Book Reviews

Ecology, 88(7), 2007, p. 1871–1872

Help for the Novice Researcher

Karban, Richard, and Mikaela Huntzinger. 2006. **How to do ecology: a concise handbook.** Princeton University Press, Princeton, New Jersey. vi + 145 p. $45.00 (cloth), ISBN: 978-0-691-12576-3 (alk. paper); $16.95 (paper), ISBN: 978-0-691-12577-0 (alk. paper).

Key words: *ecological methods, research.*

This is a self-help quiz: Do you have a host of tips for undergraduate researchers and beginning graduate students to help them plan their projects? Have you been planning to write down these tips? Have you been fretting about your procrastination? If you answered "yes" to all of these questions, you and your students may benefit from Karban and Huntzinger's *How to do ecology: a concise handbook*.

This short (122 pages) book is divided into six chapters that follow the research process—asking questions, developing methods, using experiments, analyzing data, collaborating, and communicating. The seventh, and last, chapter is a three-page summary.

In "Picking a question," Karban and Huntzinger start with the basics—research and writing can teach you how to think and communicate even if you won't do research ever again. They discuss the critical importance of novelty for academia and it's somewhat lesser importance for agencies. They discuss two approaches to finding a project: (1) starting with a system and looking for a question and (2) starting with a question and looking for a system. Perhaps the most important advice they give is to pick a question that excites the *researcher*. The most successful people are the ones who work the hardest, and "working hard is much easier if it doesn't feel like work but rather something that you are passionate about."

Chapter 2 ("Posing questions [or picking an approach]") focuses on "different ways to do ecology." Karban and Huntzinger explain that ecologists can (1) make observations of patterns, (2) conduct manipulative experiments, or (3) build models. All three of these approaches are valuable. They provide a clear discussion of correlation/causation. They provide a clear and simple explanation of how path analysis can reveal causality. Finally, they conclude that the best ecological studies use all three methods.

Chapter 3 ("Using experiments to test hypotheses") addresses the elements of good experimental design: controls, treatments, replication, randomization, and interspersion. Karban and Huntzinger also discuss the pros and cons of laboratory vs. field experiments (they recommend linking the two). They discuss the importance of sample size ("Always go for as large a sample size as you can get, even if each of your samples is sloppy and noisy"), but clearly emphasize the importance of *unbiased* samples ("A large sample size can rescue imprecise measurements, but it cannot rescue biased measurements").

Chapter 4 ("Analyzing patterns and data") addresses what you can do once you have the data. A very nice section on statistics contrasts concepts of statistics and biological significance. The authors nicely point out the arbitrariness of 0.05 ("Why should we be allowed to say that two populations are truly different if $P = 0.049$ but not allowed to say much of anything if $P = 0.051$?"). There is a good box showing how to calculate effect size. This chapter also discusses use of alternative hypotheses, negative results, and path analysis (again).

Chapter 5 ("Working with other people") is short (five pages) and focuses on communication with a major professor, authorship issues, involving committee members, attending meetings, and the pros and cons of hiring other people to help collect data. One strong recommendation is to devote time and energy to publishable work—only work on activities that don't lead to publications "if they will make you better over the long run."

Karban and Huntzinger emphasize the importance of publications next (Chapter 6, "Communicating what you find"). They note that "publications are the currency of our field" but also show how preparing your work for presentation or publication helps clarify your own thinking. They also write about the function of each of the major sections of a paper, the development of a grant proposal, and how to organize a poster.

Chapter 7 ("Conclusions") distills Karban and Huntzinger's thoughts into a set of six rules. Each rule is associated with a "cost of rule." The "rules" are reasonable (e.g., experiments are powerful, test clear hypotheses with statistics, replicate carefully) but the "costs" are not always so clear. For example, Rule 6 is that publications are very important because they are our professional currency. The unstated implication of this rule is that the publication record accurately reflects a person's professional value. The cost of this rule, then, is that a publication list does not perfectly "mirror learning about nature and advancing the field" (in the same way that grades do not necessarily reflect what a person learned in a course). In this case, I think the "cost of rule" is a square peg forced into a round hole.

Karban and Huntzinger use stories and analogies effectively to make important points, often in amusing ways. For example, they discuss correlation/causation by first recalling a story of a girl friend who didn't want Karban to buy a red car because red cars had a high accident rate—ignoring the fact that there might be an association between the types of drivers that usually buy red cars and their accident rates.

Coverage of ideas is probably a bit idiosyncratic, but not uncomfortably so. For example, Karban and Huntzinger do not explain how to conduct statistical tests (how could they in a short book?), except that they devote a 2.5-page box to calculating effect size. Sometimes they give enough information to give the reader a flavor of the idea or procedure but not enough for the reader to actually use (e.g., path analysis, meta-analysis) and sometimes they just alert the reader that a useful method is available (e.g., Bayesian analysis). Development of alternative hypotheses gets substantial detail (about six pages), including a list of potential factors that could cause an ecological pattern (amusingly, this list did not include "competition" as a possible factor).

