A COLLECTION OF COMPUTER-INTENSIVE METHODS

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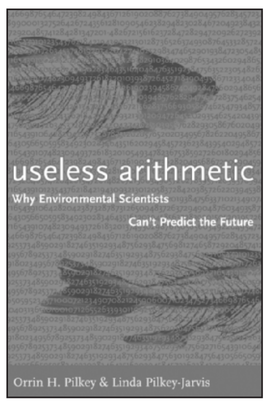
An Angry Indictment of Mathematical Modeling

Useless Arithmetic: Why Environmental Scientists Can't Predict the Future. Orrin H. Pilkey and Linda Pilkey-Jarvis. Columbia University Press, New York, 2007. 248 pp., illus. $29.50 (ISBN 9780231132121 cloth).

On the basis of an analytic model, the US Environmental Protection Agency approved a site at Yucca Mountain, Nevada, as a repository for radioactive waste, stipulating that leakage could expose humans to no more than 15 millirems of radiation in any year for the next 10,000 years. Later, a federal appeals court increased the safety window to hundreds of thousands of years. The authors of *Useless Arithmetic: Why Environmental Scientists Can't Predict the Future,* a prominent coastal geologist and his geologist daughter, aim to show that environmental science models purporting to predict the future beyond a few decades are inevitably incorrect—often drastically so—and frequently harmful, in that they lead to bad policy and convey an unwarranted sense of certainty and control.

To exemplify the problem, Orrin H. Pilkey and Linda Pilkey-Jarvis examine the use of such models in seven fields: radioactive waste disposal, fisheries, global sea-level change, plant invasions, beach nourishment, shoreline erosion, and mine-pit water quality. As they see it, in each instance, there are so many variables and stochastic inputs that predictions of any analytic (as opposed to statistical) model will quickly go awry. Contributing to the erroneous results at Yucca Mountain were climate change over a long time frame, insufficient empirical study of the chemical reactions of the waste or the degradation of waste containers and a titanium shield, and magnification of errors through the interdependence of hundreds of submodels. Any policy decision based on the results of such a model would be unwarranted.

This is not to say that analytical models cannot be useful in other ways—for example, it would seem that comparing model predictions to subsequent observations could help scientists understand a phenomenon better. Not necessarily so, according to the authors of *Useless Arithmetic,* who argue that beach nourishment, shoreline erosion, and mine-pit water models have not done even that. In these and other fields, reification of model variables has, in their view, not only led to unjustified policy decisions but also discouraged the gathering of empirical data that would enhance scientific understanding.



In contrast to those areas, the use of models in plant invasions is exemplary, Pilkey and Pilkey-Jarvis point out, lauding a National Research Council report (2002) and other invasion-biology publications for being forthright about the severe limitations of predictive models and advocating caution in applying models to policy decisions. They thus turn what is perhaps the main criticism of modern invasion biology—that it lacks a theoretical basis with quantitative, predictive, generally applicable models—into a virtue.

The chief villains in the piece, according to the authors, are engineers, and they see it as no coincidence that the National Research Council committee on predicting plant invasions consisted wholly of academic scientists—it had no engineers. Modeling in the other fields, except for fisheries and global sea-level change, is dominated by engineers. Pilkey and Pilkey-Jarvis believe that the very nature of engineering models renders the models incapable of adequately representing the complexity and stochasticity of many environmental phenomena. Concrete and steel structures are immeasurably simpler than the physical and biological processes that operate all over Earth.

The other main factor contributing to the dominance of misleading mathematical models is "political pollution," the authors' term for the pressure on modelers to produce a prediction compatible with the desires of political and economic interests, and the ability of mathematical modelers to adapt to that pressure. For a particularly good example of political pollution, consider how quantitative models abetted the collapse of the Canadian cod fishery.

This is a very angry book. Like Michael Crichton (2004), the authors accuse global-change modelers of being concerned primarily with their own funding. They call the coastal engineering profession a disgrace. They say the field of pit-lake chemistry is in a woeful state. They label much of the mathematical modeling community an unassailable and untouchable priesthood that, by virtue of being a priesthood, has avoided the criticism and debate that characterize normal science. They attack prominent approaches to policy-relevant modeling, such as meta-analysis and cost-benefit analysis. They regard many of the costly, even disastrous failures of military policies as the results of bad modeling. And they name names, identifying many of the villains in the fields they criticize and detailing their sins.

