Book Reviews

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THE MATHEMATICIANS' REVENGE

Brauer, Fred, and Carlos Castillo-Chávez. 2001. **Mathematical models in population biology and epidemiology.** Texts in Applied Mathematics 40. Springer-Verlag, New York. xxii + 416 p. $59.95, ISBN: 0-387-98902-1 (alk. paper).

In the preface of their new undergraduate textbook on population modeling, Brauer and Castillo-Chávez state, ''This book is intended to inspire students in the biological sciences to incorporate mathematics in their approach to science. . . .'' When I approached the book in this spirit, for ideas, tools, and ''inspiration,'' I found a somewhat formal text on *mathematics* using insufficient biology to illustrate the math. There are some jewels in this text, but one would need pretty strong prior motivation and decent posterior stamina to extract them. This book is intended for the student who has had a year of calculus, some background in elementary differential equations, and a little matrix theory. The authors ''hope'' that biology students will cover these math classes in their first several years of undergraduate study and then use this text in years 3 or 4 (or early grad school). Arguably, those who were not previously at least motivated enough to take matrix algebra and differential equations are not going to even dream of using this book. And besides, many a program in biology in the U.S. doesn't even require calculus. To be blunt, I'm not sure many biologists will use this book and I'm not sure biology students will be inspired.

The book is optimized to develop mathematical ideas, not biological concepts. There are three main sections: ''Simple single-species models,'' ''Models for interacting species,'' and ''Structured populations models.'' Subsections within the first main heading include ''Continuous population models,'' ''Discrete population models,'' and ''Continuous models with delays.'' The organization within each subsection is incredibly thorough, gradually adding mathematical twists to each previous equation or model. Biological examples are provided if and when they relate to a given equation and the examples are highly idealized. Several chapters are seen by the authors as containing core concepts for any modeling course. Supposedly, these are straightforward and the examples and exercises are described as potentially too easy for more experienced students. Harder chapters ''should probably be reserved for students with more mathematical background and some experience in biology.'' One could imagine (and find in bookstores) a book on theoretical/mathematical population biology where the chapter headings follow from biological principles. Such a format would probably be easier to use for a biologist interested in exploring models in their field. However, this book's format is also reasonable for a survey of applied mathematics because the format facilitates comparison across fields of biology. But in the Brauer and Castillo-Chávez book, biologists are fed a pretty thin gruel, with some ''examples'' only provided as citations, i.e., not even including the names of the species or any description whatsoever of the organisms or biological process.

Let me give an overly complete example. At the beginning of Chapter 2, ''Discrete population models,'' there is a section on linear models. The equation $x_{n+1} = rx_n$ is developed, and the process of solving the equation algebraically is illustrated. The authors observe that $x_1 = rx_0$, $x_2 = rx_1$ equals r^2x_0, etc. and then

> ''guess (and prove by induction) that the unique solution is $x_n = r^n x_0$ ($n = 0, 1, 2, \ldots$). It follows that if $|r| < 1$ then $x_n \to 0$ as $n \to \infty$, while if $|r| > 1$ then x_n grows unbounded as $n \to \infty$. More precisely, if $0 \leq r < 1$, x_n decreases monotonically to zero; if $-1 < r < 0$, x_n oscillates, alternating positive and negative values, but tends to zero; if $r > 1$, x_n increases to $+\infty$; if $r < -1$, x_n oscillates unboundedly. Negative values of x_n for this difference equation have no biological meaning, but we soon will consider difference equations in which the unknown is a deviation from equilibrium. . . rather than a population size.''

I have three objections to this section. First of all, the notation is unconventional and is similar to previous work that has been difficult to use. Secondly, this is an important moment in biology and justifies extant data and future theory, yet the biological relevance is completely unexplored except for the comment that negative values of population size are not relevant. Thirdly, no examples are provided at all.

There is some very useful information within this book. As an example, the presentation of cobwebbing under ''Graphical solution of difference equations'' is clearly applied and sketched out once, and then two other equations are depicted. Occasionally I was pleasantly surprised by a well-explained biological concept, such as the mathematical explanation for the Allee effect with a reference to overhunting and the extinction of the passenger pigeon. The layout for predator-prey systems was deliberate, describing predator functional response, predator numerical response, Rosenzweig-MacArthur models, Holling, Ivlev, and Rosenzweig functional response curves, Kolmogorov two-species models, isocline analysis, invading species, a predator and two competing prey species, harvesting in two interacting species, intermittent harvesting. . . . Generally the book was free of typographical errors and errors in equations, although the inappropriate use of the species name *Tribolium Castaneum* (sic) further demonstrated that the authors might lack familiarity with biological terminology (in fact the papers they cited correctly named the organism as *T. castaneum*). In other pages, I found *Lucilia cuprina*, lepus americanus (ugh), lynx canadiensis, and P. caudatum (no italics).

The book includes problems, ''projects,'' an in-book appendix, and a future on-line appendix. Answers are provided for some but not all problems, to encourage students to become involved and not just be spectators. The projects are multiple-step problems probably envisioned as being worked

by teams, in which students would recreate advances in any given type of model. Types of projects are all over the map, such as exploring bone marrow/stem cell maturation dynamics, quitting smoking, firing in neurons, spruce budworm dynamics, and others. There eventually will be a web site with appendix material to supplement an insecure student (giving Taylor series approximations and linear algebra as examples). This is a good idea, but such a site could become very large, because there should be information or at least links to measles data and models, fisheries and harvesting models (and data), and others. I would prefer additional ''background'' material in the book presently, such as a glossary of commonly used but not defined mathematical terms.

