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Humanized Landscapes

Time and Complexity in Historical Ecology: Studies in the Neotropical Lowlands. William Balée and Clark L. Erickson, eds. Columbia University Press, New York, 2006. 432 pp., illus. $80.00 (ISBN 9780231135627 cloth).

Time and Complexity in Historical Ecology is a sustained argument—almost a manifesto—masked as a collection of articles. Subjects range from the Petén basin in Guatemala and Belize to the Andean shore, but the heart of the book is that fabled storehouse of biodiversity, the Amazon forest. Contrary to long-held belief, the contributors insist, all of these landscapes are not little disturbed or pristine, but "domesticated," "cultivated," "cultural artifacts that archaeologists can recover and recognize," even "a form of the built environment." Indeed, editors William Balée and Clark L. Erickson claim that these places cannot be understood by biologists without reference to "humans' intentional, long-term, custodial influence," because the environments are usually shaped, and in many cases actually created, by those humans.

Historical ecology, as the editors call this perspective, inverts the widely known adaptational model, in which cultures adapt to the resources of their environments, with the differing adaptations explaining the main differences between one culture and another. Instead of fitting themselves into ecological constraints, Balée and Erickson argue, human groups rapidly "transform most of those constraints into negligible analytic phenomena," so that the environment becomes a "physical record of intentionality."

To some extent, this perspective embraces the new ecology emblematized in Botkin's *Discordant Harmonies*. But rather than assigning a starring role to "chance and randomness" (Botkin 1990), the contributors to this volume see ecosystems as driven for millennia by human agency. Controversially, they explicitly reject normative terms like "beneficial" or "degrading" to describe that agency's environmental impact, because, Erickson writes, "There is no 'natural' baseline or benchmark of pristine wilderness that should be used as a standard for comparisons...if humans played a major role in creating the very landscapes where biodiversity and nature are said to occur" (p. 246).

Instead of reading the human stories encoded in landscapes, Michael Heckenberger writes, researchers have taken the "absence of robust historical knowledge"—the relative dearth of written documents from pre-Columbian societies—"as a lack of history at all.... The history is 'naturalized' into an imagery of pristine wilderness and primitiveness" (p. 312). One need only look at a Greenpeace calendar to see what he means.

The articles in this volume exemplify diverse ways of reading these landscapes. David G. Campbell and his team contribute a clear quantitative study demonstrating that the array of tree species in the Guatemalan Petén still bears the stamp of the Maya more than a thousand years after their ninth-century "collapse," even though the region has been thinly inhabited since then. Peter W. Stahl argues that the distribution of prehistoric small-mammal remains—especially those of generalists with broad niche requirements—indicates where forests were disturbed in past centuries. More than 90 percent of western Ecuador's Jama River valley, thickly forested as late as 1920, is now cleared. But Stahl's examination of more than 85,000 archaeofaunal specimens from the region "strongly suggest[s] a prevalence of unstable edge environments and forest fragments...spanning at least 3600 years" (p. 145). The Jama's dense, nearly unbroken canopy, in other words, was a recent phenomenon, an ecological novelty no more than a few centuries old.

How did the contemporary tropical forest come into existence? The research is far from definitive, but articles by Erickson, Heckenberger, William M. Denevan, and especially Eduardo G. Neves and the late James B. Petersen provide some clue. The Amazon basin has been inhabited for at least 13,000 years (Roosevelt et al. 1996). Gradually those early inhabitants turned from foraging to "landscape management," Neves and Petersen suggest, beginning by scattering useful palms from half a dozen genera, especially *Bactris gasipaes* (peach palm). This low-intensity landscape management "may well have made a substantial impact," but it is hard to distinguish today from nonhuman processes because it represents "the cumulative outcome of individual, small-scale interventions." Perhaps 3000 years ago, though, there was "a radical shift in economic and social patterns in Amazonia," and some societies began "high-intensity" landscape management. The result, according to Denevan, was the creation of landscapes of "semi-intensively cultivated fields intermingled with fruit orchards, managed fallows, house gardens, and brief bush fallows, with semi-permanent settlements, some numbering thousands of people, surrounded by zones of modified forest manipulated by hunting and gathering activities" (p. 154)—an intricate system that both created and exploited the swaths of rich soil today called *terra preta do índio*.