The authors go so far as to open themselves to the charge of settling scores, quoting from critical reviews of a rejected manuscript of the senior author, and assailing the journal to which the paper was submitted and its editors. The vitriol is sufficiently stark and unrelenting that a casual reader, with no expertise in the specific fields under discussion, might suspect the book is the work of neo-Luddites (an epithet Pilkey proudly admits to having been called by one of the coastal engineers he criticizes).

For readers who are scientists, the authors do not help themselves by striving to present their criticism of mathematical models wholly verbally, with almost no equations except for those in an appendix that presents several beach models. Further, they could have clarified their case for both scientists and lay readers with several straightforward, definitional treatments. Importantly, rather than defining "model" and discussing the (valid) uses of models at the outset, and then considering the differences between mathematical and statistical modeling, Pilkey and Pilkey-Jarvis approach these matters tangentially and almost casually in several chapters. Nor do they describe exactly the differences between engineering and science, which they see as a crucial component of the issues they discuss. Similarly, their definition of adaptive management is informal and incomplete and does not address the substantial published criticisms of this approach to resource management (e.g., fisheries and forests); this lapse is striking, given their enthusiasm for adaptive management as a good alternative, in some settings, to mathematical models. Many scientists will perhaps be familiar with most or all of these definitions and the literature surrounding them, but for a targeted readership of "nonspecialists and nonmathematicians," these are serious lacunae.

And yet, this is a compelling book, hard to put down and impossible to dismiss on the merits of the case. The authors often score telling points, as when they show how standard coefficients in equations widely used to decide policy are often only fudge factors to make the equations produce a desired answer. Similarly, the details of many disasters make for gripping reading: the descriptions of the relationships between modeling and the decisions that led to these disasters are chilling, and often little-known matters are brought to light. The discussion of why a discredited model of shoreline retreat with sea-level rise—the Bruun rule—continues to be widely used is perceptive and broadly applicable to a number of environmental and ecological fields.

Useless Arithmetic will surely excite any reader. Some will be angry, others skeptical, many shocked and dismayed. No one will be bored, and most will want to read further. Anyone who reads policy decisions based on models will inevitably think back to the issues raised here.

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References cited

Crichton M. 2004. State of Fear. New York: HarperCollins.

National Research Council. 2002. Predicting Invasions of Nonindigenous Plants and Plant Pests. Washington (DC): National Academy Press.

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WHY NOT TEACH "INTELLIGENT DESIGN"?

Not in Our Classrooms: Why Intelligent Design Is Wrong for Our Schools. Eugenie C. Scott and Glenn Branch, eds. Beacon Press, Boston, 2006. 184 pp. $14.00 (ISBN 9780807032787 paper).

Not in Our Classrooms is a small, impressive book that will be a valuable resource for anyone interested in the various aspects of "intelligent design" and the evolution-creationism debate. Editors Eugenie C. Scott and Glenn Branch, both of whom are with the National Center for Science Education, are among the nation's leading defenders of the teaching of evolution, and their outstanding compilation of articles will be useful to anyone who likewise wants to defend the teaching of evolution and improve science education.

Scott's opening chapter ("The Once and Future Intelligent Design") puts the evolution-creationism controversy into historical context, covering most of the landmark events from the late 1800s to the present: the distribution of *The Fundamentals* (a collection of essays in defense of historic Christianity, published nearly a century ago), the Scopes "monkey trial," the revival of evolution in high school biology classrooms led by the Biological Sciences Curriculum Study, the work of Henry Morris (a young-earth creationist and founder of the Institute for Creation Research), and some of the lawsuits associated with the controversy (e.g., *Epperson v. Arkansas, McLean v. Arkansas Board of Education, Edwards v. Aguillard*). The bulk of the chapter, however, focuses on the most recent version of creationism—that is, intelligent design—and its milestones, including the publication *Of Pandas and People,* by Percival Davis and Dean Kenyon; the crusade against evolution carried out by Phillip Johnson, author of *Darwin on Trial*; and the *Kitzmiller v. Dover* decision. Scott also discusses some creationist strategies (e.g., "teach the controversy") and the scholarly pretensions of intelligent design. This chapter is one of the best summaries available for the history of the modern controversy involving creationism and evolution.