The writing is lucid, and the style has a lightness and "quirkiness" that kept me interested. I enjoyed the advice "not to obsess" about designing the perfect field study (it's impossible). I agreed with their concluding sentences: "While you play the game, keep your eye on the big prize: your own

personal and professional priorities. This is your life! You will be more successful if you're enjoying it." And I laughed when I read "If the evidence supports your hypothesis but you still don't believe your results because you feel unconfident about everything, talk about this with a therapist, but don't let these doubts pervade your presentation."

Although this book seems to be aimed at graduate students, it is also appropriate for undergraduate researchers. More and more students are conducting research early in their careers, and this book can provide a good basic starting point for anyone interested in ecological research.

Janet Lanza

University of Arkansas at Little Rock
Biology Department
Little Rock, Arkansas 72204
E-mail: jxlanza@ualr.eduedu

Ecology, 88(7), 2007, pp. 1872–1873

More Workshop than Toolbox

Mangel, Marc. 2006. **The theoretical biologist's toolbox: quantitative methods for ecology and evolutionary biology.** Cambridge University Press, New York. xiv + 375 p. $95.00 (cloth), ISBN: 978-0-521-83045-4; $50.00 (paper), ISBN: 978-0-521-53748-3.

Key words: ecological theory; evolutionary theory; mathematical modeling; statistical modeling; stochastic population dynamics.

It is not easy to write a text that covers theoretical biology, one that can appeal to empirical biologists while still serving as a handy reference for theoreticians. There is a delicate balance to be achieved between, on the one hand, taking an exhaustive approach that covers every possible angle and, on the other, a more selective approach that covers only certain topics in detail. The former approach will rapidly lead to an oversized and weighty tome, while the latter can become a "hit-or-miss" eclectic collection that covers only the author's favorite topics. Although this book more often falls into the second category—by the author's own admission it is not an exhaustive review of theory in any one particular area but is "a somewhat idiosyncratic collection of examples"—it manages, by clever design, to gain the benefits of both approaches while avoiding many of the pitfalls. Mangel has chosen, wisely, to delve into a selection of topical subjects for which he clearly has enthusiasm and which also nicely illustrate the utility of many common quantitative techniques. In 375 pages of text the author covers an impressive amount of material that, while not a comprehensive review of population biology, behavioral ecology, or evolutionary biology, certainly covers all of the major bases and, in so doing, illustrates the mathematical tools employed by theoretical biologists. This book is more than a toolbox, perhaps a better description would be a workshop—where you get to not only see the tools but see them in action.

The book has eight chapters that are divided between those that focus on specific areas of ecological and evolutionary theory and those that are more technique based. After an introductory chapter that sets the stage well using "four examples and a metaphor" there are two theory-based chapters that cover ordinary and partial differential equations, probability, and some statistics. These are followed by three chapters covering a few of ecological theory's greatest hits: "The evolutionary ecology of parasitoids" (Chapter 4); "Population biology of disease" (Chapter 5); and "Problems of sustainable fisheries" (Chapter 6)—all very fertile areas of ecological and evolutionary theory that are well suited to demonstrating the tools available to theoretical biologists. The final two chapters cover stochastic population dynamics.

The seven core chapters of the book, especially the three chapters covering particular areas, follow a fairly consistent formula: a basic question or model is introduced; complications or elaborations are layered on; related material is introduced; and the relevant literature is summarized in a section called "Connections." In this last section, instead of a mere paragraph of "further reading" or "suggested references," Mangel provides four to nine pages worth of material that points to, and briefly discusses, the literature that was either the motivation for or is an extension of the material in the chapter. The connections have a nice balance between classic papers, essential reviews, and interesting recent results.

Using the "Population biology of disease" chapter as an example, Mangel starts by analyzing a simple SI (susceptible/infected) model of microparasite epidemiology—including derivations of R_0 and a discussion of the functional form of disease transmission. He then builds on this by covering an impressive collection of related theory and relevant methods for: various permutations of SIR (susceptible/infected/recovered or removed) models; vectored-diseases; macroparasites; evolution of virulence; and optimality in host immune response. The chapter concludes with four pages of connections to the relevant contemporary literature, including references for: evolution of resistance; disease management; HIV theory; and spatial epidemiology. This chapter, while not as strong as the parasitoid or fisheries chapters, nonetheless exemplifies how Mangel is able to wrap together population biology, behavior, and evolution to present a coherent picture of how theory can be meaningfully applied to understand biological systems.

