Plants*, Columbia University Press, New York) was followed for the first time. Those who are familiar with previous editions will notice, among others, the strict use of formal family names as one of the consequences, e.g. Poaceae (for Gramineae) or Asteraceae (for Compositae).

Taxonomic changes involve, among others, the circumscription of some families. An example is the splitting of Papaveraceae s.l. into Papaveraceae s.s. and Fumariaceae. Many may see this as an improvement; the reviewer at least has always found it difficult to explain to students why *Fumaria* and *Papaver* should belong to one and the same family!

The most drastic change is the uniting of Liliaceae and Amaryllidaceae. The author, in describing the

ovary of Liliaceae s.l. as superior, apparently was unaware for the moment that in subfamily Amaryllidoideae, including the genera *Narcissus*, *Galanthus*, and *Leucojum*, the ovary is inferior. Fortunately, both character states are represented in the main key (p. 49).

Newly included is a key to 22 fairly distinct species from the complex of *Rubus* s.l. One should realize, however, that the whole complex includes about 150 species in the Netherlands, the largest percentage of which can only be identified by specialists.

There are many (over 100) name changes in this edition. Several genera, like *Bromus*, *Artemisia* and *Senecio*, have been split up (e.g. *Bromopsis erecta* for *Bromus erectus*, and *Seriphidium maritimum* for *Artemisia maritima*). Other genera, in contrast, have been united, e.g. *Cardamine* now includes *Dentaria*, and *Lepidium* now includes *Cardaria*. Although such changes probably will not be appreciated by many users, they are unavoidable as a result of recent systematic studies.

A weak point of this new edition is the fact that a substantial number of errors has crept in, such as wrong numbers in keys, wrong references to plates, etc. There are also typographic errors which should have been detected during the proofreading, such as 'Magnoliopsidae' on pp. 83 and 465 [Magnoliopsida], or 'Dennstedtiaceae' on p. 66 [Dennstaedtiaceae]. Worse is that *Sorghum* must be keyed out on the false assumption of 2-more-flowered spikelets (pp. 525–526).

A valuable aspect of this new edition is the inclusion of many illustrations. This makes it much more user-friendly.

The reviewer would particularly like to draw attention to an ingenious formula to represent areas of vascular plants occurring in the Netherlands, first published in a paper of 1992. It is explained here by two of its authors, Van Duuren and Schaminée, on pp. 25–26.

A practical feature is the short index to all common genera on the very last pages of the book.

To conclude: here is a nice, new edition of this Flora with the advantages of many, new illustrations, improved indication of the distribution of the species within Europe, and an up-to-date taxonomy; minor criticisms concern the errors throughout the text. The layout is carefully done, and the quality of the binding is such that a long life, even under rough conditions outdoors, seems assured.

P.J.M. MAAS

Physiology and Biochemistry of Plant Cell Walls

C.T. Brett and K.W. Waldron.

Chapman & Hall, London. 1996. 255 pp. Hardback £50.00. ISBN 0-412-72020-5. Paperback £24.99. ISBN 0-412-58060-8.

Differences between plants and animals in structure, development, physiology, reproduction and ecology can best be understood by considering that plant cells have rigid walls and consequently are immobile. This charming little book introduces this all-important part of the plant cell. After describing the molecular components of the wall and cell wall architecture, the wall is examined with respect to its various functions: provision of mechanical strength, maintenance of cell shape, control of cell expansion, control of inter-cellular transport, protection against other organisms, its role in cell signalling via oligosaccharins, and its storage function in many seeds. An unusual but perhaps timely chapter deals with 'cell walls in diet and health' which describes what happens to cell walls when we eat vegetables, fruits and cereals considering the effects of dietary fibres and anti-tumour polysaccharides. Perhaps as a bias of the reviewer, inclusion of fungal walls for comparison would have been illuminating, and certainly would have induced the authors to treat apical wall growth as in pollen tubes in more detail. Unfortunately, this important topic is now all but missing. With respect to industrial application of cell walls it is remarkable that the processing of cell walls in the cellulose and paper industry are not mentioned at all, nor is there anything on the importance of lignin and cellulose degradation in ecosystems. Each chapter ends with a summary, a list of references, and a list of materials for further reading. However, references in the text are given somewhat haphazardly and the work would have benefitted if references to the original literature had been more consistently supplied. The book makes easy reading, not least because background information, on such topics as carbohydrate structure, is provided in separate boxes without interrupting the main text. It is easy to see that this second edition is well upgraded and deals with the latest developments in the field. This lucidly written text can therefore be recommended to anybody who is interested in plant biology in general and wants a first introduction to plant cell walls.

