

Revue des livres

Book Review

DODDS, W. K., 2009. *Laws, Theories, and Patterns in Ecology*. University of California Press, x + 256 p., 14 × 21 cm, softcover, US\$19.95, ISBN 978-0-5202-6041-2.

In the preface to his new book *Laws, Theories and Patterns in Ecology*, Walter Dodds tells us that his own search for general principles in ecology started over “a pitcher or two” with a colleague and that he hoped the book would provide a “fruitful topic for discussion among ecologists”. It was precisely in that spirit that a group of ecologists at the Cary Institute of Ecosystem Studies got together weekly over wine and cheese to ponder the possibility of laws in ecology, using Dodds’ book as the catalyst for discussion. Surprisingly few book-length publications tackle the question of laws and theories in ecology, despite considerable debate on this topic in the ecological literature (Lawton, 1999; Murray, 2000; Colyvan & Ginzburg, 2003; Lange, 2005; O’Hara, 2005). Dodds’ book is one of the first of its kind, and he aims his treatment at the general ecology readership, where opinions on this topic are likely to be strong. For the sheer boldness and originality of this effort, and for the inevitable discussion that it will inspire, this book will be valuable to many practising ecologists.

The title of the book is a quick guide to its organization. It is divided into three main chapters that follow a short introduction. In the introduction, Dodds suggests that exploring the potential for laws in ecology “can be useful for explaining what we know; so much the better if these laws can be used to predict ecological phenomena and build ecological theories.” Dodds’ shorthand definition of a law is a statement that is “true, contingent, and general”. How much contingency or lack of generality should we allow for ecological laws? Dodds gives us his answer in Chapter 1 and enumerates 35 proposed laws for ecology presented loosely in order of most foundational to most derived. In Chapter 2, Dodds builds theories from these proposed laws and categorizes them as they pertain to the classic hierarchical levels in ecology from organisms to ecosystems. In Chapter 3, Dodds explores patterns and “hot topics” that have yet to generate sufficient generality or predictive power to meet his criteria for a law or theory but nonetheless continue to drive ecological research.

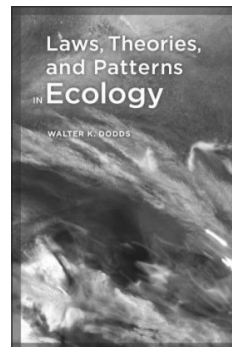
Although the ideas presented in the book are compelling, our reading group found it difficult to draw connections between and within laws and theories. This may have been due to Dodds’ somewhat inconsistent organizational approach. He wavers between a rigorous, philosophical exposition and a more casual, narrative style. The book hints at an overarching framework of laws and theories but does not supply sufficient structure or guidance to illustrate the connections in such a framework. A table or chart of laws and theories would have been useful for showing at a glance which laws provide the foundations of other laws or theories. An inconsistent naming scheme for the laws also made internal referencing difficult. Some laws are named using assertions—“All types of reciprocal interactions are possible”—while others use only vague descriptors—“Recycling rates”. When other laws or theories are related back to “recycling rates”, for example, it is no longer fresh in the reader’s mind what that law actually stated. While we recognize the difficulty in creating an overall framework diagram, the book would greatly benefit from more serviceable internal referencing and improved graphics or diagrams to help the reader form an image of how the ideas are connected.

Some important concepts were not clear, especially in the theories section. Dodds defines a theory as a “body of principles offered to explain phenomena.” This seems straightforward enough, but in several cases our group was left grasping for a clear statement of the theory and what it explained. This may have been due again, in part, to organization. Each theory’s predictive power is discussed only at the end of each theory section, following general introductory material, a reference to the laws that

support the theory, and a list of “strong patterns” that support the theory. Although this kind of depth is appropriate for topics that are clearly central to ecology, such as “hierarchical structure”, “ecosystem energetics”, or “nutrient cycling”, it was not always clear how such ideas operate specifically as theories. A concise opening statement of the theory and what it explains or predicts would make the main ideas in the theory sections more accessible.

Naturally we questioned some specific laws and theories. Is the “dominance of *Homo sapiens*” really a foundational law on par with the laws of physics, or is it a particularly significant “time- and place-based” observation? Does the river continuum concept really hold generally enough to qualify as a theory? Is the term “ecological diffusion” really appropriate for describing how organisms move? Of course, such quibbles are the stuff of good conversation. To the many provoking questions this book will coax out of most readers, the final chapter adds Dodds’ well-researched coverage of a number of hotly debated questions in ecology, such as “Can top-down control ultimately control primary production?” and “Is biodiversity predictably linked to ecosystem function?”