The writing style in this book is lively enough to hold the attention of most readers despite what some empiricists might consider a dry subject matter. The topics covered are clearly of interest to the author and this shines through in his writing, which is casual without being imprecise. The text is most compelling when, as frequently occurs, Mangel ties the methods being described to the natural history of a focal organism or system. This style, which is especially effective in the introductory, parasitoid, and fish chapters, makes the text palatable to readers with limited backgrounds in math or modeling. The author also does a good job of highlighting why certain key results from models are important.

The book is peppered throughout with exercises for the reader. Generally they are mathematical in nature, though some are more open-ended conceptual questions. Fortunately the exercises are annotated for difficulty, but in a few places it is clear that perhaps two labels would be helpful—one to indicate computational difficulty and another for conceptual difficulty.

Because these exercises are typically posed in such a way that their answer is related to the ordered development of ideas in the chapter, readers are encouraged to at least attempt their solution. In general, these exercises are both reasonable and valuable. It is worth pointing out, however, that such a structure does not reward a lazy reader, and may occasionally pose a problem for the mathematically challenged because of the omission of answers for some of the exercises. Even for those more adept readers it can be frustrating to not have answers to questions like "What does this imply about…" or "How do you interpret…" because it isn't always clear whether the answer you have in mind is the same as the point the author was trying to make. Answers can also be useful indicators of when there are simpler routes to a solution. It would be helpful if answers could be made available, perhaps on a website.

This book has a range of potential users and uses, in large part because Mangel adeptly summarizes both theory in evolutionary ecology and relevant quantitative methods. The book is marketed as "suitable for advanced undergraduate courses in theoretical and mathematical biology" but we suspect it will find a larger audience with graduate students. Most undergraduates will require substantial feedback and guidance to help them through this work, and the author describes the book's origin in six separate quarter-long classes. That does not seem unreasonable and would be an impressively broad education for any aspiring theoretical ecologist or evolutionary biologist. Several of the individual chapters, though, would be highly suitable for graduate reading groups. In a less structured format some of the connections could be explored and students could bring their own interests to the table. It should be noted, however, that to a certain extent the chapters do build upon one another and the later chapters might be tough going if they were taken out of order. For many graduate students this book would be a good investment based solely on the "Connections" section that comes at the end of each chapter that serves as an excellent introduction to the literature on a wide and diverse range of topics.

John Latto and Matt Daugherty

University of California at Berkeley
Department of Integrative Biology
Berkeley, California 94720-3140
E-mail: jlatto@berkeley.edu; fezzik@berkeley.edu

Ecology, 88(7), 2007, pp. 1873–1874

Agroecology without Ecology

Wojtkowski, Paul A. 2006. **Introduction to agroecology: principles and practices.** The Haworth Press, Binghamton, New York. xix + 404 p. $99.95 (cloth), ISBN: 978-1-56022-316-0 (alk. paper); $79.95 (paper), ISBN: 978-1-56022-317-7 (alk. paper).

Key words: agroecology; agroforestry; sustainability.

Few subjects are as important to humanity as food production, especially in the face of global climate change, increasing meat consumption (and its corresponding ecological footprint) worldwide, and a growing litany of negative impacts of modern agriculture on environmental quality and biodiversity. The extraordinary yields of crops and livestock of the green revolution were grounded in rather narrow applications of ecology and evolution. Environmental and social critics of industrial agriculture have highlighted the need for more sustainable agricultural practices that utilize ecological and evolutionary principles and knowledge to design farms, ranches, and gardens, as well as agricultural landscapes that produce abundant food while maintaining ecosystem services and safeguarding native biodiversity. In addition, the growing scientific literature in agroecology reflects the recognition that agroecosystems are an excellent arena for documenting and testing models of regulatory processes in population, community, and ecosystem ecology. Challenges in agriculture abound and the interest in sustainable food production is escalating among academics and the public. In this context, a new introduction to agroecology is a welcome prospect.

This introductory text is from Dr. Paul Wojtkowski, an independent consultant who has written four previous books on agroforestry and agroecology. The book is based on library research and many farm visits, not directly on the author's research. From the outset, Wojtkowski is enthused, idealistic, and dedicated to "nature friendly" forms of agriculture, but he ranges from vague to misinformed about concepts and analysis throughout the book.

The book contains 18 chapters. Following an introduction, the next two chapters present principles and concepts. Two chapters then cover challenges to agricultural production under the categories of "threats" and "pests." Chapter 6 concerns agroecological concepts, including agrotechnologies. Chapters 7–13 describe different production systems, including three chapters on agroforestry systems. The remaining chapters have a broader scope, including social, community, and economic topics; alternative agriculture; agroecosystem design; and agricultural landscapes. The last chapter is a summary. The text is followed by 45 pages of endnotes with commentary, digressions, and selected references. A substantial bibliography (25 pages) is followed by an index. The text and endnotes contain numerous photographs and line drawings. Many of these illustrate well the concepts or field designs in the accompanying text, while other figures are poorly explained or unclear.

