Book Reviews

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Protecting the environment: It's all about political leverage, after all

Layzer, Judith A. 2008. **Natural experiments: ecosystem-based management and the environment.** American and Comparative Environmental Policy. The MIT Press, Cambridge, Massachusetts. xiv + 365 p. $70.00 (cloth), ISBN: 978-0-262-12298-6 (alk. paper); $28.00 (paper), ISBN: 978-0-262-62214-1 (alk. paper).

Key words: conservation management; ecosystem services; environmental management; environmental policy; stakeholder participation.

The by-and-large unsustainable ways humans draw on natural resources lead to many land-use conflicts between environmentalists and commercial land users: farmers, mining companies, urban developers, and infrastructure projects. In many cases, legal regulatory frameworks exist at the national and regional levels, restricting deleterious effects of human influence on key ecosystem processes, but usually not at the local scale. Locally, stakeholder participation in ecosystem-based management (EBM) has been heralded as a mutually beneficiary framework. According to Judith Layzer, it comprises three aspects: (1) EBM addresses problems at the landscape scale, (2) EBM entails collaborative planning, and (3) EBM relies on flexible, adaptive implementation of planning goals.

To date, many ecosystem-based management studies have been initiated, but few have been evaluated for their effectiveness, i.e., how well the defined goals of environmental protection or restoration have been met. In this book, Layzer attempts to elucidate how effective participatory EBM is, how well it delivers improvements in environmental conditions, and under which circumstances this approach is particularly fruitful or ineffective. She does so by outlining an optimistic and a pessimistic model of EBM, and then investigating in detail seven case studies, three terrestrial (Austin's Balcones Canyonlands Conservation Program; San Diego Multiple Species Program, California; Sonoran Desert Conservation Plan, Pima County, Arizona), and four aquatic ecosystems (the Comprehensive Everglades Restoration Plan, Florida; the California Bay-Delta Program, California; Kissimmee River Restoration, Florida; Mono Basin Restoration, California). The book is organized accordingly—the first two chapters introduce the context, define EBM, and outline the optimistic and pessimistic models. The next seven chapters detail each of the seven case studies, followed by a concluding synthesis.

The optimistic model assumes that the landscape scale facilitates high coordination among agencies with consistent goals and actions. The collaborations with stakeholders lead to an atmosphere of trust that increases compliance in the implementation of the plan. The pessimistic model, in contrast, states that developmental interests dominate the participatory process. As a result, lowest-common-denominator solutions are the rule, which dilute precautionary protection. Also, adaptive management is likely to be met by resistance by managers.

These are the background hypotheses against which this book sets its investigation. The level of detail presented for each case study is impressive: Layzer interviews local stakeholders, land managers, and NGOs, cites newspaper articles to represent the public view, and reports on scientific advice given by environmental scientists. She also sketches the details of the implementation plans and pays particular attention to the regulatory framework accompanying the implementation. For the general reader, who may be more interested in the general outline and results, these seven chapters make hard reading. Dozens of management boards and pressure groups are reflected upon, usually by referring to an acronym. No figures other than maps help the reader understand the intricate interactions between the relevant parties, while the text is full to the brim with this information. Strangely enough, Layzer hardly ever directly reports on the exact settings of the stakeholder participations. One of these rare but telling cases is a report from the Pima County study, where Layzer clearly describes the social dynamics behind stakeholder meetings: "Instead of deliberation, the meetings featured posturing by various interests." More commonly, however, she discusses the developments at a meta-level, on the basis of dozens of reports, internal memos, newspaper clippings, and participants' statements, but leaves the reader without a direct impression of the detailed work behind the process.

The introductory and synthesizing chapters, on the other hand, provide an excellent summary of both the findings from the seven case studies and current frontiers in EBM science. On this basis, Layzer draws several important conclusions. One key problem for an objective assessment of the effectiveness of these schemes was a general lack of monitoring of the state of the environment. Sometimes such measurements were not attempted, sometimes the focus and/or implementation changed through time, making previous targets obsolete. Layzer thus had to pay more attention to the structure of EBM in the different sites, for example whether the targets of an EBM went beyond the legal minimum or whether an adaptive management plan was actually implemented and not only conceptualized.