Among the most impressive examples are the Llanos de Mojos (Mojos plains) in eastern Bolivia. Roughly twice the size of Ohio, the region is seasonally flooded with up to a meter of water for months at a time. Beginning perhaps 2000 years ago, Erickson argues, its original inhabitants humanized much of the landscape by erecting 10,000 settlement mounds, "thousands of linear kilometers of causeways and canals," hundreds of still enigmatic circular ditches, countless earthen fish weirs, and thousands of hectares of raised fields. The goal was to create "millions of linear kilometers of rich terrestrial aquatic ecotones or edges in what was previously a relatively homogeneous, flat environment." This "patchwork of artificial landforms," to Erickson's mind, was "as productive and sustainable and probably equally species-rich as the

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forests that exist there today." (I have twice visited the area with Erickson, once accompanied by Balée; both times I was powerfully struck by the evidence of landscape domestication.)

This entire system, and others like it, fell apart in the 16th century. Between 1500 and 1700, European disease, slavery, and war killed 90 percent or more of the native population. With no hands on the tiller, so to speak, landscapes throughout the hemisphere went feral, which is not the same as going "wild." The tropical forest we seek to protect today was in significant part the accidental by-product of this horrific loss.

Driven by population loss and fear of enslavement, many groups gave up agriculture in favor of foraging; Loretta A. Cormier tracks one such group, the Guajá in eastern Amazonia, who survived by "patch-to-patch movement from old fallow field to old fallow field," living off the landscape domesticated by their predecessors. Others continued to farm, Denevan notes, but in a new way: slash-and-burn. Although ecologists have both celebrated slash-and-burn as adaptive and vilified it as destructive, they have commonly regarded it as an age-old practice. Stone axes were such inefficient instruments of land clearing, Denevan writes, that "long-fallow shifting cultivation was probably difficult, even with the girdling and burning of tree trunks." Once patches of forest were opened up, farmers had an incentive to keep using them, with short fallow times to reduce weeds. By contrast, metal axes are up to 60 times more efficient (Carneiro 1979)—ideal for populations that want to move quickly in and out.

Many ecologists have come to accept these ideas, at least in part, but they remain anathema to most conservation groups and are a source of puzzlement to land managers, for whom the vision of pre-Columbian wilderness is a useful benchmark. For these people, *Time and Complexity* will provide little consolation. The task of understanding and conserving the lowland Neotropics, it suggests, falls into the purview of anthropology, archaeology, geography, and the other human sciences.

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Wisdom for a Livable Planet

The Visionary Work of Terri Swearingen, Dave Foreman, Wes Jackson, Helena Norberg-Hodge, Werner Fornos, Herman Daly, Stephen Schneider, and David Orr

BY CARL N. MCDANIEL



"This book contains a number of home truths, calmly and moderately enunciated, that point the way toward a world more sturdy and robust than the troubled one we now inhabit. It is a kind of primer for twenty-first-century citizenship, and well worth the reading."—BILL MCKIBBEN, author of *Wandering Home*

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HUMAN AGENCY GONE AWRY

People and Nature: An Introduction to Human Ecological Relations. Emilio F. Moran. Blackwell, Malden, MA, 2006. 232 pp., illus. $30.95 (ISBN 9781405105729 paper).