An appealing aspect of this book is the emphasis on epidemiology. Epidemiological modeling is a large field but is not well summarized in the literature. Brauer and Castillo-Chavez clearly are intrigued by math and disease. Epidemiology is salted throughout the book, in Chapter 1, ''The logistic equation in epidemiology,'' Chapter 2, ''Project 2.1, a discrete SIS epidemic,'' in other problems, and then in Chapter 7, ''Basic ideas in mathematical epidemiology.'' The authors restrict their treatment to classic Kermack-McKendrick SIRS models of infection, SIS models, SIR models, vital dynamics, and so forth. A nice feature is section 7.9, ''Directions for generalization,'' which lists a number of add-ons that might be needed for particular diseases, such as vector transmission, nonhomogeneous mixing, spatial non-uniformity and stochasticity.

Not included was a ''Directions for generalization'' for the whole book which should have addressed many important reasons why idealized, analytically tractable models commonly fail to fit real data accurately. A modeler needs to make intelligent choices regarding how much of the messiness and complexity of biological systems to include in a model, when additional features may obscure key points or perhaps render a model hopelessly unworkable. These choices arise from the knowledge of the biological system as well as the feasibility of performing any given analysis. Noise, spatial or temporal complexity, and other problems can make a model fit poorly, but so can a poorly chosen model. Since data are rarely idealized, it is important to understand statistics and stochasticity. Many epidemiologists have opted for intricate computer simulations and not analytical models, presumably to avoid sacrificing any biology. So clearly more bridges between the applied math and the ecology of the diseases still need to be built and I appreciate the steps toward building such bridges taken by these authors.

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RUINED LANDSCAPES

Grove, A. T., and Oliver Rackham. 2001. **The nature of Mediterranean Europe: an ecological history**. Yale University Press, New Haven, Connecticut. 384 p. $75.00, ISBN: 0-300-08443-9.

This is a beautiful book and in many ways an admirable one. It is rather argumentative—Grove and Rackham do not suffer sloppy thinkers gladly! This is no straightforward ecological history and the authors are only peripherally interested in coastlands and the Mediterranean seas. The authors use historical and landscape ecological methods to explore and challenge what they argue to be deep-rooted conceptions about landscape change and desertification across southern Europe. In doing so, they challenge many orthodox—but actually very questionable—assumptions that underlie modern agricultural and land management policy in Mediterranean countries.

The book opens with an introduction to the central idea challenged by the book—the widespread and deep-rooted thesis that the Mediterranean countries of Europe were in early historic times much more fully vegetated than today and that their degradation and even incipient desertification is the result of human activity, principally deforestation and overgrazing. The sheer diversity of Mediterranean Europe is highlighted. It then deals with the modern desertification debate and particularly the MEDALUS project—of which this book is a dissenting minority report—and finally with materials, methods, and definitions. The next chapters introduce the Mediterranean lands—the present climate and weather, the geological and geomorphological framework, the plant life, and the human ecology. One especially characteristic aspect of Mediterranean human ecology, cultivation terraces, gets a separate chapter.

The second part of the book starts to address the issue of presumed degradation and desertification. The pattern of climate change is explored, with chapters dealing with instrumental records from the last one and a half centuries, historical records of the Little Ice Age, and then early historical and prehistoric climates. They show that, in the current interglacial, the typical summer-dry Mediterranean climate has existed only for the last five thousand years or so, and that during this time climates have been relatively unstable. They emphasize that short periods of data collection—such as the existing instrumental record that is rarely more than 120 yr long—usually miss the long return-interval, high-magnitude events that shape landscapes and cause major disasters. Two chapters then deal with an overview of vegetation, firstly in prehistory, then in historic times. Grove and Rackham argue that palynologists have naturally chosen wet sites for their work and thus that

pollen of distant dryland plants are under-represented. Therefore, previous reconstructions of the Early Holocene flora in Mediterranean countries are likely to underestimate the importance of savannah vegetation. I do not accept this thesis, since palynologists regularly allow for the ''over-representation'' of local wetland taxa in their analyses. Nevertheless, they argue that Mediterranean vegetation under the less seasonal climates of the early Holocene was characterized by deciduous oaks, hornbeams, beech, and northern European species such as alder to a far greater extent than is the modern forest. The early Holocene forest changed as a response to aridization of climate after the sixth millennium B.C. and then again with the advance of agriculture, often during the Bronze Age. Grove and Rackham argue that the major areas of forest, pasture, and cultivation were established by classical times and subsequently changed relatively little until the widespread abandonment of the poorer agricultural land, especially in hill country, during the twentieth century.

In the subsequent chapters the authors give a harsh lesson to many researchers engaged in process and landscape change studies in Mediterranean Europe. They start with a detailed exposition of the fire ecology of Mediterranean ecosystems and demonstrate that many modern land use policies and patterns, especially the restriction of traditional grazing activities, are predisposing the landscape to catastrophic fires. They then take a swipe at modern erosion studies—criticized for not continuing for long enough to capture the long return-interval events that actually most shape many Mediterranean landscapes. This is an important observation, since it means that most existing process data on Mediterranean erosion phenomena substantially underestimate the probability of severe erosion from long return-interval extreme events and as a result planners do not prepare for them. They argue that, during such events, precipitation can be so great that factors such as dense ground cover, which will normally prevent substantial erosion, become immaterial. So much water is in motion that gullying and other forms of severe erosion phenomena will occur even beneath forest, though it is likely that these phenomena will be even more marked on recently ploughed land. Grove and Rackham have little time for the idea that anthropogenically accelerated erosion leads to desertification. They argue that grazing shaped many Mediterranean ecosystems and that much traditional agriculture has adjusted to erosion either by exploiting opportunities created by places where sediment accumulates temporarily or by adopting simple soil conservation measures such as terracing. On the other hand, modern engineering solutions—bulldozed false terraces, modern mechanized deep plowing, road building, and the removal of boundaries are responsible for significant localized erosion.

