Ecological Flux and Traditional Religion

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Ecological Flux and Traditional Religion

Religion and the New Ecology: Environmental Responsibility in a World in Flux. David M. Lodge and Christopher Hamlin, eds. University of Notre Dame Press, Notre Dame, IN, 2006. 344 pp., illus. $40.00 (ISBN 9780268034043 paper).

Now that we characterize nature by flux rather than stability, what are we to do? This question is the focus of *Religion and the New Ecology,* edited by two professors at the University of Notre Dame, David Lodge (Department of Biological Sciences) and Christopher Hamlin (Department of History). The book grew out of a Lilly Fellows conference, "Ecology, Theology, and Judeo-Christian Environmental Ethics," held at Notre Dame in February 2002.

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Because many of the matters "conspicuous in environmentalism are genuinely religious," Hamlin and Lodge draw moral implications of "flux ecology" from religious sources, specifically Christian ones. Despite this Christian emphasis, the book is excellent. In particular, it is refreshingly multidisciplinary, incorporating three chapters by historians, two by ecologists, one by a philosopher, and two by ecotheologians, in addition to bookends by Hamlin and Lodge. Although I am not convinced that this topic is particularly new—historians have been analyzing and considering these issues since at least 1990—the topic still merits ongoing reflection and dialogue.

The first question that readers of *BioScience* might ask, however, is "Why would a nice person like me be caught dead with a book like this?" There seem to be too many good reasons to doubt that traditional religion is the place to find out how to act ethically with regard to the environment. As Gary Belovsky points out, the Bible's repeated advocation of human fertility surely would not be viewed as environmentally friendly today. More incisively, Belovsky examines whether we can find a basis for environmental ethics in Christianity, given that biblical authors largely ignored environmental change, attributing it to an angry God rather than to their own actions. Kyle Van Houtan and Stuart Pimm demonstrate how scripture is selectively quoted to support the ties between some Christian organizations and politically conservative think tanks. Elsewhere, John Haught questions whether belief in the "next world" lessens our devotion to this world, which might be served best by radical naturalism.

Overall, however, the authors firmly believe that religion has much to offer to modern environmentalism. They pragmatically argue that we need to engage with American Christians specifically, simply because of their prominence. More important, the authors genuinely believe that Christianity has the potential to contribute to a renewed environmental ethic; they unanimously dismiss Lynn White's infamous thesis that Christianity is essentially the cause of ecological degradation. Van Houtan and Pimm, for example, review Christian environmental worldviews, concluding that they "cannot be placed in one simple box" and arguing that ecologists and Christians need to work together in the interest of conservation.

Several authors consider the transformative potential of religion for inspiring "changes of human identity," perhaps reincorporating the classic virtues (especially humility and moderation, and even antimaterialism). In the introduction, for example, the editors claim that the tenets of religious leaders throughout history imply "a greater accountability to creation—a degree of accountability that sits uncomfortably with contemporary American culture but that is familiar to religious people." While such accountability would be welcome, this statement uses a particularly narrow version of "religious people" if it at the same time excludes the forms of Christianity that to a large extent define contemporary American culture.

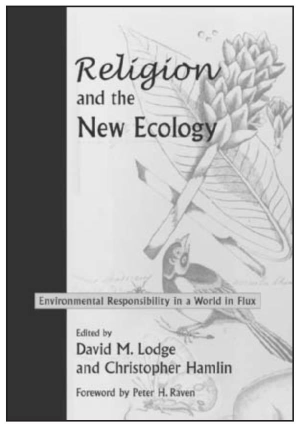
Whether or not one agrees that we need to draw on the tenets of Christianity to think about the environment, this volume further asserts that we cannot draw just on science. A number of contributors demonstrate that science is a value-laden enterprise, meaning we must reflect on its processes and findings ethically. Mark Stoll, for example, points out that the guiding ecological notion of a "community" derives from the Protestant background of founding ecologists, in which lies "the taproot of modern American ecological science." Because "community…implies morality," ecologists' faith led them to value their object of study, and therefore made them want to conserve it. Though study of the "Book of the Bible" was gradually replaced by study of the "Book of Nature," these historical roots are still evident: ecologists undertake study of the natural world to conserve it, as "priests of nature." More fundamentally, Larry Rasmussen demonstrates that ecological science, in the service of managing natural resources, exemplifies the belief that we can control and master nature through technology to increase human well-being ("eco-modernity"). To rectify this, he calls for a new "moral habitat," one that questions our secularist and scientistic assumptions as much as problematic religious ones.