The chapter is followed by "Analyzing Critical Analysis: The Fallback Antievolutionist Strategy," in which Nicholas Matzke and Paul Gross analyze the many evolving forms of creationism (e.g., creation science and its born-again cousin, intelligent design). The authors review creationists' recent uprisings in Ohio and Kansas, then discuss several fallacies of creationists' arguments, including their misrepresentations of phylogenetic trees and transitional forms, Haeckel's exaggerated similarities between the early developmental stages of vertebrate embryos, and the concept of "irreducible complexity." As Matzke and Gross note, the "objections to evolution are not serious scientific arguments; they are superficially investigated and poorly reasoned talking points... aimed at uninformed audiences."

Martinez Hewlett and Ted Peters, authors of "Theology, Religion, and Intelligent Design," are self-described "theistic evolutionists" who "embrace healthy science as an expression of [their] religious faith." Their chapter, which focuses on the history of the design-based argument, discusses William Paley's *Natural Theology,* Johnson's *Darwin on Trial,* Michael Behe's *Darwin's Black Box,* and William A. Dembski's mathematics-based claims for intelligent design. Hewlett and Peters then offer a critique of intelligent design and discuss how the controversy is affected by religious diversity.

The purported controversy...is illusory; nearly all scientific professional organizations have published statements supporting the teaching of evolution in science classrooms, and rejecting the teaching of creationism.

Jay Wexler gives an outstanding analysis of the constitutional issues associated with creationist teaching in "From the Classroom to the Courtroom: Intelligent Design and the Constitution." This chapter pays special attention to the *Edwards* and *Kitzmiller* decisions, and provides an excellent summary of the legal issues involved in each case. It should be required reading for all teachers, school administrators, and school-board members.

Brian Alters, in "Evolution in the Classroom," tells readers about the realities of teaching evolution in high school classrooms. He opens the chapter with an excerpt from a letter Stephen Jay Gould sent to McGill University: "I don't think that any job in the entire world—and I include Popes, Presidents and Generals—could possibly be more important than teaching science to secondary school students." Alters then explains that antievolutionists often raise the specter of scientific controversy regarding the validity of evolution—claiming, for example, that some scientific evidence questions evolution—and demand that teachers "teach the controversy." The purported controversy, however, is illusory; nearly all scientific professional organizations have published statements supporting the teaching of evolution in science classrooms, and rejecting the teaching of creationism.

The last chapter, "Defending the Teaching of Evolution: Strategies and Tactics for Activists," discusses what people who want to improve science education can do to promote the effective teaching of evolution. Complacency is the enemy, says author Glenn Branch. Despite their many legal defeats and the overwhelming scientific evidence supporting biological evolution, antiscience activists will not stop trying to undermine science education and eliminate evolution from high school biology classrooms. If the evolution-creationism issue hasn't flared up in your community, it most likely will, at which time you can turn to this chapter to learn how to thwart the creationists' well-organized (and well-funded) efforts to corrupt science education.

In summary, *Not in Our Classrooms* is a powerful, accessible introduction to the many facets of intelligent design. There are several good books about the evolution-creationism controversy, but none is better than *Not in Our Classrooms.* If you read just one book about this subject, read this one. Then give the book to others and urge them to do the same. It is a valuable resource.

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A COLLECTION OF COMPUTER-INTENSIVE METHODS

Introduction to Computer-intensive Methods of Data Analysis in Biology. Derek A. Roff. Cambridge University Press, New York, 2006. 376 pp. $65.00 (ISBN 9780521608657 paper).

Technological advancements have allowed biologists and ecologists to amass enormous amounts of data. Moreover, many contemporary issues require various sources of information—differing in quality, completeness, and scale—to answer pressing research questions or to evaluate important hypotheses. These advancements and the demands of modern science call for sophisticated methods for dealing with large and diverse sources of data. Modern computational and statistical methodologies are bringing data analysis and modeling into balance with data collection and storage capabilities, allowing us to address scientific problems in ways that were unimaginable 20—or even 10—years ago.