Three chapters then deal with phenomena that according to Grove and Rackham are often misidentified as resulting from anthropogenically accelerated erosion. The first addresses badlands—spectacular erosion forms relatively common on weak, rapidly uplifted rocks such as marine clays. They argue that badlands—often cited as evidence for past land-use disasters—are not the result of poor cultivation practice or overgrazing but are natural geological phenomena which should be (and in the past often were) avoided by agriculturalists. They then devote two chapters to river terraces and deltas as evidence for erosion in the later Holocene. River terrace studies took off with the work in the sixties of Claudio Vita-Finzi and has provided a fertile field subsequently for many authors, including this reviewer. The authors criticize—rightly in my view—the often appallingly low standard of evidence used to link ''human activity'' with alluviation. They tend to argue that alluviation should be linked with weather phenomena, particularly the intense downpours they call deluges, rather than with other possibly causal factors such as climate change, tectonics, or human activity. They are, however, selective in their reading of the recent literature, ignoring relatively solid evidence that links alluviation episodes with widespread upland clearance. They argue that if there is a direct link between alluviation and human activity, the present prevalence of Europe-subsidized agriculture should be leading to massive alluviation in many areas and that this is not occurring. This is a simplistic argument: the sources are not the same as they were—much modern intensive agriculture is concentrated in relatively low-angle lowland terrain and many upland catchments have been dramatically reforested since the early years of the 20th Century. In hard rock terrain it takes centuries, if not millennia, to generate stores of unconsolidated material which can contribute to alluviation pulses. Also significant are the increasing trend to dense river-marginal vegetation, which efficiently adsorbs runoff and sediment before it reaches the fluvial system and the fact that few major rivers are not dammed.

Two chapters conclude the book. The first is a pithy exposition of a modern tragedy of the commons—the present misuse of groundwater in Mediterranean countries. The second reviews the key lines of evidence in the book and reiterates that desertification per se is not the major challenge facing Mediterranean Europe. They argue that unsustainable ''scientific'' land-use policy is the real problem and that locally determined, small-scale, diverse, historically rooted activity is the best solution.

The nature of Mediterranean Europe is a considerable achievement, building on the accumulated experience and wisdom of two pre-eminent scholars. They have got deep ''under the skin'' of the countryside of Mediterranean Europe and provide a long-term perspective that is in many ways at odds with prevailing wisdom and much recent science. Unlike many highly focussed modern texts, this book is broad and offers a variety of insights, accessible to almost anyone. It is a product of deep learning and should not be ignored just because it argues with prevailing orthodoxy—it offers important lessons. It should be compulsory reading for every official and academic interested in landscape change and the development of land use policy for southern Europe. The book is near-impeccably produced and beautifully illustrated with abundant maps, drawings, and color photographs. It would grace—but be wasted on—any coffee-table.

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CHANGES ACROSS THE ARCTIC

Nuttall, Mark, and Terry V. Callaghan, editors. 2000. **The Arctic: environment, people, policy.** Harwood Academic, Amsterdam, The Netherlands. xxxviii + 647 p. $118, £78.00, €124.00, ISBN: 90-5823-087-2.

The Arctic is not a neglected backwater for research. Instead for decades, the Arctic has attracted researchers from all disciplines and a fair part of their efforts is condensed into this densely packed compendium. The first half of the book covers the Arctic's physical and life sciences. The life sciences section has chapters on marine biology, freshwater ecology, terrestrial biodiversity, ecosystem structure, and function. The final two chapters in the life sciences section are medical science and physical anthropology. The other half of the book deals with people—the indigenous people, their political evolution and their relationships with people from other global regions, and the impacts on the Arctic through long-distance transport of contaminants including greenhouse gases.

The book's rather breathless introduction justifies the diversity of chapter topics as an encouragement for scientists to communicate with each other and with stakeholders (although who these might be is not given). More specifically the book aims to compile a baseline of current arctic research ''. . . against which future complex changes can be measured.'' The chapters were intended to have three themes (consequences of human-caused changes; inter-relationships between arctic and other global regions; and the contribution of arctic research to the understanding of global issues).

The book largely succeeds as a compilation of authoritative accounts not only of physical, life, and social sciences, but also of some of the Arctic's international organizations and their history. In particular, the inclusion of chapters with Russian authors opens up a literature previously relatively inaccessible to non-Russian speakers. Most chapters are readable (except for a few startling lapses into pretension to the point of obscurity). Sheila Kirkwood's chapter entitled ''Upper atmosphere physics and chemistry'' is a delight in its clear explanations of the aurora, noctilucent clouds, polar vortex, and ozone depletion. The chapter is also thoughtful in its division of material between text and tables and listing of references. Egil Sakshaug and John Walsh's chapter on marine biology is detailed but clear in using data from the Barents and Bering Seas to reveal the interactions between fishing and decadal climate-driven natural cycles in fish stocks. Those decadal climate switches (such as the North Atlantic Oscillation) are also described in Gunter Weller's chapter on climatology but, surprisingly, not in terrestrial ecosystems, although effects have been recently described elsewhere.