The morals we can derive from flux ecology are even less certain. This is particularly true given that, as the volume points out, the myth of stability is entrenched and comfortable. Peter S. White examines some of these ethical challenges, including the paradox of "extend[ing] the human hand…into ecosystems we want to see free of human influence," the lack of a "reference state by which to evaluate human-caused change," and the challenge of thinking in terms of dynamic stability on a multipatch scale rather than on the scale of individual patches. Nonetheless, he seeks a way to assess change in terms of "bounds of natural variability," while at the same time recognizing that the scale of change is more important than whether its source is in humans or in nature.

In one of the more creative flourishes in the book, Patricia Ann Fleming inquires into some of the moral hypotheses that might be consistent with flux ecology, showing how challenging this extension will be and how it must extend to questions about the moral actor himself or herself, a stronghold of traditional religion. A greater problem comes from the naturalistic fallacy, the question of whether we should move between "is" and "ought." Fleming's chapter addresses this issue most acutely, asking whether we are justified in building ethical superstructures on the foundation of this new flux view.

Lodge and Hamlin, for example, see the flux of nature as "closer correspondence to reality," thus giving it a certainty that seems at odds with what a more encompassing view of flux might allow. I can imagine a social constructionist replacing "ecologist" in the following sentence of theirs—which is meant to apply to ecologists' relation to the general public—with "social constructivist": "If we follow Dostoevsky, the right thing for ecologists to do might be to keep the unsettling new truths secret, to recognize that stable equilibria are the bread and circuses of our time, and that faith and hope are essential to human sanity, however ill founded" (p. 9).

By applying the flux paradigm more broadly to human knowing, we might obtain a more radical uncertainty, and perhaps an even more "honest ecology[,] by ceasing to disguise those moral problems as somehow [resolvable] in the natural order of things." In this regard, it is telling that Lodge and Hamlin downplay the more constructivist claims of several authors. Elsewhere, however, they recognize that the flux paradigm will devolve the focus of responsibility from the "experts" to a more "communitarian" model.



Although I sympathize with the authors' intention to appeal to Americans, many of whom adhere to Christianity, I wonder whether something was lost with the Christian focus, and whether the conceptual foundation of the book would have been more defensible if built less on the expediency of appealing to the dominant tradition. In this respect, it was surprising that neither Buddhism nor Islam even appears in the index, and that Hinduism appears only once, in connection with a single sentence in the book. Yet these religions certainly have something to offer. For example, one of the key doctrines of Buddhism is *anicca* (impermanence), which has tremendous relevance to the arguments made in this book. Although the editors can be commended for focusing on one tradition, and they would be justified in deferring to the comprehensive "Religions of the World and Ecology" book series, I concur with Belovsky, who points out that the global environmental problem requires "an environmental ethic suitable for all people, not just a single culture." This is especially salient, given that sociologists of religion have shown American Christianity to be unusual in many respects.

In summary, this book is engagingly written, and the editors have ensured that chapters based in the humanities engage with the biological sciences, and vice versa, which is no small order. Consequently, a wide range of chapters should be of interest to readers of *BioScience,* and I encourage them to look through the volume for sections that whet their appetite. Ultimately, our concerns about biodiversity do not arise solely from the natural sciences—they are moral concerns, too. We therefore cannot avoid questions about the relation between "is" and "ought" in this domain, and *Religion and the New Ecology* is a good entrée into the relevant issues. It raises important questions about how we are to relate to this world, especially in the sense entailed by the Latin root of the word *religion,* meaning "to bind." Some readers may find the scriptural quotations outlandish, but there is much to be said for the editors' opening argument that the scriptures are nonetheless the cultural context in which much biodiversity discussion must be understood. If we can't engage Christians in conservation—maybe even "convert" them to it—we're not going to get very far.