J.G.H. WESSELS

A Land-ecological Study of Soils, Vegetation, and Plant Diversity in Colombian Amazonia

J.F. Duivenvoorden and J.M. Lips.

The Tropenbos Foundation, Wageningen. 1995.

438 pp. Paperback. US\$72.00.

ISBN 90-5113-024-4.

This book describes a comprehensive set of ecological surveys conducted in the Caquetá region of Colombian Amazonia. Having worked in the region since the mid-1980s, the authors are the first to investigate such a broad array of ecological processes

in the western Amazon. They examined soil characteristics, species diversity and vegetation patterns in one river basin, making a significant contribution to tropical ecology and conservation. The project was sponsored by the Tropenbos Foundation, a Dutch organization that promotes conservation and sustainable land use in the humid tropics.

The 14 chapters provide a well-organized treatment of both descriptive and analytical aspects of the study. Chapter 1, the 'General Introduction', explains the components of the project and explicitly states the premises and objectives of each. The study area was selected in 1985 so that the spatial patterns of soils and mature vegetation near the middle Caquetá could be investigated at several scales. There is currently a paucity of scientific data concerning most ecosystems in western Amazonia, and these studies will enable researchers to make more accurate generalizations about the region as a whole.

Chapters 2 and 3 describe the study area in detail. In chapter 2, field techniques and salient aspects of the physical geography are introduced. After each vegetation community and soil type is mentioned, current land uses are discussed. Chapter 3 presents the Pleistocene climatic history in relation to current geomorphology, and trends are compared to those that characterize the greater Amazon Basin. Both chapters are illustrated with excellent maps and black and white photographs.

Most tropical ecologists agree that far more studies of soils are needed to evaluate forest management and other land utilization strategies in Amazonia. Chapters 4 and 5 cover the classification and formation of soils in the Caquetá basin. Particular emphasis is given to upland soil heterogeneity and thin section analyses. Methods for determining the composition of soils are documented, and all of the results are adequately illustrated with numerous diagrams and graphs. Because these chapters explain both the techniques and their limitations carefully, they should be quite valuable to a wide range of tropical researchers.

In part because many soil studies are conducted in relation to agriculture, researchers have previously devoted attention primarily to the mineral soil. However, in order to understand forest ecosystem dynamics, one needs to know the composition of humus and appreciate the numerous roles that it plays in nutrient cycling. Chapters 6–8 describe three very thorough studies of terrestrial humus forms. After basic properties of humus are described, attention is given to its classification and formation, fine foot patterns, and the effects of fine litter input. Because there have been so few studies of tropical humus, these chapters will be of particular interest to many readers; they present unique results and a conceptual framework that may provide a basis for future studies.

Covering the plant species diversity and forest community ecology, chapters 9–11 also make valuable contributions to science. Not only does this section summarize one of the largest plant diversity studies ever conducted in the Colombian Amazon, but it also presents analyses of plant community patterns, which are rare for tropical humid forests in general. After 94 0.1-ha plots were inventoried, vegetation patterns were determined with the use of both Canonical Correspondence Analysis and Detrended Correspondence Analysis. Results are well-interpreted, and the graphs are very readable.

Given that 1077 tree species occur in these plots, the region appears to exhibit tree species densities comparable to those documented by Gentry (1988) in eastern Peru. Explanations for this exceptional diversity are presented and critically compared to ones offered previously for western Amazonia.

Chapter 11 presents total vascular plant species counts for the region and relates these patterns to various ecological parameters. All three of these chapters contain large quantities of information and provide overviews of neotropical plant diversity that will interest all tropical botanists.

The next two chapters describe the Savanna vegetation that occurs on a nearby sandstone plateau. While the phytosociology sections of chapter 12 are a bit lengthy, the quantity of information presented is impressive. Chapter 13 compares the local flora to species assemblages that occur in six other phytogeographic provinces. It is concluded that the Caquetá savanna should be included in the western section of the Guyana region.