Success is less assured in how the book meets its objective of a baseline for current research. Success mostly comes in the chapters for the physical and life sciences that summarize current understanding with supporting data and current references. There are, inevitably, gaps and one obvious omission is an exploration of the contribution to understanding biodiversity from using mitochondrial and nuclear DNA to analyze patterns of genetic variation below the species level. Although as several chapters comment, species diversity is low in the Arctic, genetic variation below the species level is often high. Other gaps include the short shrift given to parasitology although it is an emerging field in ecology. Terrestrial and marine mammals and fish receive minimal attention despite their importance to indigenous peoples. The lack of information on diseases transmitted from wildlife to people (given the close relationship between indigenous people and wildlife) is surprising especially given predictions about diseases and parasitism in the face of global climate change. Fortunately, only a few chapters are closer to being discursive essays peppered with generalizations rather than citations or data that will cramp using those chapters as a baseline. For example, the excellent chapter on human population numbers and trends is unfortunately not paralleled by a similar level of detail with data on subsistence use and traditional economies (although the data do exist).

The theme of human-caused changes (mostly global climate change, ozone depletion, UV-B radiation) is conspicuous in the chapters on oceanography, upper atmosphere, climate, marine biology, and freshwater ecology as well in greater detail in the book's fourth section. In their chapter entitled ''Biodiversity of terrestrial ecosystems,'' Nadya Matveyena and Yuri Chernov make the generalization that the existing latitudinal gradient in biodiversity, with its dependence on temperature, is in itself the answer to how communities will change with global warming. However, Sven Jonasson et al. are more cautious in their chapter on terrestrial ecosystem function. The authors suggest that predicting responses of terrestrial ecosystems is difficult because likely environmental changes are more than just rising temperatures but include increasing carbon dioxide, UV-B radiation, and pollutants whose effects will be interactive.

The book's second theme (inter-relationships between arctic and other global regions) is well described for climate and upper atmosphere and discussed at length in the chapters dealing with the relationships between the Arctic's indigenous people and people from other regions. Those relationships include the ''long history of ambiguous interactions [of indigenous peoples] with Euro-American scientists . . . which often lead to misunderstandings, misinterpretations, and a sense of exploitation.'' More recently, and to some extent, the gap between indigenous people and scientists may be closing through the institutional recognition of indigenous knowledge as it is increasingly incorporated into management decisions for wildlife and fisheries.

The third theme—how arctic research contributes to understanding global issues—is poorly developed. Likewise, although the book is strong on two of its title's topics (environment and people), the third title topic (policy) is less well served, especially at the national rather than international

level. The problems facing the Arctic are seen as mostly external (trans-boundary contaminants, global atmospheric changes). Less attention is paid to possible environmental effects from increasing human populations (despite the evidence for this in Chapter 1), increasing access through road-building, and increasing aircraft service to smaller communities.

The book suffers from being edited with a light touch. This is suggested by the overlap and lack of integration among chapters and the variable structure of each chapter (for example, whether there is a summary, a set of conclusions, or research needs, and how closely each chapter supports the book's objectives and themes). Typographical errors are common, many figures are poorly reproduced (one set of line figures is repeated as color plates) and the index is so sketchy that it is almost useless.

However, just for the convenience of having the authoritative chapters covering the range of physical, life, and social sciences within one volume, it is worth having this book as a reference. Collectively, the chapters document that the Arctic is not a remote and pristine part of the globe but that we, elsewhere in the world, have already influenced its landscapes and peoples.

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DESERT ECOLOGY: HOOKING STUDENTS ON NATURE

Sowell, John. 2001. **Desert ecology: an introduction to life in the arid southwest.** University of Utah Press, Salt Lake City, Utah. xii + 193 p. $17.95, ISBN: 0-87480-678-X (alk. paper).

With increasing urbanization of the planet, students have less and less personal experience with natural environments. Nowadays, their sole experience is with human-engineered places that are landscaped, paved-over, climate-controlled, artificially hydrated, fertilized, and populated by a depauperate domesticated biota. How, then, are we to expect students to develop a deep appreciation for the challenges that all environments present to their inhabitants, the remarkable adaptations that organisms have evolved to overcome them, and the underlying causes of patterns of distribution, abundance, and diversity? How can we teach ecology effectively?

Harsh environments like deserts may provide the needed hook for the imagination. Popular culture is full of images of dehydrated people under a blazing sun, crawling desperately up a sand dune in search of water, and most students have experienced being hot and thirsty. What better way to capture their imaginations than to focus on deserts and their unique and remarkably diverse inhabitants?

This is precisely what John Sowell has done in over a dozen years of teaching ecology to undergraduate biology majors and nonmajors alike. *Desert ecology* is an outgrowth of these classes. It is intended as an accessible introduction to the physical environments of North American deserts, the physiological, behavioral, and life-history adaptations of plants and animals to their physical environments, as well as the organization of desert ecosystems. Rather than providing a technical treatise that emphasizes the evidential basis for generalizations about deserts or gaps in knowledge, Sowell hopes to pique curiosity, and to instill appreciation and empathetic understanding as well as factual knowledge. To these ends, the book is short and inexpensive, and the writing is conversational and direct, cluttered with a minimum of technical jargon, data tables, or citations. Figures are clean and photographs, although black-and-white, are sharp and nicely composed. Most chapters begin with engaging anecdotes or stories, including some from the personal experience of the author. The bibliography contains a reasonably comprehensive mix of natural history and technical sources that provide plenty of opportunity for more in-depth study. Its utility is, however, compromised by the very limited amount of citation in the text, and by the lack of bibliographic annotations. The chapters are relatively loosely organized with only a few general section headings, but a reasonably complete index permits readers to find passages relevant to particular subjects.