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THE ACTIONS OF FUNGI IN ECOSYSTEMS

Fungi in Biogeochemical Cycles. Geoffrey Michael Gadd, ed. Cambridge University Press, New York, 2006. 490 pp., illus. $150.00 (ISBN 9780521845793 cloth).

I was a zoology major as an undergraduate student. I had not thought at all about fungi until I took an introductory ecology course in my second year, taught by a fungal ecologist who was clearly trying to shake us up when he asked this question in class: What are the minimum requirements for a functioning ecosystem? I didn't think much about the question, but the answer certainly got my attention. Necessary components for a functioning ecosystem included primary producers (plants) and decomposers (bacteria and fungi), but not animals. Clearly, the question was designed to get us out of our normal animal-centered thinking and make us realize that other organisms, such as fungi, also play vital roles. That lecture was my first exposure to the importance of fungi in the cycling of materials and energy, and it was a pivotal moment in my career. I went on to study fungal biology and ecology, and I have devoted my time to the subject ever since.

Fungi are ubiquitous, even in extreme environments; they are very diverse taxonomically and phylogenetically, and provide a wide variety of ecosystem services. Arguably, their most important function is as agents of biogeochemical cycling. The ability of saprobic fungi to decompose complex substrates makes them astonishingly important for turnover of materials. Of course, we must remember that other fungi that influence the cycling of energy and materials are not considered saprobes. They include mutualists, parasites, and pathogens, and they also have diverse functions. Many books have been published on fungal biology, but few on fungi's role in ecosystem processes (an exception being John Dighton's *Fungi in Ecosystem Processes*). The topic is becoming increasingly important, especially the study of biogeochemical changes resulting from such influences as climate change, land-use change, and invasion by exotics. The field is advancing very quickly, so a book such as *Fungi in Biogeochemical Cycles* is timely.

Geoffrey Gadd, the book's editor, is a professor of microbiology at the University of Dundee and a leading researcher in basic and applied microbial biogeochemistry. His work focuses primarily on determining the microbial-mediated mechanisms for metal mobility in natural and contaminated ecosystems. Gadd has gathered an excellent set of authors, all leaders in their various fields and in particular fungal groups, to summarize current research and to highlight the roles of fungi in biogeochemical cycles. The contributors offer a balance between processes involving fungi in natural systems and those in contaminated systems.

Overall, the book provides a good summary of the actions of saprophytic and mycorrhizal fungi, as well as some lichen-associated fungi. I am glad that in some chapters bacteria are discussed in comparison, as they are also highly relevant. All these organisms are well linked to biogeochemical processes—among others, mineral transformations and transport, nutrient cycling, water dynamics, and degradation of complex materials such as polycyclic aromatic hydrocarbons and polymers. There is good coverage across different ecosystem types, such as soil, freshwater, marine, and estuary systems. The particular strength of *Fungi in Biogeochemical Cycles* is its balance among the "bio," "geo," and "chem" components of biogeochemistry.

Although I am enthusiastic about the book because of the excellent individual contributions, I do see some shortcomings. First, I would have liked more continuity from chapter to chapter. Although authors do refer to information in other chapters, a better synthesis could have been achieved by having an introductory chapter that discussed the book's goals and intended "deliverables." Similarly, a final chapter that summarized the various contributions would have helped. In my opinion, all multi-author volumes should have such editor-written, synthesizing chapters. Another limitation of the book is that it largely ignores the indirect contributions of fungal parasites and pathogens. These latter functional groups are also ubiquitous in ecosystems, and can exert a profound influence by affecting the activities of primary producers and other organisms.

Overall, I highly recommend this volume, not just to the mycologist but also to the ecologist, geologist, environmental scientist, and earth scientist. It will be especially useful to senior undergraduates and graduate students in interdisciplinary fields such as ecosystem ecology and biogeochemistry. Perhaps some of them will discover their own enthusiasm for fungi and become convinced—as I was—of the importance of this often-overlooked group of organisms in the functioning of ecosystems.

