studies concerning ground flora rather than the author's particular studies. This was true for many of the chapters. However, most of the authors perform an adequate job in discussing and integrating most of the literature, above and beyond their particular research objectives.

Overall, I found the book to be most informative and easy to read, and it provided ecologically sound information regarding a diverse array of topics. This text is an excellent information source to any ecologist whose interests concern impacts of a rather ancient form of land management and the long term effects upon the biotic and abiotic components of that environment. With the concerns in the previous paragraphs noted, I still strongly suggest its reading.

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PLANT BIOMECHANICS

Niklas, Karl J. 1992. **Plant biomechanics: an engineering approach to plant form and function.** University of Chicago Press, Chicago, Illinois. xiii + 607 p. $75.00, £59.95 (cloth), ISBN: 0-226-58630-8 (alk. paper); $29.95, £23.95 (paper), ISBN: 0-226-58641-6 (alk. paper).

Biomechanics has garnered increasing attention from ecologists and evolutionary biologists in the last 15 years. Texts such as those by Wainwright et al. (1976. *Mechanical design in organisms.* Wiley and Sons, New York), Vogel (1981. *Life in moving fluids.* Willard Grant, Boston, Massachusetts), and Denny (1988. *Biology and the mechanics of the wave-swept environment.* Princeton University Press, Princeton, New Jersey) introduced ecologists to a set of conceptual and mathematical tools, experimental techniques, and many unanswered questions concerning how organismal form and function is constrained and affected by basic physical laws and physical forces in the environment. Solutions to many of these questions have, for example, altered our view of optimality models, and provided explicit mechanisms for evolutionarily convergent morphological patterns. Despite their central role in terrestrial ecosystems, however, vascular plants have received little attention from biomechanicists, who have focused their attentions primarily on relatively large vertebrates, marine invertebrates, and seaweeds. In this wonderfully written book, Karl Niklas fills this lacuna, illustrating the importance of biomechanics in physiological, ecological, and evolutionary interpretations of plant form and function.

Chapter 1 confronts the reader with the fundamental premise of most investigations into biomechanics: " . . . many of the evolutionary patterns observed in the fossil record [and by extension among contemporary organisms] are the result of persistent pressures brought to bear by physical laws and processes on the many potential expressions of organic form, structure, and reproduction . . . ." This premise can lead easily to adaptive storytelling and a rapid slide into reductionism where all biological phenomena are reduced to first principles of physics. In a lucid and welcome discussion, Niklas exposes the philosophical biases underlying biomechanics, acknowledges the limitations of the biomechanical framework, and remains within those limits when drawing conclusions from his and others' data.

Much of the theory of static mechanics and fluid mechanics is based on beams and structures of uniform composition, density, and taper, and "ideal" Newtonian fluids. Yet virtually all biological materials are composites; plant stems and animal limbs, though often tapered, look little like columns prized by architects and engineers, and biologically interesting fluids are non-Newtonian. While other authors have saved consideration of "non-ideal" situations for final chapters or appendices, Niklas glides easily in every chapter between the engineer's ideal and the biologist's real. Nearly one-third of the book (chapters 2 and 3) is devoted to accessible algebraic and geometric presentations of the mathematical theory necessary to approach plant biomechanics adequately. I was particularly entranced with the geometric presentation, known as Mohr's circle, of the relationship between normal and shear stresses operating on an inclined bar. Generally, key formulae are explained and presented while their complex derivations are elided; an exhaustive bibliography directs the mathematically masochistic to their primary sources.

The bulk of *Plant biomechanics* is concerned with static mechanics of plants, viz., physical properties of, constraints on construction of, and static forces acting on plant cell walls (chapter 5), tissues (chapter 6), organs (chapter 7), and the plant body itself (chapter 8). It did not take long for people to realize, for example, that the tensile strength of fruit skins is tied directly to the transport and marketability of fruit. Consequently, in discussing static mechanics of plants, Niklas uses extensive data from the agronomic literature on such things as the mechanical properties of apple skins, potato parenchyma, and timber, as well as data from his own extensive empirical research. The effects of physical properties of water and variable plant tissue hydration on static properties of plant tissues are discussed in chapter 4. That structural attributes of tissues change as a function of hydration comes as no surprise; the lack of attention to such effects in earlier studies of organismal biomechanics simply results from the choices of study species. Classical fluid mechanics is discussed in the context of plant–water relations (chapter 4), wind pollination, and fruit and seed dispersal (chapter 9). Because the fluid surrounding terrestrial plants (i.e., air) does not affect as many life history processes as water does for marine animals and plants, the relative balance between static and fluid mechanics in this book is about right. I would have liked to see more discussion of the biomechanics of plants under dynamic loadings, such as those that would occur in relatively high winds, but the observation that most plants are "overbuilt" with respect to rarely-encountered strong winds justifies the relatively scant attention paid to this topic. *Plant biomechanics* concludes with a thorough discussion of the relationship between biomechanics and plant evolution. Niklas argues convincingly for the adaptive nature of plant evolution with respect to the laws of physics and chemistry, while acknowledging forthrightly alternatives to this interpretation.