The book has a logical structure. The first chapter defines what a desert is, explains global distributions of arid climates, and introduces typical desert landforms and features of the major North American deserts. Chapters 2 and 3 discuss plant ecophysiology and life history, respectively. The following three chapters treat the same two subjects for animals. Chapter 7 discusses desert community and ecosystem structure, Chapter 8 environmental gradients associated with desert mountains (''sky islands''). Chapter 9 treats human physiological tolerances for heat and aridity and human impacts on desert ecosystems. Instructors who wish to capitalize on the dramatic potential of deserts may prefer to have students read about human physiology after the introduction to the physical environment of desert, and then go on to consider the physiological responses of other organisms. Animals are given more attention than plants, and the emphasis is on organismal rather than population and community ecology.

I find *Desert ecology* unique in its interdisciplinary focus on a system rather than a subdiscipline of biology, in its blending of natural history with technical science, and in the inclusive treatment of earth science, plant and animal organismal biology, and ecosystem ecology. In principle it should be useful for nonmajors' as well as majors' classes. However, as is true of many texts that arise out of specific classes, it is not intended to serve as a comprehensive text and may not be easily adapted to serve different student clientele or to fit into different institutional settings, curricula, or styles of instruction. For this reason, instructors interested in adopting *Desert ecology* for their courses would be well advised to plan to supplement with material that fits particular pedagogical goals. Although an effort has been made to avoid jargon and to explain concepts, nonmajors may well lack the background or vocabulary to understand many basic points, and instructors may wish to provide supplemental lectures or reading; understanding the discussions of physical processes that control climate, or photosynthesis, for example, presupposes considerable science background. A glossary would be a helpful addition for these students, as would suggestions for further reading at the end of each chapter. As another example, the book lacks a clear emphasis on core concepts in ecology, and instructors may wish to provide students with their own conceptual ''road map.'' For instance, the words ''adaptation'' and ''adapted'' are used liberally throughout the book, yet they are not defined formally and there is no explanation of natural selection.

I found relatively few significant factual or typographical errors. There is a bit of sloppy interpretation of some of the technical literature with which I am familiar, and occasional lapses into ''conventional wisdom'' that is misleading (such as the notion that ocotillos are pollinated primarily by hummingbirds; in some areas, carpenter bees are more important). There is some lack of attention to detail that affects the reader's comprehension. For example, the map of North American deserts in Chapter 1 does not indicate major geographical features that are mentioned in the text; and terms are sometimes introduced before they are defined.

Despite its weaknesses, *Desert ecology* holds considerable promise for engaging students' interest in ecology because it adopts an interdisciplinary approach to the ecology of these dramatic environments. It would optimally be supplemented by field trips—without direct experience, even the most compelling natural history story remains an abstraction—and so is probably most easily adopted by institutions in the Southwest. Even so, ecology instructors elsewhere may well wish to consider developing courses that are centered on the ecology of the environments in their geographical area, for this approach can be a powerful way of giving students an appreciation for organisms in natural environments—that is, a strong sense of place.

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EVERYTHING YOU ALWAYS WANTED TO KNOW ABOUT WHITEBARK PINE . . .

Tomback, Diana F., Stephen F. Arno, and Robert E. Keane, editors. 2001. **Whitebark pine communities: ecology and restoration.** Island Press, Washington, D.C. xv + 440 p. $70.00 (cloth), ISBN: 1-55963-717-X; $32.50 (paper), ISBN: 1-55963-718-8 (alk. paper).

The preface of this book opens with the startling sentence: ''In the northwestern United States and southwestern Canada, much of the whitebark pine (*Pinus albicaulis*) is disappearing.'' Similarly, the first chapter, ''The compelling case for management intervention,'' establishes the tone of the entire text and underscores the purpose of the development of the book. As the editors describe in the preface, there is a sense of urgency in preparing this book, synthesizing the information and informing the general public and researchers alike. The story is familiar to forest ecologists and is increasingly common—merely changing the species could disclose another scenario about a different forest community. The simple elements of this story are that fire suppression has contributed to competition from more shade tolerant species, e.g., subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*), while white pine blister rust caused by the introduced fungus *Cronartium ribicola* has further contributed to the demise of white bark pine. There is much more to this story than the simple elements, however. The interrelationships, if not interdependence, of Clark's nutcracker, grizzly bears, and red squirrel contribute to an interesting and complex situation.

The twenty chapters of this book are neatly organized into four main parts: (1) statement of the problem; (2) the biology of whitebark pine; (3) whitebark pine communities: threats and consequences, and (4) restoring whitebark pine communities. The first part contains only one chapter, but the other three consist of no fewer than five thorough chapters.

With such a collection, it is not surprising to find a wide variation in style and content. Contributions in this book include the complex, involved, scientific findings of papers discussing potential coevolutionary relationships, the reproductive biology of whitebark pine, the integral relationship of various species in this ecosystem, and the epidemiology of white pine blister rust. However, contributions

in his book also expound on authors' personal impressions of these high elevation ecosystems such as experiencing a hike in whitebark pine forests. The mixture of scientific and non-scientific information and variation in contributions makes it difficult to determine the intended audience. The editors likely aimed this book at a broad group of potential readers. It may best fit in that growing collection of books aimed at naturalists, ecologists, environmentalists, and even casual recreationists. Most important, however, is that this book has elements that would be illuminating for any of these audiences.

Despite substantial ecological content, it would be difficult to characterize this book as scientific. Although some chapters contain important findings, much of it synthesized from several sources and there is a reliance on personal communications, making the book somewhat anecdotal. The extensive use of first personal plural at times makes it read more like a naturalist's guide book than a scientific text. In many ways this book can be characterized as homage to a species and clearly was developed by a group of people for whom this tree species holds special significance. These people happen to be scientists who can supplement their personal and emotional ideas with objective details, providing a unique approach to understanding a species and a community.