Some statistics-oriented books introduce, often in great detail, modern computational methods for data analysis that are meeting the challenges of a data-rich world. In my opinion, however, biologists and ecologists largely lack the training in these state-of-the-art statistical methods. The ideal textbook would provide an overview of those modern computational statistics that are potentially of greatest relevance to biologists, highlight the important theoretical underpinnings, discuss the motivation behind using particular approaches, give sufficient detail on implementation, and include examples based on the types of data and problems that biologists "typically" encounter. When I learned of Derek Roff's recent book, *Introduction to Computer-intensive Methods of Data Analysis in Biology,* I initially thought this could be that book.

Roff is a professor in the Department of Biology at the University of California, Riverside. As he is an evolutionary population ecologist, many of his examples are drawn from evolutionary ecology, population biology, and ecological genetics. He has published extensively in these fields, including four books related to evolutionary biology, life-history evolution, and quantitative genetics. Roff's experiences working with a variety of data sources are presumably what stimulated him to compile this book and to write, "Much of the development of statistical tools has been premised on a set of assumptions, designed to make the analytical approaches tractable."

In my view, such assumptions—normality, linearity, and independence, among others—are often very restrictive and can force one to pigeonhole a data set (and a research question) into an existing approach that is inappropriate for the problem at hand. I therefore wholeheartedly agree with Roff's observation that "we have now entered an era where we can, in many instances, dispense with such assumptions and use statistical approaches that are rigorous but largely freed from the straight-jacket imposed by the relative simplicity of analytical solution." And indeed, Roff does give many biologically inspired examples that do not conform to classical, canned analysis methods.

The title and preface led me to think that the book would cover modern approaches of computer-intense data analysis, but Roff focuses primarily on relatively old-school, established methods—the jackknife (chapter 3), the bootstrap (chapter 4), randomization (chapter 5), and regression trees (chapter 6). Chapter 2 (maximum likelihood) and chapter 7 (Bayesian methods) have the greatest potential to contribute toward a discussion of cutting-edge computational statistical methods. However, Roff pays little attention to many computer-intensive methods that have come to the fore in the past decade, even though these are primarily responsible for the resurgence and escalating popularity of Bayesian, maximum likelihood, and some other approaches. For example, the Bayesian chapter is based on analytical results and issues from some years ago: there is no reference to the recent flood of numerical and computational methodologies that are responsible for the rapid rise of Bayesian approaches in many applied fields. Among the key advances missing from the book are, for example, Markov chain Monte Carlo (MCMC) algorithms (e.g., Gibbs sampling, the Metropolis–Hastings algorithm). Likewise, much of Roff's discussion of maximum likelihood approaches is based on rather simple examples and analytical derivations. Yet these approaches may require sophisticated and computationally intensive algorithms such as the expectation-maximization algorithm, simulated annealing, and MCMC-type hill-climbing routines. I was disappointed that *Computer-intensive Methods* overlooks many of the truly state-of-the-art computational statistical methods that are applicable to data analysis in biology and ecology.

Nevertheless, some elements make the book a potentially useful resource for researchers and graduate students. One redeeming quality is that throughout the book, Roff makes the point that one should routinely conduct simulation analyses to evaluate the usefulness of a particular data analysis method. He gives several examples of instances for which he simulated pseudodata from a known process (e.g., parameter values and distributional forms are known), and then subjects the pseudodata to different analysis methods to reconstruct (estimate) the known parameters. A good method would yield parameter estimates that agree with the known values.

Another positive feature is that about one-third of the text is an appendix with annotated S-PLUS code; any biologist who wished to learn or use S-PLUS for conducting simulations and data analysis would very likely find this book valuable. Moreover, Roff has made the code publicly available on his UC Riverside Web page (*www.biology.ucr.edu/people/faculty/Roff.html*). S-PLUS is a powerful and flexible language for conducting both classical and more modern, computationally demanding analyses. Although code for R (a free software package similar to S-PLUS) might have been useful to a wider audience, one should be able to use the S-PLUS syntax as a starting point for programming Roff's examples in R. Last, Roff does provide a fair amount of detail and references regarding various jackknife and bootstrap methods, which someone interested in using these methods would find valuable.