Plant biomechanics is eminently readable and very well produced. Given the large numbers of mathematical variables used throughout the book, I often wished for an appendix listing all these variables in one place. However, there is an extensive glossary that will help botanical and biomechanical novices through the linguistic mazes of both disciplines. The first and last chapters of this book should be read for their refreshing breadth and perspective by virtually all evolutionary ecologists; biomechanicists and plant ecologists will find the intervening chapters informative and thought-provoking.

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Extinction in Phylogeny, or Phylogeny in Extinction?

Novacek, Michael J., and Quentin D. Wheeler (eds.). 1992. **Extinction and phylogeny.** Columbia University Press, New York. vi + 253 p. $50.00, ISBN: 0-231-07438-7.

This book is a patchwork of eight papers that address the theme of extinction and phylogenetic analysis based on cladistic methods. This is a laudable goal given that, as we all know, extinction threatens much of the biosphere in the coming decades. Unfortunately, this volume suffers even more than most edited volumes from uneven quality and style of papers, and a mosaic of subject matter that varies wildly from tse-tse flies to trilobites to molecular phylogenetics. Also, the title is reversed because the main emphasis of the book is more on phylogeny than extinction. (The Introduction includes a brief primer on cladistics.) Indeed, many papers discuss extinction as a niggling obstacle that phylogeneticists need to watch out for in their efforts to reconstruct phylogenies. Only one paper really inverts this odd set of priorities to show how phylogenetic analysis can be used to minimize future biodiversity loss from extinction.

But let's not dwell on the negative aspects. Ecologists, of all people, do not need to be told that information about extinction is badly needed, and this book is not without some useful and important insights. The last chapter, "Measures of phylogenetic diversity" by Nixon and Wheeler, is the paper that addresses how phylogenetic studies can be used in coping with the ongoing biodiversity loss. Two focal concepts of the chapter are phylogenetic diversity and phylogenetic uniqueness. The authors correctly note the importance of these two concepts in planning and designing preserves to sustain biodiversity. Given the "triage" situation we face, it is inevitable that objective criteria will be needed to decide which taxa have preservational priority. Phylogenetic diversity refers to the species richness of a clade; phylogenetic uniqueness refers to the phylogenetic diversity of a monophyletic group relative to its sister group. Clearly, priority should be given to those species which belong to clades of low diversity and high uniqueness. We would choose, to take an extreme example, to emphasize preservation of a duck-billed platypus over a species of rodent, or just about any placental species. Such prioritization is not new of course, having been advocated by Paul Ehrlich, E. O. Wilson, and many others for years. But this paper supersedes most of these earlier discussions of prioritization by being based on phylogeny instead of taxonomy. And more importantly, the paper provides a clear presentation of rigorous metrics of phylogenetic diversity to attain this goal.

Most of the other seven papers in the book are concerned with extinction and phylogeny reconstruction in the fossil record. Happily, many of these progress beyond the short-sighted view that phylogenetic reconstruction is an end in itself and show various applications of phylogeny toward resolving substantive theoretical or methodological problems. Many of these demonstrate how an improved understanding of phylogeny can provide insight into origination and extinction dynamics. Nixon and Wheeler present a model that may conform to many patterns seen in the fossil records: the correlation of extinction and speciation rates among taxa, the strong extrinsic (abiotic) control of most major (large-scale) speciation and extinction events, and so on. While many such models have been proposed over the years to explain these, and other, patterns, that of Nixon and Wheeler is notable for explicitly incorporating phylogenetic aspects that are usually neglected. For example, extinction of plesiomorphic character states results in speciation, i.e., character transformation. The role of cladogenesis versus anagenesis in evolutionary events is a welcome addition to the very coarse-grained tabulations of taxonomic rates one usually finds in the paleontological literature.

Norell also demonstrates the importance of phylogenetics in fossil studies in reconstructing taxic origin and diversification. Instead of the simple gross accumulation of fossil first occurrences and durations, a phylogenetic approach is likely to provide more accurate and more complete information, in calculations of evolutionary (taxonomic) rates of origination and extinction. For example, "ghost" lineages are invisible in the fossil record, but are no less real for it. This is illustrated