This book encompasses surprising breadth, with chapters ranging from description of current approaches to examining genetic diversity to a primer on growing whitebark pine seedlings. The editors of this book have developed a text with regional focus but substantial ecological detail. *Whitebark pine communities* seems to go considerably beyond the scope of those other available books, particularly with the inclusion of the non-technical and easily accessible chapters. This book is likely unparalleled in the natural history of whitebark pine. Furthermore, the extensive literature cited sections accompanying each chapter provide valuable resources for further research. Some chapters have a synoptic paragraph at the beginning or summaries at the end.

The case is made (repeatedly) that successional changes, influenced by fire suppression and white pine blister rust, account for the continuing decline in abundance of this species. According to this compilation, climate change also represents a potential death knell for whitebark pine. Furthermore, a native insect, mountain pine beetle (*Dendroctonus ponderosae*), has accounted for mortality in white bark pine. There is no doubt that a collection of organisms, notably among them grizzly bear and Clark's nutcracker, are essential components of the ecosystem dominated by white bark pine—and simultaneously dependent on that ecosystem. The keystone role of white bark pine, however, is not entirely convincing, and it may be that the authors extended this notion as further justification for the case for intervention. Although ''keystone species'' and ''ecosystem management'' tend to be unavoidable in discussions of restoration and management, this text provides convincing arguments using species biology and successional theory, without the need to invoke contemporary paradigms.

There are some technical problems with the book. For example the inferior quality of photos makes it difficult to visualize the authors' intent. Also, at points, it seems that tables were not needed and simply confounded the message the authors made in the text. There was a degree of duplication, e.g., a chapter describing white bark pine and its environment overlapped with the chapter describing community types and natural disturbance processes. Similarly, the text contains a reiteration of the blister rust mechanism in a chapter on decline that immediately succeeds a thorough description on white pine blister rust. There is some value in this repetition of concepts previously introduced: a reader can pick up this book and select any chapter randomly, read it, and be aware of the primary theme of the book. The book is quite satisfactory for the casual, interested reader. It is also, however, valuable for the informed ecologist, providing more detail to certain concepts and providing in some chapters the amount of detail that would only interest the ecologist.

This book represents a fine educational tool, particularly for those unfamiliar with the high-elevation whitebark pine communities. Several significant and timely ecological themes that transcend species and communities are presented in this book. Whitebark pine communities represent one of several fire-dependent communities in which shifts in species composition are occurring after a century of fire suppression. A non-indigenous pathogen contributes to dramatic changes in the communities. It is well known that exotic organisms have pronounced effects on ecosystem across the globe. An important, albeit not directly expressed, message in this book is that numerous forested ecosystems across the continent have similar trends. Another apparent message from the book is that preservation alone is not the answer to maintaining biodiversity, and that approaches using active intervention have become increasingly accepted by a variety of interests.

The broad swath of this book, encompassing fundamental community ecology and population genetics as well as recreational attributes and management potential for whitebark pine communities, provides a useful template for understanding comparable communities, particularly ''communities-at-risk.'' The authors make it clear that there is still much to learn about whitebark pine communities; however they also make it clear that there may not be much time. Whether their pronouncement is alarmist is not possible to discern from the text, but their collective narrative provides an intriguing assessment.

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LANDSCAPE ECOLOGY EXPLAINED

Turner, Monica G., Robert H. Gardner, and Robert V. O'Neill. 2001. **Landscape ecology in theory and practice: pattern and process.** Springer-Verlag, New York. xii + 401 p. (with CD-ROM) $119.00 (cloth), ISBN: 0-387-95122-9 (alk. paper); $59.95 (softcover), ISBN: 0-387-95123-7 (alk. paper).

As the study of the complex feedback loops between spatial patterns and ecological processes, landscape ecology has a growing relevance in a transforming world. An understanding of how spatial heterogeneity influences ecological dynamics has great relevance to land-use planning, conservation biology, natural resource management, and other fields. Therefore, having a thorough textbook that explains the principles and techniques of landscape ecology is an important resource. Written by three past winners of the U.S. Chapter of the International Association for Landscape Ecology's Distinguished Landscape Ecologist award, *Landscape ecology in theory and practice: pattern and process* describes what landscape ecology is, from whence it developed, the kinds of research questions it addresses, and the techniques it currently uses to answer those questions. In so doing, the book outlines the contributions landscape ecology has made to ecology as a whole.

The book commences with two revealing quotes. The first, by Paul Risser and colleagues (organizers of the first landscape ecology gathering in the U.S.), states that landscape ecology is an interdisciplinary field rather than a branch of ecology per se because it incorporates aspects of ecology, geography, and other discrete disciplines. The second quote, by John Wiens (former president of the International Association for Landscape Ecology), proposes that the emergence of landscape ecology has effected a shift in the viewpoint of ecology as a whole. These quotes set the theme for the entire book: landscape ecology is a novel way of understanding the world because it integrates facts and ideas from a multitude of sources to produce new insights.

Although landscape ecology was originally developed in Europe to examine the effects of long-standing human habitation on the land, landscape ecology in North America emphasizes organism-environment relationships without necessarily involving human-dominated systems or land as a limited resource. Landscape ecology thus has something of a split personality. This book takes a North American approach at an introductory level, filling a void in the landscape ecology literature. Other introductory textbooks have a distinctly European flavor, and those texts that have taken a North American stance were written for more advanced or specialized audiences.

