Diversity and Complexity by Scott E. Page

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1 author:

Charles Goodnight
University of Vermont
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mals. This broad subject encompasses a wide array of phenomena, ranging from the role of herbivore-induced plant volatiles as olfactory foraging cues for insect predators to the use of visual and other plant-derived cues by fruit-eating vertebrates. These disparate topics are studied by similarly diverse researchers from a variety of scientific disciplines. Nevertheless, these topics are unified—or should be—by a common grounding in basic ecological and evolutionary principles relating to the origin and function of biological cues and signals. This book does a good job of explicating those principles and describing their application across a wide range of systems through an explicitly comparative approach.

An initial introductory chapter presents general concepts in the evolutionary ecology of communication within the context of plant-animal interactions and a second discusses key aspects of the sensory modalities (olfactory, visual, gustatory, and auditory) that mediate such interactions. Building on this foundation, subsequent chapters discuss the role of plant-animal communication in ecological interactions, including herbivory and frugivory, seed dispersal, and pollination, and also touch on issues such as mimicry and deception. A concluding chapter highlights overarching conceptual issues and priorities for future research, including the role of communication in multispecies interactions and the need for further synthesis of work on sensory and ecological aspects of communication.

This accessible volume will no doubt serve as a useful introduction for nonspecialists. But it is also likely that researchers studying various aspects of plant-animal interactions will find it a helpful summary of broader conceptual issues that integrate work on different taxa and modes of communication.

Mark C. Mescher, *Entomology, Pennsylvania State University, University Park, Pennsylvania*

Tropical Rain Forests: An Ecological and Biogeographical Comparison. *Second Edition.*

By Richard T. Corlett and Richard B. Primack. Hoboken (New Jersey): Wiley-Blackwell. $140.00 (hardcover); $79.95 (paper). x + 326 p.; ill.; index. ISBN: 978-1-4443-3254-4 (hc); 978-1-4443-3255-1 (pb). 2011.

The World of Northern Evergreens. *Second Edition.*

By E. C. Pielou. Ithaca (New York): Comstock Publishing Associates (Cornell University Press). $19.95 (paper). xiii + 155 p.; ill.; index. ISBN: 978-0-8014-7740-9. 2011.

This small and engagingly readable book is an updated and expanded version of *The World of Northern Evergreens*, first published in 1988. In it, Pielou successfully combines: a general introduction to North American boreal forests; a field identification guide to the many conifers, the handful of broadleaf (deciduous) trees, and major groups of animals in these forests; informative (and sometimes playful) illustrations; and decades of research findings by herself and others into a rich, descriptive tapestry of information about a kind of forest that many of us take completely for granted. Chapters retained from the first edition include those on the origin of evergreen boreal forests; conifer identification, reproduction, and life history; contrasts between broadleaf and conifer trees (with an apropos reminder that angiosperms and gymnosperms, both of which we bipeds call "trees," are more distantly related to each other than mammals are to birds); the wealth of animals—including parasites, herbivorous insects, mammals, and birds—that inhabit the boreal forests; and forest succession. New material on logging is included in the chapter on forest succession, and three completely new chapters cover: the soil and understory vegetation of the forest floor; biogeography; and the physics of global climatic change and its effects on these forests.

The World of Northern Evergreens is as timely in 2012 as it was in 1988. Now, as then, people in much of North America see conifers as ever-present background, assuming they will be there forever. At the same time, conifers are dying and disappearing throughout their range: eastern and Carolina hemlocks from the hemlock woolly adelgid, many western pines to various *Dendroctonus* bark beetles, and all of them felled by axes, fires, and climatic change. Already, visitors to southern forests where eastern hemlock is almost entirely gone—the Shenandoah and Great Smoky Mountains—barely recognize its loss, just as the absence of American Chestnut from eastern North American forests is rarely appreciated. Pielou once again reminds us to stop and pay attention while we still can.

Aaron M. Ellison, *Harvard Forest, Harvard University, Petersham, Massachusetts*

CONSERVATION BIOLOGY

Diversity and Complexity. *Primers in Complex Systems.*

By Scott E. Page. Princeton (New Jersey): Princeton University Press. $19.95 (paper). xi + 291 p.; ill.; index. ISBN: 978-0-691-13767-4. 2011.