We certainly live in ecologically interesting times. In 2005, the Millennium Ecosystem Assessment (MEA)—the most comprehensive sustainability assessment ever undertaken—proclaimed: "At the heart of this assessment is a stark warning. Human activity is putting such a strain on the natural functions of the Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted" (MEA 2005). The language is plain enough. Humanity has a collective problem that demands determined action by the entire world community. But wait a minute—didn't the Union of

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Concerned Scientists (UCS) "warn all humanity" back in 1992 that "a great change in our stewardship of the earth and the life on it is required, if vast human misery is to be avoided and our global home on this planet is not to be irretrievably mutilated" (UCS 1992)? If the MEA's yellow flag is justified, it seems that the UCS's earlier, even more strident warning has had minimal effect. Just what is going on here? Why does the purportedly most intelligent and self-aware species on Earth seem bent on destroying its habitat just like any other plague species?

Anyone looking for insight into this question might naturally be drawn to Emilo F. Moran's *People and Nature: An Introduction to Human Ecological Relations.* The book's title is enticing enough, and Moran has impeccable credentials. A well-known ecological anthropologist, he is Rudy Professor of Anthropology and the director of the Anthropological Center for Training and Research on Global Environmental Change, as well as a professor of environmental sciences, at the University of Indiana. The goal of *People and Nature* is ambitious and its scope wide ranging. Moran promises "to introduce the reader to the evidence, both historical and contemporary, for how the reciprocal interactions between people and nature have developed, the urgency for action now to prevent truly disastrous consequences, and to make suggestions as to how we might go about doing so" (p. xi); for the most part, he delivers.

Moran begins by establishing an essential element of context—in the past 50 years there has been a sea change in nearly every aspect of humanity's relationship with nature. Under the inexorable pressure of exponential growth, the most recent doubling of the global material economy has taken us from a half-empty to an ecologically overfull world. Moran also emphasizes human agency—people's active, cumulative role in accelerating the degradation of the ecosphere as well as our potential to arrest the process. Significantly, he acknowledges that the "we" in this context does not apply evenly to all members of the human family. "Clearly, the burden on the planet today is coming from urban-industrial societies and this 'we' has to step forward now and take responsibility for solving the problem it has created. We must lead by example" (p. 2).

Going further against the mainstream grain, Moran explicitly fingers globalization for its role in accelerating the degradation of critical ecosystems. Hunter-gatherers and even preindustrial farmers lived their lives spatially within the ecosystems that supported them and thus suffered the direct and immediate consequences of overhunting or the misuse of local landscapes. Regrettably, globalization and urbanization, two of the most powerfully prevalent of contemporary trends, effectively short-circuit this critical feedback mechanism by distancing people both spatially and psychologically from the ecosystems that support them. The materially wealthy are not directly affected by the negative consequences of their consumer lifestyles on distant supportive ecosystems.

Overall, the major themes of *People and Nature* provide a menu rich enough to satisfy any beginning student of ecological anthropology. Moran explores the history of human–environment interactions in all its diversity, both bleak and encouraging; describes the web of life and humanity's role in it; discusses adaptation

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and how various peoples use information to adjust to changing ecological realities; explains why sustainability represents an unprecedented challenge to humanity's collective future; and argues that in developing an appropriate global response, the primacy of consumption and material accumulation in the wealthy world must give way to values rooted in reciprocity, human dignity, and mutual trust.

Of course, any ambitious book is bound to have weaknesses, and this one has two that especially grate. First, the text too frequently assumes the quality of an unedited first draft. In describing systems' resistance to dramatic change, for example, Moran writes, "As with trying to shift the course of an ocean liner or a large tanker, it takes quite a bit of time to change the forward momentum of a ship" (p. 155). The simile acquires meaning in context only if the reader substitutes "ecological change" for "a ship." In other places, verbless or isolated phrases masquerade as sentences, and there are even occasional factual errors. For example, it most assuredly does *not* "now take only 32 years for the human population to double" (p. 114). Moran's assertion implies a global population growth rate of 2.2 percent per year, a rate that has never quite been achieved, and which is double today's actual (and declining) population growth rate.