In summary, Roff gives a brief overview of some data-analysis methods, but many areas lack sufficient explanation. Thus, it would be good if users had a basic understanding of the theoretical foundations underlying the different approaches. I also would have liked to have seen more discussion about the motivation for choosing particular methods. Additionally, with the exception of the jackknife and bootstrap chapters, I felt that the chapters were not well integrated. I would hesitate to recommend *Computer-intensive Methods* as a primary text for a graduate course; however, the S-PLUS appendix and simulation analysis examples make this book a potentially valuable resource for those who are interested in these aspects of data analysis.

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HISTORICAL JOURNEY IN THE EVOLUTION OF SOIL SCIENCE

Footprints in the Soil: People and Ideas in Soil History. Benno Peter Warkentin, ed. Elsevier, Burlington, MA, 2006. 548 pp. $75.00 (ISBN 9780444521774 cloth).

Footprints in the Soil, edited by Benno Peter Warkentin, is a journey through the history of soil science, led by a distinguished group of writers who explore the progression of concepts about soil's nature, its components and processes, and its importance to societies over the ages. It encompasses this history in four sections: "Early Understanding of Soils," "Soil as a Natural Body," "Soil

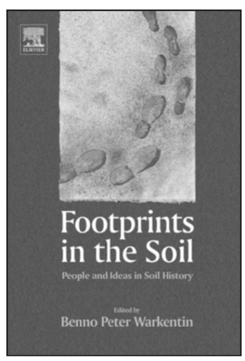
Properties and Processes," and "Soil Utilization and Conservation." Together, they cover the entire range of components that constitute the discipline of soil science.

The first section alone makes *Footprints in the Soil* indispensable reading for soil scientists who may not be familiar with the early beginnings and sources of the concepts related to soil's importance to agriculture and society. Written by members of the archaeological and anthropological communities, the section traces the history and development of the early concepts of the soil and earth, beginning with the ancient Romans, whose husbandry derived from their coupling of Greek ideas with their own practical knowledge of soils. The discussion moves on to the additions that other cultures have made to the body of knowledge about soils, to those cultures' understanding of the interrelationships between soil and agriculture, and to the incorporation of concepts about soil into their religious and ethical thinking. These early concepts are the basis for present-day holistic approaches to environmental ethics and ecology in natural ecosystems.

A note about the progression of chapters in the first section: Chapter 3, "The Heritage of Soil Knowledge among the World's Cultures," is a good overview of indigenous people's knowledge of soil and land-use systems. Readers may want to begin the section with that chapter, follow with chapters 1 and 2 (on the ancient Romans and pre-Colombian Mesoamerica, respectively), and then move to chapters 4 ("Some Major Scientists [Palissy, Buffon, Thaer, Darwin and Muller] Have Described Soil Profiles and Developed Soil Survey Techniques before 1883") and 5 ("Souls and Soils: A Survey of Worldviews").

The next section of *Footprints in the Soil* moves to the West (as does the focus of the book) by way of Russia, where Dokuchaev, in the late 19th century, was developing his concepts of soil genesis to explain soil diversity. Dokuchaev's ideas resonated with soil scientists in the United States, but divergence in approaches soon arose. One chapter in the second section describes the clash between Eugene Hilgard and Milton Whitney, two US scientists with very different backgrounds who advocated two very different approaches to advancing knowledge of soil fertility: Hilgard believed soil chemistry was the appropriate route, whereas Whitney thought that soil physics research was. Both of them were right.

Chapter 9, "A History of Soil Geomorphology in the United States," describes the introduction of pedological concepts into geomorphology, an important science for reconstructing past landscapes and environments. It is a fascinating look into how current approaches to geomorphology developed, and into the roles of the soil scientists who contributed to that development in the United States. For a soil scientist, this chapter is as compelling as a novel: the pages turn faster and faster as the history unfolds.



"Soil Properties and Processes," the third section, begins with an interesting description of how concepts from soil science and from ecology cross-fertilized each other. Soil scientists incorporated emerging ecological concepts about the interactions between the biotic and abiotic features of an ecosystem to explore the interrelationships among soil-forming factors, whereas from soil science, Warkentin says, "ecology found a new object of investigation that extended beyond the limits of individual organisms." Understanding soil dynamics and changes in varied ecosystems is incomplete, despite important developments in soil chemistry and soil physics. The material in the second and third sections of *Footprints in the Soil* will help advance that understanding, however, by pointing the way for graduate students and beginning scientists to integrate basic sciences with the applied and social sciences.