The book has several valuable strengths. Wojtkowski is committed to evaluating agroecology as a scientific subject, but recognizes that many traditional or indigenous agricultural practices contain valuable ecological insights even if practiced by people with little formal education. He also recognizes that agriculture represents more than science and comfortably admits social and economic perspectives into his analysis. The chapters are short and the text is free of excessive jargon, making the book accessible to students and a lay audience. The book contains a reasonable survey of the agroecological literature, from older classics to much contemporary research (although there are notable omissions). The author mentions case studies from many regions of the world. Also, he considers agroforestry an important part of sustainable agriculture, and

the chapters on agroforestry are the strongest ones in the book because the case studies there are presented in sufficient detail.

This book could be successful if the text were focused on the goals and challenges facing agriculture today: the ecological concepts, processes, and models appropriate for single- and multi-species assemblages in agroecosystems; the interactions between the planned biodiversity of agroecosystems with the native biodiversity in the larger landscape; and the principles of ecology needed for environmentally sustainable food systems. But these are not the subjects of the book. Rather, principles and concepts have idiosyncratic explanations with little relationship to academic ecology, agronomic research, or practical farming. For example, Chapter 2 ("Spatial principles") contains several pages and figures about resource functions to explain planting density in relation to yield. This section conveys little meaningful information because neither the text nor the captions sufficiently explain the figures and no analytical or predictive relationships emerge. A key "agro-bionomic concept" is species governance, explained as "governance by a few occurs when a limited number of component species or individual plants set most of the ecological agenda." Ecosystem governance occurs "when there is enough immediate biodiversity, flora coupled with fauna, so that the ecosystem takes on a life of its own." Top-down control means that the larger species are the driving force, while bottom-up control means that microbes are more influential. The author uses self-styled concepts, including the species interaction zone (SIZ) and desirable plant characteristics (DPCs); while their intuitive meaning is clear enough, there is no overarching analytical framework in which to place them. They are simply acronyms.

Adding to these difficulties is weak writing. For example, with regard to the resource functions, "The exact shape of the resource functions are species and variety dependent. These are universally unknown." In this case, reading the passage in context does not make it any clearer. Errors of grammar and spelling are frequent, starting with the dedication page, where the source of a quotation from Stephen Jay Gould's book *Wonderful life* is given the subtitle *The Burghers Shade* [should be *The Burgess Shale (and the nature of history)*]. Both the author and the editor need higher standards of proofreading.

The text has notable omissions both in subject matter and citations. There is no chapter on soils or fertility or climate. Neither "fertility" nor "nitrogen" has an entry in the index (but molybdenum does!), even though fertility is one of the main preoccupations in any kind of agriculture. The chapter on alternative agriculture is a rambling "trove of possibilities" without details or case studies of the many documented achievements in yields, fertility management, pest management, or economic viability in current agroecological production systems. The bibliography lacks citations for Vaclav Smil, David Pimentel, Jules Pretty—productive contributors to current research and evaluation of the environmental dimensions of conventional and alternative agriculture. Also missing is reference to agroecological research from the Rodale Institute's Farming Systems Trial, where field studies have been conducted since 1981.

It is not clear who the intended audience is. The deviations from current ecological concepts and terminology and the lack of quantitative analysis of inherently quantitative subjects (with the exception of the land-equivalent ratio) make this book unsuitable as a textbook for college or university courses. The field designs and agrotechnologies ("serviceable but ecologically distinct, land-use options") are presented in insufficient detail to be useful to most farmers or gardeners. Lay audiences are not likely to be attracted to the current title or the high price, even though they are most likely to appreciate the author's orientation and least likely to mind his errors.

In summary, the book is off the mark as an ecologically based introduction to agriculture. Stephen Gliessman's text (*Agroecology: ecological processes in sustainable agriculture*. 1998. Ann Arbor Press, Chelsea, Michigan) will serve students, instructors, and researchers much better. Neither is the book an ecologically oriented manual for farmers, or gardeners. *Rodale's illustrated encyclopedia of organic gardening* (Pauline Pears, editor. 2002. DK Publishers, New York) contains more valuable practical information about species interactions, crop fertility, and field design. Even for a lay audience, the subject of agroecology deserves a clearer analysis of the challenges, research methods and findings, and strategies for ecological approaches to agriculture.

Catherine Badgley

University of Michigan
Museum of Paleontology
Ann Arbor, Michigan 48109-1079
E-mail: cbadgley@umich.edu