A more important weakness is the author's prescription for what ails us. In his final chapter, Moran all but eschews "global solutions" and underplays collective action in favor of individual human agency and "a set of considerations for reflection so that each of us, following our own ethics and conscience, can begin to construct a set of human ecological relations that is consistent with the sustainability of people in nature" (p. 151). This prescription seems not to recognize, however, that the dominant material ethic in the world today is rampant consumerism; that the ecologically literate behave much the same as the uninformed; that humanity has limited capacity for extended altruism; and that most governments, international institutions, and ordinary people show overweening confidence in technology to substitute for nature. And where does this leave the many potential lessons of cultural and ecological anthropology that one might reasonably have expected from this book? Not all preindustrial peoples destroyed their supportive ecosystems, nor has the total human enterprise always been at odds with nature. Surely there is a missing story here.

In the end, then, Moran does not draw enough from the richness of his own discipline. Indeed, he barely touches upon such contemporary solutions as ecologically truthful pricing and improved foreign policy. He mainly exhorts wealthy consumers to "choose to consume a lot less and become models of a new biocentric model of production and consumption" (p. 158). We must "resist the forces of global consumerism" (p. 166) and "[turn] off our televisions" so that we can "[reconnect] with members of our families and communities and [begin] to buy only what we really need" (p. 168). As any iPod-addicted teenager heading to the mall in the family SUV is certain to respond, "Oh, yeah, like, that's totally gonna happen!" Without a more broadly based policy platform for global sustainability, including strong collective interventions to force individual behavioral change, contemporary evidence suggests modern humans are likely to continue dismantling their only planetary habitat.

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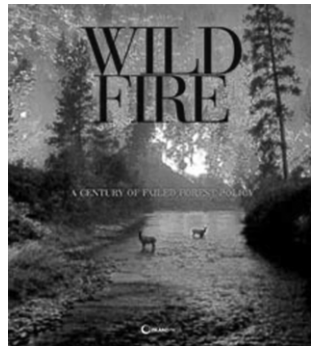
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A MISSED OPPORTUNITY TO INFLUENCE FIRE POLICY

Wildfire: A Century of Failed Forest Policy. George Wuerthner. Island Press, Washington, DC, 2006. 350 pp., illus. $75.00 (ISBN 978159726069X cloth).



The ecology and politics of fire are big topics, and *Wildfire: A Century of Failed Forest Policy* is a big book—its 350 softbound pages measure 13-1/4 by 11-3/4 inches, and it weighs more than five pounds. If you're strong enough to lug it to a table that can support it, it's worth taking a look at. Don't expect it to fit on a standard bookshelf, however, or in your pocket or backpack. This is a coffee-table book, but one with substantial content, not merely striking photographs of ecosystems aflame or flowering postfire meadows.

The book has a clear agenda, which occasionally gets in the way of its coherency. Sponsored by the Foundation for Deep Ecology, and edited and written by George Wuerthner, *Wildfire* has an evangelical tone that stems from the voices of former smoke jumpers and firefighters who have learned to appreciate the critical role of fire in forest ecosystems. Their message is a bit too strong in some places, but the book has some excellent chapters and covers many aspects of this broad topic.

The book starts off on an uneven and politicized track with a series of "myths" about fire, each followed by a brief explication of the "truth." Among the myths are these: "Big fires are the result of too much fuel," "logging mimics fire," "big fires can be stopped," "fire 'sterilizes' the

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land," "livestock grazing can prevent fires," "salvage logging after a fire is necessary to restore forests," and "prescribed burning is an adequate substitute for wildfire." Like most generalizations, these statements are false under some circumstances, but many are true under other conditions found in some parts of North America and in other parts of the world. The failure to address the variability of fire regimes systematically, and thus to emphasize the variation in appropriate management methods, is the primary weakness of the book.

The text is divided into six main sections, with a short conclusion called "Time to Retire Smokey Bear." The first section, "Wildfire: Perspectives and Visions," includes an introduction, by Stephen Pyne, and a chapter entitled "Fire and Native Peoples," by Thomas Vale, that will perpetuate the controversy over the role of Native Americans in managing fire-maintained ecosystems in North America. Although the book's focus is wildfires in forests, most of the examples of landscapes "humanized" by fire are in grassland and savanna ecosystems. This discrepancy reveals another weakness found throughout the book: its failure to clarify the differences in fire regimes found across the rainfall and temperature gradients that influence the ecosystems of North America. Entertaining chapters by Conrad Smith and Les AuCoin address the "incendiary language" that shapes the news and political discussions about fire, and help to explain the disconnect between fire science and fire policy, which is the major theme of the book.