In the end, this book falls short of laying out a handy set of connected principles that explain everything we want to explain in ecology. But that may not have been Dodds’ goal exactly. The book covers many important ideas and will inevitably introduce most ecologists to concepts in sub-disciplines outside their own areas of expertise. It should help researchers to see their own work in a broader context and could be useful in a classroom as an alternative or supplement to an ecology text that follows a more traditional format. It has a comfortable length with suitable depth for general ecologists, and it avoids overly technical language. And it certainly delivers on its promise as a catalyst for discussion. The quest to communicate the most powerful ideas in ecology—their foundations and their interconnections—is something that should appeal to all ecologists. Dodds approached this work as a personal exercise to articulate these ideas. The most valuable contribution of this book might be to inspire the rest of us to do the same, perhaps around a table bolstered by a heady drink or two.



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FORTMANN, L., (ed.), 2008. Participatory Research in Conservation and Rural Livelihoods: Doing Science Together. Wiley-Blackwell, xi + 316 p., 15 × 23.5 cm, softcover, US\$70.00, ISBN 978-14051-7679-8.

How can collaborating with local stakeholders benefit your research and support local conservation? If your interest is piqued by this question, Fortmann's book will encourage you to explore this idea further. Specifically, the book describes the "what," "why," and "how" of building partnerships between researchers and rural community members to address questions of conservation and rural development. The authors use the terms participatory research and interdependent science interchangeably to describe research and learning partnerships between conventional researchers and rural community members, referred to as civil scientists.

The book is organized into three parts: two introductory chapters, six case studies with paired chapters contrasting perspectives of conventional scientists and civil scientists for each case study, and two concluding chapters integrating common themes, practical challenges, and lessons learned. The case studies cover a range of topics in a diversity of geographic regions, from plant breeding in Rwanda and Honduras, to spring restoration and harvest of non-timber forest products (NTFP) in the US, to community forest management in Sweden, Zimbabwe, and Indonesia.

The stated purpose of the book is to persuade conventional scientists that partnering with civil scientists opens new avenues to address complex research questions, thus improving the quality of research. The authors also aim to make the case that partnering with civil scientists increases the potential that research findings will be translated into local actions, such as reduced harvesting of sensitive species or more effective, informed local participation in forest planning. Throughout the book, there is also an emphasis on social justice, demonstrating how research partnerships can empower marginalized people by increasing their confidence and capacity to take leadership roles in developing improved conservation and livelihood strategies.

The authors most convincingly demonstrate their social justice claims. For example, the Swedish and Honduran case studies, the authors show how women and landless farmers, respectively, established community organizations, allowing them space to experiment with innovative approaches for poverty reduction, community resilience, and conservation. The authors also present convincing examples of positive community outcomes that resulted from research partnerships. For instance, in Honduras, research led to improved bean varieties that increased the food security of poor farmers; in Arizona, research on spring restoration led to an educational program with high school students; and in Zimbabwe, research on indigenous tree conservation in communal areas led to establishment of a tree nursery. However, the book delivers mixed results in attempting to persuade conventional researchers that participatory research can improve the quality of their research findings. The Honduras case study of seed improvement was the only clear example linking civil scientist innovation to research advances. Other case studies lacked the detail for readers to assess the significance of research findings and/or the degree to which partnering with civil scientists influenced the quality of the findings. For example, on one side, the US case study on NTFP harvest increased communication among forest stakeholders and addressed social justice issues by working with a marginalized group of immigrant NTFP harvesters; on the other hand, results from this study examining the environmental impact of different NTFP harvest methods seemed to be inconclusive due to interference with control and experimental harvest treatments.

Half of the case studies were conducted by doctoral students for their dissertation research, while the other half were conducted by experienced scholars with a long history of research with and about communities. Although there were only a limited number of citations from the participatory research literature, analysis and discussion of the case studies demonstrated an insightful synthesis of themes from the broader literature of participatory research, including philosophical concepts, practical strategies, logistical challenges, and ethical dilemmas.

There are many edited books on participatory research in conservation and community development (e.g., Pound *et al.*, 2003; Wilmsen

et al., 2008), but the unique power of this book comes from the paired chapters, which contrast conventional and civil scientist perspectives on the research process and its outcomes. Notably, in several chapters civil scientists describe their residual confusion with research questions and project goals, yet at the same time, they clearly provide examples of how their own capacities for conservation and community development were strengthened as a result of their participation in the research. This is especially impressive, considering that the research projects often took place many years before the reflection and writing for these chapters, indicating the importance of these projects in the lives of these individuals. From the researchers' perspective, the case studies emphasize the importance of strong relationships with local partners, which lead to greater insight into local research contexts and the ability to refine research questions and methods to fit local information needs. The fact that researchers were open to critical feedback from civil scientists during the research and even now with the paired chapters in this publication is testament to the researchers' commitment to learning how to address some of the substantial challenges of "doing science together."