Finally, 'General Conclusions' are discussed in chapter 14. Findings are summarized concisely and related to other trends known for the neotropics. Shifting agriculture is currently the principal form of land use in this region, and the development of more intensive agriculture may be severely limited by low soil fertility. In the final section, the authors discuss the significance of their findings in relation to current Colombian policies.

In summary, this volume makes an excellent contribution to tropical ecology. Not only does it provide a wealth of information for a previously neglected region, but it describes some 'state of the art' methodologies for studying the humid tropics. The results are always illustrated appropriately and interpreted in a scholarly manner. After the final chapter, an 8-page summary of the text appears in Dutch, English and Spanish. The four appendices, which contain the results of plant surveys and soil profiles, also enhance the book's value. Finally, a 37-page bibliography lists many important references. This authoritative work will undoubtedly lay the foundation for future studies in Amazonia and

elsewhere. I recommend it highly to all scientists interested in lowland tropical ecosystems.

PHILIP L. KEATING

Reference

- Gentry, A.H. (1988): Tree species richness of upper Amazonian forests. *Proc. Natl Acad. Sci. USA*, **85**: 156–159

Paleoclimate and Evolution, with Emphasis on Human Origins

Elisabeth S. Vrba, George H. Denton, Timothy C. Partridge and Lloyd H. Burckle (eds). Yale University Press, New Haven. 1996. 547 pp. £60.00. ISBN 0-300-06348-2.

The book is based on a conference on paleoclimate and evolution held in 1993 and covers the Middle Miocene to Pleistocene. The biotic evolution deals with floral and mammalian evolution, with particular emphasis on the hominid evolution.

The book starts with three introductory chapters. The first two focus on the different causes of paleoclimate change. Tectonism plays an important role, although there is scholarly disagreement on the precise mechanism. Unfortunately, a contribution in this book from one of the representatives arguing that uplift and erosion could be the result of global cooling and not the cause of this cooling, is lacking. The chapter dealing with the connections between paleoclimate and evolution presents different models with respect to speciation, migration and extinction and an update of the turnover pulse hypothesis. This hypothesis postulates that like the climate signal itself, also the biotic responses present an hierarchically nested pattern.

The remaining 33 chapters are classified by the three main periods: the Middle to Late Miocene, the Pliocene and the Pleistocene, in which the Pliocene, being the transition period between the warm Miocene and cold Pleistocene, is well represented. It is also this period for which information on plants is most extensive. With respect to the Miocene one chapter is dealing with pollen evidence from Southern Africa and another one discusses the Australian paleobotanical record, incorporated in a review of both Tertiary and Quaternary vegetation.

The paleoclimate and/or paleoenvironment of the Pliocene is documented by pollen from the Northern Hemisphere, Colombia and Northwestern and East Africa. A reconstruction of global vegetation types of the Northern Hemisphere is based on a comprehensive data set and includes a comparison with the modern situation. Although the paleobotanical evidence for South America is restricted to the high plain of Bogotá (eastern Colombia), an area which is

well-documented by several palynological studies, the contribution commands respect for presenting new results of a coring to a depth of 586 m. This Funza II core was the follow-up of Funza I and offered the opportunity for constructing a better time-scale, and with that improving the reconstruction of the climatic and environmental evolution of the area. Antarctica is dealt with on the basis of fossil *Nothofagus* wood and a critical revision of the diatoms from the Sirius Formation.

The botanical information on Africa is of special interest with respect to the hominid evolution. One contribution presents a revision of 120 pollen diagrams (in the text the confusion word 'spectrum' is used) of East Africa, with special emphasis on

modern pollen influx. A second one analyses different characteristics of Pleistocene savannas in South Africa on the bases of micromammalian evidence.

From a botanical point of view, the book is rather unbalanced by not presenting botanical data from the Pleistocene. The absence of an interpretative summary and conclusion is also an omission. The index is extensive with respect to persons, whereas organisms are only partly incorporated. Taking these objections into account, the book still offers a wealth of updated information and is recommended to those interested in paleoclimate and evolutionary aspects of environments.

RENÉ CAPPERS