The second section, "Fire Ecology: Stories and Studies," will be of most interest to scientists. Wuerthner provides a good summary of the 1988 Yellowstone fire, and Jan Wagtendonk and Dominick DellaSalla give overviews of fire ecology in the Sierra Nevada and Klamath-Siskiyou ecoregions, respectively. Jon Keeley and C. J. Fotheringham discuss the ecology and management of the most problematic interface between society and fire in North America, the chaparral of southern California. These authors provide a good overview of the fire regimes of North America and a thorough discussion of the ecological, climatic, and social processes that make the California shrublands such an interesting and dangerous ecosystem. Thomas Swetnam, Craig Allen, and Julio Betancourt's chapter, "Applied Historical Ecology: Using the Past to Manage for the future," summarizes their extensive research on the effects of past climatic variations on the vegetation patterns and fire regimes of the American West. Other chapters in this section address fire in the Southwest and in the East, as well as the effects of fires and succession on forest bird populations.

The third section, "Fire and Its Paradoxes," is a picture album of many western landscapes in various stages of fire-induced succession—lots of beautiful pictures. The final three sections address issues that have been front-page controversies over the past decade or longer. Part four, "(Un)healthy Forest Policy: Suppression, Salvage, and Scurrilous Solutions," includes the following chapters: "Vested Interests Masquerading as Purveyors of Forest Health" (Wuerthner), "Ecological Differences and the Need to Preserve Large Fires" (Wuerthner), "Ecological Impacts of Salvage Logging" (James Strittholt), "Conventional Salvage Logging: The Loss of Ecological Reason and Economic Restraint" (Chris Maser), and "The Role of Livestock Grazing in Worsening Fire Severity" (Wuerthner). Together, these chapters make a strong case for the superiority of natural fires—when compared with logging, salvage logging, replanting, and other management techniques—for maintaining the biodiversity and critical functions of forest ecosystems.

The fifth section, "The New Gravy Train: The Emergence of the Fire-Military-Industrial Complex," addresses the corrupting effect of money on the politics of fire management. Chapters in this section are "The Flawed Economics of Fire Suppression" (Wuerthner), "The Economics of Forest Fuel Reduction Strategies" (Thomas Power), "Money to Burn: Wildfire and the Budget" (Randall O'Toole), and "The War on Wildfire: Firefighting and the Militarization of Forest Fire Management" (Timothy Ingalsbee). These chapters provide a good overview of the history of firefighting as a business and present a disturbing analysis of the costs—in lives as well as money—versus the benefits of fighting wildfires.

The final section, "Eliminating the Smokescreen: Toward an Intelligent Fire Policy," offers a few hopeful tidbits, but they don't seem to hold much promise for reversing the disturbing trends described in other chapters, or for reducing the political sway of the fire-military-industrial complex. Craig Allen and several coauthors present a broad plan for the ecological restoration of the southwestern ponderosa pine ecosystems, where a combination of intentional and unintentional fire suppression, along with suburban sprawl and rural developments, has produced a dangerous mixture of housing in a fire-prone ecosystem over much of the western United States. This problem is elaborated in the chapter "Sprawling into Disaster: The Growing Impact of Rural Residential Development on Wildland Fire Management in the Greater Yellowstone Area," by Crystal Stanionis and Dennis Glick. John Krist discusses the perverse economic incentives that fuel rural development in "Burning Down the House: The Role of Disaster Aid in Subsidizing Catastrophe," and Brian Nowicki and Todd Schulke present a rational plan for minimizing fire damage to homes in "The Community Protection Zone: Defending Homes and Communities from the Threat of Forest Fire."