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BY THE NUMBERS

The Theoretical Biologist's Toolbox: Quantitative Methods for Ecology and Evolutionary Biology. Marc Mangel. Cambridge University Press, New York, 2006. 390 pp., illus. $56.00 (ISBN 9780521537483 paper).

For too long, biology has been thought of as a descriptive discipline, driven by the inductive methods of collating facts to support theories rather than by the more deductive methods appropriate to mathematics. Values, opinions, and science, however, can all rapidly change (as Thomas Kuhn has taught us). Mathematical approaches form a cogent framework, a common language, for developing, testing, and criticizing biological hypotheses. The application of mathematics to biological problems is now a science for the 21st century. While physics and chemistry have a long historical integration with math, biology has often seemed to lag behind—but not anymore.

Mathematical biology is a highly disparate discipline—many available approaches and techniques involving algebra, geometry, number theory, topology, probability, and statistics have applications to biological or medical research problems. Often a student's first (and last) exposure to such applications is during high school, through simple statistical tests on biological data—a χ^2 test, for instance—yet mathematical biology is infinitely richer than this. We can apply calculus to understand evolution, geometry to understand development, and number theory to understand pattern formation, among other examples. Rapid advances in all areas of biology make the development of cohesive mathematical frameworks for guiding or interpreting progress an essential attribute and skill, which all who are interested in the life sciences need to develop. The release of *The Theoretical Biologist's Toolbox,* by Marc Mangel, offers a refreshing approach to this goal by providing aspiring (and even established) theoreticians with a user-friendly and thorough introduction to a wide variety of techniques.

Marc Mangel is a professor of applied math and statistics, and fellow of Stevenson College, at the University of California, Santa Cruz. His scholarly output extends to many areas of biology: among the books he has written or coauthored are *Decision and Control in Uncertain Resource Systems*, *Dynamic Modeling in Behavioral Ecology* (with Colin Clark), *The Ecological Detective: Confronting Models with Data* (with Ray Hilborn), and *Dynamic State Variable Models in Ecology: Methods and Applications* (with Colin Clark). *The Theoretical Biologist's Toolbox,* which follows in the vein of these titles, is a how-to guide with applications. It is arranged into eight chapters and covers broadly sweeping topics, from the evolutionary ecology of parasitoids and the population biology of disease to topics in ordinary and partial differential equations. Mangel aims to give readers the skills they need to understand problems in theoretical and mathematical biology.

The book is a graduate-level text that covers modeling ideas, differential equations, and probability in the first three chapters, and then, in the five subsequent ones, the evolutionary ecology of parasitoids, diseases, fisheries, and stochastic population theory, both the basics and its applications in ecology, evolution, and demography. It is an accessible introduction to different models and analyses in theoretical population biology.

Unsurprisingly, as the book was written around a taught course, it is replete with exercises. These are not confined to the end of each chapter but appear after the introduction of associated material. This approach is a huge asset that underscores the book's pedagogic approach to mathematical biology, allowing easy reference to (and reinforcement of) particular topics. Following an exercise, the material extends into the next section of the chapter and concludes with a section identifying further reading to enable a deeper understanding.

Each chapter is self-contained (apart from some basic calculus skills, which are available from any good reference guide), yet there is considerable benefit to starting at the beginning of this book and finishing at the end—it serves aptly as a learning guide as well as a toolbox. The reader can learn how to use one tool well before moving to the next—although knowing how to use a mallet is invaluable, knowing how to use one with a chisel can lead to works of art.

Developing a skill set and populating your own toolbox will not only provide personal edification but also offer unprecedented opportunity to help resolve a growing number of real-world problems that require sets of mathematical sensibilities. Research in areas such as bioinformatics, epidemiology, population ecology, and immunology recently has seen record growth. The application of mathematics to both large-scale patterns (climate change) and fine-scale patterns (cell regulation and gene expression) is revealing detailed insight into the underlying biological phenomena that generate the patterns. The challenge is open for those who are motivated to learn mathematics and biology. Mangel's book should be an inspiration.

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NEW TITLES

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