Through the case studies, the book presents an honest look at the inner workings of participatory research projects, with valuable insights and synthesis that will be especially useful for graduate students and other researchers interested in participatory research who are only just beginning to grapple with some of the practical issues. This book is probably less convincing for skeptics since most of its emphasis is on the research process and outcomes, with little left for the description of the quality of research results obtained, which is in fact the common bottom line for conventional researchers. In addition, the book may be less attractive for researchers studying ecological questions since there is less emphasis and detail on those subjects.

The true strength of the book lies in its focus on the quality of research partnerships and the power of these relationships to address social justice issues as they relate to conservation and rural livelihoods.

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Pastor, J., 2008. Mathematical Ecology of Populations and Ecosystems. Wiley-Blackwell Publishing, xiv + 329 p., 19 × 25 cm, hardcover, CAD\$221.99, ISBN 978-1-4051-8811-1.

If a book can be described as robust, then *Mathematical Ecology of Populations and Ecosystems*, by John Pastor, deserves that description. The book's straightforward structure confronts the reader immediately with the main questions of mathematical ecology applied to populations and ecosystems, approaching them from a variety of mathematical viewpoints. *Populations and Ecosystems* are first described as separate entities (in

separate sections), and the two are then integrated in the final section, *Populations and Ecosystems in Space and Time*.

The opening sentences of the book immediately express its aim. After introducing broad terms like perturbations, persistence, dynamics, decay, growth, populations, and cycles, the author asks: “How can we think clearly about how these abstract terms relate to the plants, animals, and soil? That is what this book is all about.”

The first part of the book addresses the preliminaries of mathematical theory applied to ecology (Part 1, Chapters 1 and 2; in addition, MatLab functions are discussed at the end of the book), including a mathematical tool box on calculus, matrix algebra, and equilibrium. These basics are necessary for understanding the theories on populations and ecosystems presented in the following chapters, so their inclusion here helps readers avoid mathematical pitfalls.

Populations are introduced in Part 2, with growth and decay concepts examined in Chapter 3. Both exponential and geometric growth models of populations are introduced. As one would expect, the author discusses the shortcomings of simple population growth models, criticizing assumptions like *i*) birth and death occur continuously and *ii*) birth and death rates are constant for all individuals of a population.

These assumptions are scrutinized in the next chapter (Chapter 4), which introduces age- and stage-structured linear models, relaxing assumptions related to population homogeneity. In these models, birth and death are no longer constant within a population but are allowed to vary depending on the age class or the life stage being considered, with particular reference to Leslie (1945) matrix modeling. Leslie’s age-class and life-stage models suffer from unbounded population growth if total fecundity exceeds total mortality. Relaxing the assumption of constant birth and death, *i.e.*, introducing the concept of K (carrying capacity), transforms these exponential models into the logistic-like models introduced in Chapters 5 to 7 (see, *e.g.*, Equation 5.7a), such as the Ricker (1954) or the Beverton–Holt (1957) models, which are explained in detail. Chapter 6 introduces important issues like chaos and oscillations in population growth, allowing us to match the life history of organisms with the solution of a mathematical model. Assuming that a population grows following a logistic-like model, perturbations like resource harvesting (Chapter 7) or predation (Chapter 8) by a second population are then considered. Chapter 7 provides a detailed discussion of different harvesting strategies, *e.g.*, quota, proportional, hyperbolic, and sigmoid harvesting, and corresponding population responses. Chapter 8 introduces predator–prey models, relying on, among others, the celebrated Lotka–Volterra model (Lotka, 1925; Volterra, 1926), a density-dependent self-regulation of prey model, and the hyperbolic Michaelis–Menten (1913) harvesting function to explain predator harvesting of prey. Each of these predator–prey models is examined by delving into the resulting population oscillations around a coexistence equilibrium point. Having accounted for harvesting and predator–prey models, the author then proceeds to consider species interactions in more detail, considering competition, mutualism, and invasion (Chapter 9). Chapter 10 introduces the concept of species communities, addressing the interaction between more than two species. Interactions among species are a crucial issue in population ecology since the inclusion of additional species in a population model may lead to completely different outcomes. There are a number of ways to model species interactions. In this case, for space reasons, the book focuses only on food web models.

The *Ecosystems* part of the book begins in Chapter 11, which looks at resource uptake from an ecosystem point of view. The effect of nutrient cycling on an ecosystem’s equilibrium is considered starting in Chapter 12, in which litter return is accounted for in one- and multi-species systems. The complexity of modelling consumers *versus* producers (plants) is taken into account in Chapter 13. It turns out that many models of consumer *versus* plant interactions rely on only one consumer compartment. The need

to generalize such models to n -species interactions is discussed in detail in this chapter. Predator–prey models are considered in Chapter 14, which introduces stoichiometry, *i.e.*, the characteristic elemental ratios of each species.