Layzer's conclusion from these seven case studies, and from much of the literature she cites, is rather bleak. Particularly the large four case studies (Balcones Canyonlands Conservation Program; San Diego Multiple Species Program; Comprehensive Everglades Restoration Plan; California Bay-Delta Program) do not satisfy many of her criteria for defining success, and, in terms of environmental benefit, provide "no discernible change or a mixed bag." Ecosystem-based management is a complex issue. Tackling both the scientific issues and the legal and conflicting interests is necessarily difficult. However, the key feature of successful EBMs was the support by public officials "articulating a strong, pro-environmental goal and employing regulatory leverage," also known as "conventional politics." This conclusion coincides with the pessimistic model of EBM outlined in the second chapter: economic interests are usually very capable of steering a participatory scheme in their direction, while environmentalists already start with a willingness to find compromises. Only a strong and clear commitment to environmental protection by municipal and governmental officials can balance short-sighted economic interests in favor of long-term sustainability.

Can seven studies be generalized to the U.S. in general? Can, furthermore, seven U.S. case studies inform non-U.S. environmental scientists about the prospects and perils of

EBM? The answer to both questions is, in principle, "yes." The structures that further or hinder EBM in these seven studies are similarly encountered throughout the U.S. and other countries with strongly developed governmental and non-governmental institutions. Although seven case studies are insufficient for general statements, the detailed analysis is the right method and provides the right tools for a meta-analysis, and the Layzer's findings are likely to be robust.

Carsten F. Dormann

Helmholtz Centre for Environmental Research UFZ
Department of Computational Landscape Ecology
Permoserstr. 15
04318 Leipzig, Germany
E-mail: carsten.dormann@ufz.de

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Mathematical ecology

Pastor, John. 2008. **Mathematical ecology of populations and ecosystems.** Wiley and Sons, Hoboken, New Jersey. xiv + 329 p. $175.00 (cloth), ISBN: 978-1-4051-8811-1 (alk paper); $75.00 (paper), ISBN: 978-1-4051-7795-5 (alk. paper).

Key words: ecological models; eigenvectors; litter return; harvesting; multispecies models.

The fundamental goal of John Pastor's fine new book is to establish a common mathematical approach that can be applied equally to both population and ecosystem ecology. As he describes in his preface, while population ecologists have been trained to use analytical mathematical models, which allow them to generate algebraic expressions, ecosystem ecologists have used computer simulation models. Furthermore, while population biologists treat deaths as losses, ecosystem ecologists treat dead individuals as remaining within the system, while playing important roles in energy flow and nutrient cycling. Thus, mathematically oriented ecosystem and population ecologists have lacked a common approach to significant common problems. The purpose of Pastor's text is to help advanced undergraduate and graduate students (and I daresay many professional ecologists) bridge this gap by providing a common set of mathematical tools that can be used to approach the study of both populations and ecosystems.

The book is broken up into four parts. In part I, "Preliminaries," he first outlines what mathematical ecology consists of and why we are motivated to do it. More importantly, in Chapter 2 he presents the "Mathematical toolbox." This chapter is essential to the success of the book. Here he reviews the basics of calculus, the idea of the limit, differentiation and integration, and the Taylor expansion. Then he introduces matrix algebra, eigenvalues, and eignvectors. Generally speaking, Pastor explains all of this very elegantly and pleasantly. However, given the importance of this chapter to the rest of the book, I wonder if more examples and a bit more handholding are in order. Throughout the book, Pastor sprinkles in exercises to help the reader determine if he/she has understood the critical points; unfortunately, there are no solutions to these exercises anywhere in the book and I found no evidence of a web page where one could look for solutions.

The remainder of the book is divided up into sections on "Populations" (part 2), "Ecosystems" (part 3) and "Populations and ecosystems in space and time" (part 4). Each chapter begins with an introduction to a topic and the derivation of a simple model. In the remainder of the chapter the mathematical assumptions are relaxed and analyzed. In many of the chapters he explores simple geometric analyses, followed by an analysis using matrix algebra. At the conclusion of each chapter Pastor includes a summary section and a section entitled, "Open questions and loose ends" in which he points the way to other topics a student may wish to explore, building on what has been discussed within the current chapter.

Does Pastor succeed in establishing a common mathematical approach to populations and ecosystems? I would say, yes. The first few chapters on populations do not lead to many surprising results, but he does establish his methodology of establishing eignevalues and evaluating them at equilibrium. Chapter 7 on harvesting of populations was both illuminating and frustrating. Pastor points out that harvested populations can show bifurcations, in which small increases in harvesting can initiate dramatic changes in the population, leading to sudden declines and even extinction. This is an excellent cautionary point that needs to be made to resource managers (such as fisheries biologists), but Pastor systematically avoids even the mention of stochastic models (the word first appears on page 260 and is not even in the index) that should be mentioned when discussing harvesting of populations and/or prevention of species extinctions.