This kind of prose repels those whose opinions need to be changed if a more scientific and rational approach is to be taken to fire management. I don't see any point in putting this much money and effort into a book for the purpose of preaching to the choir.

Who is the target audience for this book? The oversized format and beautiful pictures make it well suited for the

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homes and offices of politicians and businessmen, and the sound science and well-written content of many of the chapters have the potential to actually change some minds and influence policy. Unfortunately, the new-age flavor of some of the text and graphics, particularly in the introduction and conclusion, is likely to alienate those who most need to be influenced. For example, the polarized worldview laid out in the introduction—complete with a collage of tree stumps, money, Smokey Bear, and the White House—is not helpful, nor is the concluding chapter, "The Ultimate Firefight: Changing Hearts and Minds" (by Andy Kerr), with subheadings such as "Empower Pyrophiles," "Distinguish between Good and Bad Firefighters," and "Starve the Beast." This kind of prose repels those whose opinions need to be changed if a more scientific and rational approach is to be taken to fire management. I don't see any point in putting this much money and effort into a book for the purpose of preaching to the choir. While I appreciate *Wildfire*'s beautiful pictures and interesting science, history, and commentary, I would like to see a book like this have an impact outside the environmental movement. Nonetheless, I can recommend the book's content for teaching about fire issues.

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WE KNOW IT WHEN WE SEE IT

The Altruism Equation: Seven Scientists Search for the Origins of Goodness. Lee Alan Dugatkin. Princeton University Press, Princeton, NJ, 2006. 188 pp. $24.95 (ISBN 9780691125909 cloth).

In my undergraduate course on animal behavior, the topic that without fail generates the most interest, discussion, and often humor is—perhaps unsurprisingly—mate choice. The next most attention-grabbing topic is altruism (for the moment, read as goodness). I believe that altruism ranks so highly on the interest scale, so to speak, because it is one concept in animal behavior that people can intuitively understand and integrate conceptually into virtually every aspect of their lives: their interactions with others, their political and social institutions, and their religious beliefs. Have we not all wondered for whom or under what conditions we would be willing to sacrifice ourselves?

Altruism is a relatively simple concept to define. It refers to behavior that increases the fitness of the recipient at a cost to the fitness of the donor. When one individual comes to the aid of, or provides resources to, another individual, altruism has taken place, at least in theory. Altruism is a much more complex concept than this simple definition implies, however. The complexity lies in defining a currency of fitness that can be consistently applied in studies of different kinds of organisms. The most commonly used currency of fitness is reproductive success; thus, an altruistic act is one that increases the reproductive success of a recipient at a cost to the reproductive success of the donor. But in fact, most real or apparent altruistic acts occur in a context completely independent of reproduction, or toward individuals that are past their reproductive age. The theory can be modified to account for such acts—for example, "reciprocal altruism" holds that individuals help others deemed likely to reciprocate the help—but any measure of fitness will run into difficulty when it comes to making general and specific testable predictions. A second problem is that empirically, it is often impossible to accurately quantify the costs (to the donor) of particular behavioral acts. Whether the aid given consists of protection, food, or any other service or resource, the cost the donor incurs is often only theoretical. Can a theory be rigorously tested if the individual variables cannot be quantified?

Despite these difficulties, altruism does occur in both humans and other animal species, even if it is sometimes hard to study quantitatively. Although altruism was once thought to be one of those behavioral traits, like tool making and complex language, that separate humans from other species, we now know that we are not so different from other species. Altruism in humans, however, is clearly complicated by cultural evolution—it is no simple matter to disentangle the interaction between biology and culture.

This anthropocentric view of altruism is clearly evident in the history of altruism as an idea, a history that Lee Alan Dugatkin brings to life in *The Altruism Equation: Seven Scientists Search for the Origins of Goodness.* In this delightful book, Dugatkin takes the reader from Darwin's confusion over honeybee behavior (and his fear that sterile worker bees raising siblings represented an exception to natural selection) through more than 125 years of research, theoretical thinking, and public argument about what altruism or goodness is, its relationship to kinship, and how it has been studied.