In both the *Populations* and the *Ecosystems* parts of the book, landscape and the distribution of organisms are assumed to be homogeneous. The last two chapters (Chapters 15 and 16) consider a more realistic model of life interactions, explicitly looking at transition probabilities between populations (metapopulation theory, see, *e.g.*, Levins, 1969) and organism diffusion. This final part (*Populations and Ecosystems in Space and Time*) also seems to relax the major assumption of the whole book, *i.e.*, landscape homogeneity. Relaxation of this assumption opens the way for a (potential) future focus on the spatial patterns of dispersion of organisms in the landscape, with an explicit up-scaling from populations to ecosystems to biogeographical patterns in space and time. Future editions of the book would benefit from greater discussion of these topics, incorporating new, challenging issues related to landscape *versus* population ecology such as landscape genetics, landscape diversity effects on populations’ structure, and environmental factors affecting the spread of populations.

Overall, this book has a number of pros and very few cons. Its best feature is the scientific soundness that permeates the whole book, founded on a robust mathematical treatment of most of the arguments. This emphasis on math may hamper undergraduate or even graduate students looking to quickly get up to speed on the subject. However, once the mathematical background (mainly matrix algebra, trigonometry, and topology) is dealt with, the book will prove to be a vital reference on population ecology.

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*Note: All references cited in this review are cited within the reviewed book.

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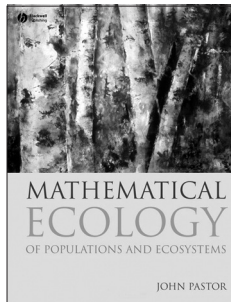
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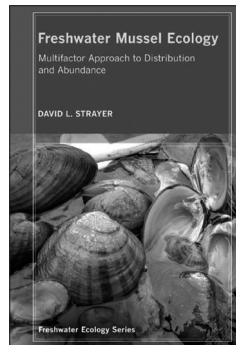
Strayer, D. L., 2008. Freshwater Mussel Ecology: A Multifactor Approach to Distribution and Abundance. Freshwater Ecology Series, Volume 1. University of California Press, xvi + 216 p., 15 × 23 cm, hardcover, US\$45.00, ISBN 978-0-520-25526-5.

The author has synthesized the literature on freshwater mussel ecology to produce an easy to read text that is logically organized into three sections. The first section identifies the topic of study and the need for an integrated multi-factor theory to explain freshwater mussel abundance and distribution (Chapters 1 and 2). The second section (Chapters 3 to 8) describes the five limiting factors of freshwater mussel abundance and



distribution (dispersal, habitat, hosts, food, and enemies). In addition, that section identifies gaps in scientific information that can impede research, management, and conservation in this field. The final section (Chapters 9 and 10) discusses methods to create a working unified theory for understanding freshwater ecology.

Overall, the book is compelling, informative, and insightful in its demonstration of the key role of mussels in their ecosystem. Ecologically, freshwater mussels are important because they are the dominant filter feeders and shell builders (sequestering calcium) in freshwater systems, thus influencing water chemistry and clarity. Their waste and shells can boost algae and benthic macroinvertebrates, and mussels are valuable prey for several predators, some of which are protected. Economically, freshwater mussels were once harvested as sources of meat, pearls, and ornamental shell. Today, this harvesting has largely disappeared due to overharvesting, habitat alteration and destruction, pollution, and the development of barriers to dispersal (such as dams that cause significant thinning of mussel ranges). Overall, human activity continues to alter system hydrology, sediment, nutrient loads, thermal and light regimes, and shorelines through dredging channels, filling shallow waters, altering the availability of fish as hosts, introducing exotic predators and competitors, and polluting these systems with toxins. Given the slow response times for parts of ecosystems and the long life spans of freshwater mussels, we are



underestimating the severity of impacts both spatially and temporally, making mussels one of the most imperiled groups of freshwater fauna in North America and the focus of many conservation efforts (Dudgeon *et al.*, 2006; Strayer & Dudgeon, 2010).

The author correctly concludes that tremendous complexities, lack of resources (money, manpower, and time), and lack of adequate knowledge inhibit the construction of a comprehensive model for predicting freshwater mussels' distribution and abundance. Overall, the lessons imparted by this book on the current status of freshwater mussels, and its reflection on freshwater organisms in general, constitute a sobering long-term reality check for students, faculty, researchers, and managers, and I recommend it highly.

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