Written as an advanced undergraduate- or graduate-level text, the book consists of 11 chapters that cover most of the types of research conducted in the name of landscape ecology. The first chapter discusses what landscape ecology is, its main historical influences, how landscape ecology differs from other fields, and why it emerged in recent years. Subsequent chapters focus on scale and its role as an (or possibly *the*) organizing principle in landscape ecology; the importance of models in a discipline where replication and manipulation are logistically problematic (including a separate chapter on neutral models, a special class of models that is particularly well suited to landscape ecological analyses); climate, human land use, and other factors that generate spatial pattern (including a separate chapter entirely devoted to disturbance, with an excellent discussion of how equilibrium is a necessary, if often latent, component of disturbance and how equilibrium itself is a scale-dependent phenomenon); how spatial pattern is quantified (including a discussion of the effects of aggregating data and changing scale, and reviews of some simple pattern metrics, spatial statistics, and computer software for the analysis of spatial patterns); how organisms respond to spatial pattern (including treatments of island biogeography, metapopulation theory, the meaning of ''habitat,'' spatially explicit population models, habitat corridors, and conservation biology); effects of spatial pattern on biogeochemistry; and applications of landscape ecology in land-use planning, forest management, ecological risk assessment, and biotic monitoring. The concluding chapter suggests some general areas for future research.

The writing is clear throughout, although a couple of chapters do not immediately follow related chapters (the chapter on neutral landscape models does not follow the general ''Introduction to models'' chapter, and the chapter on disturbance does not follow the one dealing with other pattern-generating agents). The discussion questions and recommended readings at the end of each chapter guide teaching and learning. There is an extensive reference section at the end of the book with historic and modern citations. Examples from the primary literature are referenced throughout the text, with a reasonable balance of studies on different organisms and systems (although the emphasis is on large scales, with only a few casual references to microlandscapes or experimental model systems). A few case studies are provided. There are black-and-white figures and photographs throughout the book, and an accompanying CD-ROM gives each image in color in both jpg and pdf formats. Most of the black and white images are clear, except for some maps with more than three shades of gray and some photos of highly textured images.

Although the breadth of coverage is extensive, some of the more complex subjects receive only a surface treatment. The book gives a theoretical treatment to landscape ecology rather than a detailed guide to how landscape ecology is done, meaning that students will learn ''about'' but not ''how to do'' landscape ecology. A forthcoming companion guide by Sarah Gergel and Monica Turner (*Learning landscape ecology: a practical guide to concepts and techniques*) will cover activities and exercises for students and practitioners alike.

Landscape ecology is a relative newcomer to the college curriculum. This text is a real boon to professors and students. Although the hardcover edition is priced out of range of many students, the soft cover edition is reasonably priced. The book is a thorough treatment of the current activites of landscape ecology, and I recommend it highly.

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Spotlight

Recent Publications of Particular Interest

Callicott, J. Baird, and Eric T. Freyfogle, editors. 1999 (cloth), 2001 (paper). **For the health of the land: previously unpublished essays and other writings by Aldo Leopold.** Island Press, Washington, D.C. xix + 243 p. $22.95 (cloth), ISBN: 1-55963-763-3 (acid-free paper); $15.00 (paper), ISBN: 1-55963-764-1 (acid-free paper). This book contains 11 previously unpublished essays by Aldo Leopold. Also included are 42 other essays (many of them just a page or two) that are now difficult to find.

Wolbarst, Anthony B., editor. 2001. **Solutions for an environment in peril.** The Johns Hopkins University Press, Baltimore, Maryland. xv + 214 p. $22.50, ISBN: 0-8018-6594-8 (acid-free paper). This collection of 16 essays derives from seminars given to the EPA in the 1990's on environmental problems and possible solutions. The authors of the essays include scientists, legislators and other government officials, and environmental advocates.

Books and Monographs Received through August 2001

Callicott, J. Baird, and Eric T. Freyfogle, editors. 1999 (cloth), 2001 (paper). **For the health of the land: previously unpublished essays and other writings by Aldo Leopold.** Island Press, Washington, D.C. xix + 243 p. $22.95 (cloth), ISBN: 1-55963-763-3 (acid-free paper); $15.00 (paper), ISBN: 1-55963-764-1 (acid-free paper).

Chapin, F. Stuart, III, Osvaldo E. Sala, and Elisabeth Huber-Sannwald, editors. 2001. **Global biodiversity in a changing environment: scenarios for the 21st century.** Ecological Studies. Volume 152. Springer-Verlag, New York. xii + 376 p. $129.00 (cloth), ISBN: 0-387-95249-7 (alk. paper); $49.95 (paper), ISBN: 0-387-95286-1 (alk. paper).

Dale, Virginia H., and Richard A. Haeuber, editors. 2001. **Applying ecological principles to land management.** Springer-Verlag, New York. xviii + 346 p. $99.00 (cloth), ISBN: 0-387-95099-0 (alk paper); $54.95 (paper), ISBN: 0-387-95100-8 (alk. paper).

de la Peña, Martín R., and Maurice Rumboll. 2001. **Birds of southern South America and Antarctica.** Princeton Illustrated Checklists. Princeton University Press, Princeton, New Jersey. 304 p. $24.95, ISBN: 0-691-09035-1.

Feinsinger, Peter. 2001. **Designing field studies for biodiversity conservation.** Island Press, Washington, D.C. xx + 212 p. $27.50, ISBN: 1-55963-878-8 (alk. paper).