Dugatkin focuses his historical attention on seven men who were, in his opinion, the most important biologists in the development of the current theory of altruism and of empirical tests of that theory. Those biologists are Charles Darwin, Petr Kropotkin, Thomas H. Huxley, J. B. S. Haldane, W. C. Allee, William D. Hamilton, and George Price. Anyone compiling such a list might choose different members, but there is no doubt that these scientists played a central role in our current understanding of altruism. Of course, those on the list did not work alone, and Dugatkin also discusses the contributions, direct or indirect, made by at least eight other biologists (Ronald Fisher, Sewall Wright, Richard Dawkins, John Maynard Smith, E. O. Wilson, Steve Emlen, Paul Sherman, and Hudson Kern Reeve), sometimes in such great detail that I wasn't always sure who was on the central list of seven to which the book's title refers.

The history of altruism was not a steady, steplike process. After Darwin highlighted the apparent difficulty that

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altruism in social insects presented for his theory of natural selection as an agent of evolutionary change, biologists did not immediately begin thinking about a general theory of altruism (or, for that matter, evolution). That development would wait more than 75 years. Following Darwin, Kropotkin and Huxley waged academic battles over whether altruistic acts were dependent on the relatedness of individuals. The answer, of course, is both yes and no, depending on the ecological and behavioral circumstances.

A general theory of altruism would not surface until the early 1960s, when Bill Hamilton published what has become known as "Hamilton's rule"—that is, altruism (or helping or aid-giving behavior) can evolve whenever the benefits of the act devalued (multiplied) by the coefficient of relatedness between the individuals exceeds the cost of the act. The simplicity of the final theory belies the underlying complex mathematics that led to it, as well as the long history of thinking about these ideas. Although the impacts of Hamilton's theory were not immediate, they were dramatic. Once the model was widely understood, it had impacts well beyond considerations of altruism. It led at least in part, if not directly, to a gene perspective of evolution, the theory of kin selection, the foundation for much of the emerging field of sociobiology, and sex ratio theory; it also led to the development of game theory and the notion of evolutionary stable strategies. In other words, it changed the way people thought about social behavior specifically, as well as about evolution generally.

As fascinating as the intellectual development of altruism theory is, the personal, human side of the development is equally interesting. As I read the historical account, I thought that Dugatkin had done for social behavior what James Watson did for the discovery of the structure of DNA with *The Double Helix*. Scientists whom most people know simply as the authors of citations in a publication are brought to life in this book, and their interactions, collaborations, and sometimes ill feelings toward one another make for an intriguing story. Although I think that Bill Hamilton is clearly the central figure in the history of altruism as an evolutionary concept, as Dugatkin portrays him, all of the biologists discussed in this book made valuable contributions, and Dugatkin does an excellent job of putting everyone's historical and current roles in perspective.

I thoroughly enjoyed reading this book, and I think anyone with an interest in animal behavior will find it valuable, but I did find myself wishing from time to time that the author had included more information about some topics. Specifically, I think a longer discussion is warranted on the semantic issues concerning altruistic as opposed to cooperative behavior. I would also have enjoyed more discussion of the interaction between culture and biology in shaping altruism in humans. Given the focus at the end of the book on presenting the results of specific research projects, it would have been helpful to see a discussion of the practical difficulties of testing the underlying theory, the simplicity of Hamilton's ideas notwithstanding. Last, I think the book ended on a flat note, with no discussion of where the study of altruism is headed. Surely not everything regarding altruism has been solved; indeed, some people still argue about whether it occurs at all. Although thanks to this book we can better understand the history of the ideas, some predictions or even speculations about future work would have allowed the author to end on an altruistic note.

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FEELING THE HEAT

Birds and Climate Change. Anders P. Møller, Wolfgang Fiedler, and Peter Berthold, eds. Elsevier, Burlington, MA, 2006. 276 pp., illus. $49.95 (ISBN 9780123736147 paper).