This volume addresses important issues. The idea of an intellectual exploration of the concepts of diversity and complexity in the context of complex systems is interesting, all the more so because of his goal of developing a general concept of these

ideas centered in complexity theory and independent of the more traditional fields of, for example, biology and economics. Thus, it has great promise. Unfortunately, it falls short.

The best of this book is found in the later chapters. It is in these chapters that the effects of diversity are presented in some detail. Chapter 5 is a good discussion of robustness, and what that means. Chapter 6 explores the importance of averaging using the central limit theorem and portfolio theory, and Chapter 7 discusses the impacts of diversification and diminishing returns. Chapter 8 is perhaps the most important chapter where Page assembles the ideas discussed in the rest of the volume to describe in some detail the impact of diversity on complex systems.

Although there are some important ideas discussed in this book, the main issue is that it falls short in two serious ways. First, and most important, the core concepts are not adequately defined. The most glaring example of this is his "definition" of complexity. In the first chapter, he gives two definitions, his BOAR definition and his DEEP definition. The BOAR definition is simply incorrect—complexity is not the space "Between Order And Randomness"—and the second, complexity cannot be easily "Described, Evolved, Engineered, or Predicted," is useless. No one denies that it is difficult to define complexity; nevertheless, it is a scholar's job to take on difficult problems. Second is that he concentrates on biological examples that tend to be outdated, naïve, or just plain wrong. I leave it to readers to decide which of these are most irritating, but I at least found the widespread biological naïvety to be a big enough problem that it was difficult to appreciate the important points the volume did have to offer.

CHARLES J. GOODNIGHT, *Biology, University of Vermont, Burlington, Vermont*

BIOLOGICAL DIVERSITY: FRONTIERS IN MEASUREMENT AND ASSESSMENT.

Edited by Anne E. Magurran and Brian J. McGill. Oxford and New York: Oxford University Press. $135.00 (hardcover); $72.50 (paper). xvii + 345 p.; ill.; index. ISBN: 978-0-19-958066-8 (hc); 978-0-19-958067-5 (pb). 2011.

The goal of the book is to provide an up-to-date and accessible account of biodiversity measures. It generally accomplishes this goal and is useful, albeit at times also disappointing. It contains a wealth of information, but also misses opportunities to bring order to a cluttered and confusing topic. It is written for graduate students and researchers. A reasonable grounding in mathematics and statistics is necessary to follow all of the arguments and to use the described metrics. The writing is clear throughout, and chapters end with a prospectus on future directions and a summary of key points.

The strength of the volume is Parts III and IV on, respectively, species abundance distributions and aspects of diversity other than abundance. The former, in particular, contains a set of closely connected chapters that walk through the various concepts and metrics with clear guidelines on which of the very many metrics are the most useful.

Part II, on inventory and differentiation diversity (also known as α and β diversity), is disappointing. This section needs the synthetic framework that the editors ask for in their concluding chapter. The pity is that such a framework exists in the use of Hill numbers that the editors explicitly mention. For β diversity, Tuomisto (2010. *Ecography* 33:2-22) gave us that framework, and although that paper is cited, none of its content is mentioned.

Missing from the book is what should have been Chapter 1, a framework and review of concepts. Chapter 16, on microbial diversity, indicates that differences in species concepts for bacteria and archaea affect how their diversity is measured, but never describes those differences. As "species" are central to the entire enterprise of measuring biodiversity, this topic should have been covered in that nonexistent first chapter.

Part V (Applications) contains an odd assortment of chapters that are often redundant (for example, Chapter 17 on disturbance contains nothing new besides a definition of disturbance). Chapter 20, rather than being the promised discussion of species-area curves, repeats material from Chapter 4 on species richness. Despite these flaws, I recommend this book.

SAMUEL M. SCHEINER, *Arlington, Virginia*

EVOLUTION

THE EVOLUTION OF THE HUMAN HEAD.

By Daniel E. Lieberman. Belknap Press. Cambridge (Massachusetts): Harvard University Press. $35.00. xi + 756 p.; ill.; index. ISBN: 978-0-674-04636-8. 2011.

The human head is no small topic of research. In fact, one could argue that no other anatomical system has received so much attention or scrutiny, so much so that entire dissertations are written about tiny anatomical subsets of the skull as a whole. The enormous complexity and integration involved in the numerous substructures and anatomical systems results in many researchers, such