The fourth section returns to a theme developed at the beginning of the book—the value of soil to society—but from the perspective of soil conservation and sustainable agriculture. The chapters in this section point to the need for soil-science applications—physical, chemical, biological, and ecological—to meet the challenges related to conserving land quality, preventing soil erosion and loss of nutrients, and sustaining soil fertility for long-term food production. The discussion of agricultural terracing brings the concerns of ancient indigenous peoples full circle to those of present-day agricultural producers: the aim then was, and is now, to conserve resources. It is up to soil scientists today to provide the research and quantitative information that will enable the conservation and optimal management of soil, an essential resource for providing food security for global populations.

Although *Footprints* is an extremely useful textbook for upper-level undergraduates as well as professors, researchers, and scientists working in the relevant sciences, it could also serve as a valuable reference for others. Any reader can appreciate the historical integration of biology, physics, chemistry, philosophy, and ethics that led to our reliance on soil and our understanding of its complexity. Notable scientists have contributed excellent overviews on aspects of soil science that cover the discipline from the beginnings of soil concepts to the current state of knowledge. As a result, the book includes a comprehensive collection of references ranging from ancient documents (many of them difficult to find) to papers published in the 21st century. The bibliographic information is extensive and detailed. Moreover, the sidebars that expand on the biographies and major findings of early soil researchers add a pleasing, personal touch.

I do have a couple of quibbles. With regard to production, the publisher chose a paper that is too thin, and there are a few editorial oversights in some chapters (information missing from a figure, e.g.). I wish there had been more chapters in which authors pointed out knowledge gaps in soil-science research and challenged and encouraged future scientists to fill them.

Nonetheless, I found the book excellent overall. By presenting the evolution of soil science in a way that relates key concepts to specific individuals, *Footprints* leaves readers more inclined to appreciate the wide range of disciplines integrated into the field and perhaps more capable of understanding its present-day challenges. The book also reminds soil scientists that the history of their discipline is still being formed, and their legacy is still evolving.

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NEW TITLES

Agricultural Biotechnology and Intellectual Property: Seeds of Change. Jay P. Kesan, ed. CABI, Cambridge, MA, 2007. 416 pp., illus. $140.00 (ISBN 9781845932015 cloth).

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Bioviolence: Preventing Biological Terror and Crime. Barry Kellman. Cambridge University Press, New York, 2007. 392 pp. $28.99 (ISBN 9780521709699 paper).

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Dietary Supplements for the Health and Quality of Cultured Fish. Heisuke Nakagawa, Minoru Sato, and Delbert M. Gatlin III, eds. CABI, Cambridge, MA, 2007. 256 pp., illus. $140.00 (ISBN 9781845931995 cloth).

Electron Crystallography of Biological Macromolecules. Robert M. Glaeser, Kenneth Downing, David DeRosier, Wah Chiu, and Joachim Frank. Oxford University Press, New York, 2007. 492 pp., illus. $124.50 (ISBN 9780195088717 cloth).

Evolutionary Ecology of Social and Sexual Systems: Crustaceans as Model Organisms. J. Emmett Duffy and Martin Thiel, eds. Oxford University Press, New York, 2007. 520 pp., illus. $59.50 (ISBN 9780195179927 cloth).

Evolution for Everyone: How Darwin's Theory Can Change the Way We Think about Our Lives. David Sloan Wilson. Bantam Dell, New York, 2007. 400 pp. $24.00 (ISBN 9780385340212 cloth).

A Field Guide to Household Bugs: It's a Jungle in Here. Joshua Abarbanel and Jeff Swimmer. Plume, New York, 2007. 128 pp., illus. $12.00 (ISBN 9780452288744 paper).

Fish Conservation: A Guide to Understanding and Restoring Global Aquatic Biodiversity and Fishery Resources. Gene S. Helfman. Island Press, Washington, DC, 2007. 608 pp., illus. $85.00 (ISBN 9781559635967 paper).