Chapter 8, on predator-prey interactions, is very well done and contains some interesting historical information on Lotka and Volterra. Chapter 9, in which he uses the traditional Lotka-Volterra equations to explore both competition and mutualism, was of little interest to me. Pastor does his best with what I think is an outmoded set of models, but I found the conclusions drawn from his analyses to be less than useful. We probably knew already that species coexist if competition is not too intense. And, as has been pointed out by many others, the application of the Lotka-Voterra equations to mutualism leads nowhere. Pastor's conclusion that stable coexistence of two mutualistic species is possible only if one of the species is facultative or if the mutualistic interaction is weak, ignores a great deal of natural history. He closes this section by building a bridge to the ecosystem section via a chapter on food webs and multi-species communities.

The best section of this book is the ecosystem section. Here Pastor begins with an analysis of resource uptake and efficiency. He introduces, among other things, the Tilman approach to competition for resources, leaving behind the Lotka-Volterra approach. This chapter is where the melding of population and ecosystem approaches becomes evident. Populations can be modeled as a balance between resource uptake and conversion to biomass vs. losses of biomass to metabolism and mortality. In the next chapter he deals with the effects of litter return and nutrient cycling on ecosystem stability. At this point Pastor shows that plants can be thought of as "predators" on resources and that the uptake function is formally equivalent to the predator harvesting function. On the other

hand, when a plant dies its nutrients are eventually returned to the resource pool. Thus, although there are similarities between a model of nutrient recycling and a predator-prey model, there is no stable limit cycle for nutrient cycling as one finds in predator-prey models. At the conclusion of this chapter he points out that ecologists have begun to recognize litter decay as a sort of life history trait of a species. The so-called secondary compounds of plants affect not only potential herbivores, but also the chemistry of the litter, which, in turn, has significant effects on ecosystem functioning and stability. I have one bone to pick with this chapter. He asserts that less than 10% of plant biomass flows to higher tropic levels in most ecosystems, the remainder being processed by decomposers. While this is true in forested ecosystems, a much greater percentage is handled by the herbivore-based food chain in grasslands and aquatic ecosystems.

The last two chapters in this section explore consumer regulation of nutrient cycling and stoichiometry. In the consumer regulation chapter, he attempts to explore models linking consumers, plants, and resources, not an easy task. The question of top-down vs. bottom-up control of ecosystems is posed and found to be a false dichotomy. Both operate simultaneously. Pastor also shows how competitive exclusion between two plant species is avoided when in the presence of a consumer.

As Pastor points out, mathematical modeling of stoichiometry is on the cutting edge of current research. Adding stoichiometric constraints adds a variety of behaviors to predator-prey or plant-nutrient uptake models.

The last section consists of two chapters. The first deals with landscape ecology and metapopulations, the second with diffusion and spatial patterns. I probably learned less from this section, but as Pastor points out, it is important to "relax" the assumption that populations and resources are homogeneous in space.

I would recommend this book to students or ecologists who work in either population or ecosystems ecology. The mathematics is dense at times, but Pastor does an excellent job of guiding us through the equations and helping us understand what they mean in an ecological context. The format of the graphs was such that they were supposed to look like they were hand drawn, and I found that distracting. But they were useful and reasonably easy to understand. The bibliography was excellent and I am grateful to Pastor for pointing out some excellent reference works.

Larry L. Rockwood

George Mason University
Department of Environmental Science and Policy
Fairfax, Virginia 22030
E-mail: lrockwoo@gmu.edu

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Spotlight

Recent Publications of Particular Interest

McGowan, Kevin J., and Kimberley Corwin, editors. 2008. **The second atlas of breeding birds in New York State.** Cornell University Press, Ithaca, New York. xxii + 688 p. $59.95, ISBN: 978-0-8014-4716-7 (alk. paper). This second edition of the atlas, coming 20 years after the first, is a compilation of an enormous amount of work and contains chapters on methods, land use, birding history in New York, conservation, and species acc ounts of more than 250 species. Each species account includes a map that compares the occurrence of the species in 1980–1985 to that in 2000–2005.

Mitchell, Joseph C., Robin E. Jung Brown, and Breck Bartholomew, editors. 2008. **Urban herpetology.** Herpetological Conservation. Number 3. Society for the Study of Amphibians and Reptiles, Salt Lake City, Utah. xvii + 586 p. $75.00, ISBN: 978-0-916984-79-3. Forty chapters and 13 case studies explore a wide variety of topics related to urban populations of amphibians and reptiles. Chapters are grouped into sections on habitat loss and change, effects of roads, chemical and light pollution, urban waters, introduced species, geographic reviews, management and regulations, and education and citizen involvement.