Gardner, Robert H., W. Michael Kemp, Victor S. Kennedy, and John E. Petersen, editors. 2001. **Scaling relations in experimental ecology.** Complexity in Ecological Systems Series. Columbia University Press, New York. xxx + 373 p. $65.00, £43.50 (cloth), ISBN: 0-231-11498-2 (alk. paper); $30.00, £20.00 (paper), ISBN: 0-231-11499-0 (alk. paper).

Gisel, Bonnie Johanna, editor. 2001. **Kindred and related spirits: the letters of John Muir and Jeanne C. Carr.** The University of Utah Press, Salt Lake City, Utah. xviii + 394 p. $34.95, ISBN: 0-87480-682-8 (alk. paper).

Godoy, Ricardo A. 2001. **Indians, markets, and rainforests: theory, methods, analysis.** Columbia University Press, New York. xviii + 256 p. $60.00 (cloth), ISBN: 0-231-11784-1 (alk. paper); $25.00 (paper), ISBN: 0-231-11785-X (alk. paper).

Groves, R. H., F. D. Panetta, and J. G. Virtue, editors. 2001. **Weed risk assessment.** CSIRO, Collingwood, Australia. x + 244 p. $80.00 (Australian), ISBN: 0-643-06561-X.

Hawksworth, David L., editor. 2001. **The changing wildlife of Great Britain and Ireland.** The Systematics Association Special Volume Series 62. Taylor and Francis, New York. xv + 454 p. $200.00, ISBN: 0-7484-0957-2.

Hulse, Arthur C., C. J. McCoy, and Ellen Censky. 2001. **Amphibians and reptiles of Pennsylvania and the Northeast.** Comstock Books in Herpetology. Cornell University Press, Ithaca, New York. x + 419 p. $39.95, ISBN: 0-8014-3768-7.

Kerr, S. R., and L. M. Dickie. 2001. **The biomass spectrum: a predator-prey theory of aquatic production.** Complexity in Ecological Systems Series. Columbia University Press, New York. xviii + 320 p. $55.00, £37.00 (cloth), ISBN: 0-231-08458-7 (alk. paper); $30.00, £20.00 (paper), ISBN: 0-231-08459-5 (alk. paper).

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Love, Rosaleen. 2001. **Reefscape: reflections on the Great Barrier Reef.** Joseph Henry Press, Washington, D.C. v + 264 p. $24.95, $35.95 (Canada), ISBN: 0-309-07260-3 (alk. paper).

McCarthy, James, Osvaldo F. Canziani, Neil A. Leary, David J. Dokken, and Kasey S. White, editors. 2001. **Climate change 2001: impacts, adaptation, and vulnerability.** Contributions of Working Group II to the Third Assessment Report of the Intergovernmental Panal on Climate Change. Cambridge University Press, New York. x + 1032 p. $130.00 (cloth), ISBN: 0-521-80768-9; $49.95 (paper), ISBN: 0-521-01500-6.

Metz, Bert, Ogunlade Davidson, Rob Swart, and Jiahua Pan, editors. 2001. **Climate change 2001: mitigation.** Contributions of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, New York. x + 752 p. $130.00 (cloth), ISBN: 0-521-80769-7; $49.95 (paper), ISBN: 0-521-01502-2.

Millspaugh, Joshua J., and John M. Marzluff, editors. 2001. **Radio tracking and animal populations.** Academic Press, San Diego, California. xvii + 474 p. $69.95, ISBN: 0-12-497781-2 (alk. paper).

Orzack, Steven Hecht, and Elliott Sober, editors. 2001. **Adaptationism and optimality.** Cambridge Studies in Philosophy and Biology. Cambridge University Press, New York. xv + 404 p. $74.95 (cloth), ISBN: 0-521-59166-X; $27.95 (paper), ISBN: 0-521-59836-2.

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Pigliucci, Massimo. 2001. **Phenotypic plasticity: beyond nature and nurture.** Syntheses in Ecology and Evolution. The Johns Hopkins University Press, Baltimore, Maryland. xvi + 328 p. $65.00, ISBN: 0-8018-6788-6 (alk. paper).

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Soulé, Michael E., and Gordon H. Orians, editors. 2001. **Conservation biology: research priorities for the next decade.** Island Press, Washington, D.C. xvii + 307 p. $50.00 (cloth), ISBN: 1-55963-868-0 (alk. paper); $25.00 (paper), ISBN: 1-55963-869-9 (alk. paper).

Sprent, Janet I. 2001. **Nodulation in legumes.** Royal Botanic Gardens, Kew, United Kingdom. xii + 146 p. £27.00, ISBN: 1-84246-013-7.

Teale, Edwin Way, editor. 2001. **The wilderness world of John Muir: a selection from his collected work.** Houghton Mifflin, New York. xx + 332 p. $15.00, ISBN: 0-618-12751-8.

Turner, I. M. 2001. **The ecology of trees in the tropical rain forest.** Cambridge Tropical Biology Series. Cambridge University Press, New York. xiv + 298 p. $80.00, ISBN: 0-521-80183-4.

Turner, R. K., I. J. Bateman, and W. N. Adger, editors. 2001. **Economics of coastal and water resources: valuing environmental functions.** Studies in Ecological Economics. Volume 3. Kluwer Academic, Norwell, Massachusetts. vii + 342 p. $105.00, £74.00, €120.00, ISBN: 0-7923-6504-6 (acid-free paper).

Valiela, Ivan. 2001. **Doing science: design, analysis, and communication of scientific research.** Oxford University Press, New York. viii + 294 p. $75.00 (cloth), ISBN: 0-19-507962-0 (acid-free paper); $39.50 (paper), ISBN: 0-19-513413-3 (acid-free paper).

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