Foraging: Behavior and Ecology. David W. Stephens, Joel S. Brown, and Ronald C. Ydenberg, eds. University of Chicago Press, Chicago, 2007. 624 pp., illus. $99.00 (ISBN 9780226772639 cloth).

Functioning of Microphytobenthos in Estuaries. Jacco C. Kromkamp, Jody F. C. de Brouwer, Gérard F. Blanchard, Rodney M. Forster, and Véronique Créach, eds. University of Chicago Press, Chicago, 2007. 272 pp., illus. $78.00 (ISBN 9789069844534 paper).

The Great Brain Debate: Nature or Nurture? John E. Dowling. Princeton University Press, Princeton, NJ, 2007. 200 pp., illus. $16.95 (ISBN 9780691133102 paper).

Greenhouse Gas Sinks. David S. Reay, C. Nick Hewitt, Keith A. Smith, and John Grace, eds. CABI, Cambridge, MA, 2007. 306 pp., illus. $160.00 (ISBN 9781845931896 cloth).

Memory: The Key to Consciousness. Richard F. Thompson and Stephen A. Madigan. Princeton University Press, Princeton, NJ, 2007. 288 pp., illus. $18.95 (ISBN 9780691133119 paper).

The Middle Path: Avoiding Environmental Catastrophe. Eric Lambin. University of Chicago Press, Chicago, 2007. 192 pp., illus. $25.00 (ISBN 9780226468532 cloth).

Nectaries and Nectar. Susan W. Nicolson, Massimo Nepi, and Ettore Pacini, eds. Springer, New York, 2007. 395 pp., illus. $239.00 (ISBN 9781402059360 cloth).

The New Encyclopedia of Snakes. Chris Mattison. Princeton University Press, Princeton, NJ, 2007. 272 pp., illus. $35.00 (ISBN 9780691132952 cloth).

Physiological Ecology: How Animals Process Energy, Nutrients, and Toxins. William H. Karasov and Carlos Martínez del Rio. Princeton University Press, Princeton, NJ, 2007. 744 pp., illus. $65.00 (ISBN 9780691074535 cloth).

Positive Interactions and Interdependence in Plant Communities. Ragan M. Callaway. Springer, New York, 2007. 415 pp., illus. $249.00 (ISBN 9781402062230 cloth).

The Public, the Media, and Agricultural Biotechnology. Dominique Brossard, James Shanahan, and T. Clint Nesbitt, eds. CABI, Cambridge, MA, 2007. 405 pp., illus. $140.00 (ISBN 9781845932046 cloth).

Sacred Sea: A Journey to Lake Baikal. Peter Thomson. Oxford University Press, New York, 2007. 336 pp., illus. $29.95 (ISBN 9780195170511 cloth).

Scaling Biodiversity. David Storch, Pablo A. Marquet, and James H. Brown, eds. Cambridge University Press, New York, 2007. 488 pp., illus. $70.00 (ISBN 9780521699372 paper).

Science for Sale: The Perils, Rewards, and Delusions of Campus Capitalism. Daniel S. Greenberg. University of Chicago Press, Chicago, 2007. 288 pp., illus. $25.00 (ISBN 9780226306254 cloth).

Subterranean Rodents: News from Underground. Sabine Begall, Hynek Burda, and Cristian E. Schleich, eds. Springer, New York, 2007. 398 pp., illus. $199.00 (ISBN 9783540692751 cloth).

Transdisciplinary Challenges in Landscape Ecology and Restoration Ecology—An Anthology. Zev Naveh. Springer, New York, 2007. 440 pp., illus. $189.00 (ISBN 9781402044205 cloth).

Twelve Diseases that Changed Our World. Irwin W. Sherman. ASM Press, Washington, DC, 2007. 230 pp. $29.95 (ISBN 9781555814663 paper).

Understanding New, Resurgent, and Resistant Diseases: How Man and Globalization Create and Spread Illness. Kurt Link. Praeger, Westport, CT, 2007. 200 pp., illus. $44.95 (ISBN 9780275991265 cloth).

What We Know about Climate Change. Kerry Emanuel. MIT Press, Cambridge, MA, 2007. 85 pp., illus. $14.95 (ISBN 9780262050890 cloth).