With the launch this year of the latest reports by the Intergovernmental Panel on Climate Change (IPCC) and the growing public awareness of the very real impacts that climate change is already having on the natural world, *Birds and Climate Change* is a timely, useful, readable book.

The IPCC says that global warming is "unequivocal," and that it is "very likely"—that is, there is a 90 percent likelihood—that humans are the major drivers of this climate change. Birds are perhaps the best-studied taxa in ecology because they are diurnal, use many of the same senses as humans, are ubiquitous, and are relatively easy to observe. As a result, there are many long-term data sets on a wide range of different aspects of bird ecology that are waiting to be explored with respect to climate change.

This book brings together many of the key practitioners in this field to provide a good overview of the current understanding of birds and climate change. Also, like all good books, *Birds and Climate Change* highlights much of what is not known, thus constituting a useful source for people looking for important questions to answer.

The book is a collection of 11 chapters on a variety of topics, including phenology (the study of the timing of natural events), breeding performance, evolutionary processes, population dynamics, and community structure. Although *Birds and Climate Change* was based on a workshop held in 2003, it is still a key reference today. The authors undertook meta-analyses and reviews that have not been published before, and extensive reference lists lead the reader to the original texts. (Unfortunately, however, the publisher provides only the authors and journal references, not the titles of the pertinent articles.)

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The first chapter is a particularly good review of studies of the arrival and departures of migrant birds on their breeding grounds. Lehikoinen, Sparks, and Zalakevicius synthesize the results from more than a thousand time series to show that species are arriving on their breeding grounds earlier than before, and that many are departing later. It appears that long-distance migrants are not advancing their arrivals as much as species that fly shorter distances to migrate, and a later chapter, by Visser, Both, and Lambrechts, describes how this could affect breeding performance and population status. For example, long-distance migrants such as pied flycatchers (*Ficedula hypoleuca*), which time their migration from Africa on the basis of photoperiodic or other endogenous cues unrelated to temperature, are becoming out of synchrony with conditions at the breeding grounds. Thus, they return to their breeding grounds too late, when the caterpillars they feed to their young are no longer abundant. Populations that are unable to advance their arrival date are experiencing population declines. The authors then discuss how birds may cope with climate change through modifications of individual bird behavior, or by genetic adaptation and evolution.

Two interesting chapters follow, one by Coppack and Pulido on the photoperiodic response and adaptability of life cycles, and the other by Pulido and Berthold on microevolutionary responses to climate change. In bird life cycles, photoperiods (i.e., light–dark regimes) are often very important in determining when birds come into breeding condition, when they moult, and when they migrate. These responses can vary according to latitude, because, for example, the lengthening of days in spring happens at a faster rate at higher latitudes. Populations appear to be adapted to these differences. If species shift their breeding range northward in response to climate warming, however, the photoperiodic responses of the species, in determining when they become physiologically ready for breeding, might be inappropriate at the higher latitudes, leading to mistiming. Studies of adaptation and evolution are still rare, but a small number do show that species can exhibit individual plasticity through nongenetic adaptation, and that rapid evolutionary change through natural selection is possible. Further research is urgently needed in this area, as it is essential for understanding whether and how wildlife can adapt to climate change.

Another series of chapters in *Birds and Climate Change* looks at population processes. Dunn reviews an extensive body of work on egg-laying dates and breeding performance. Unsurprisingly, many studies show that birds are tending to lay earlier in response to climate warming, but the impacts on breeding performance are mixed. Some birds apparently benefit through larger clutch sizes and fledging success, but others experience detrimental effects resulting from changes in rainfall patterns or from mistimed reproduction.

Dunn also discusses why some 40 percent of species show no apparent response to changing temperatures; for example, larger-bodied species appear to be less affected, possibly because their thermoregulatory costs are lower than those of smaller-bodied species in temperate climates. Also, generalist species, that is, those with a broader range of diet, may be less constrained by the impacts of ambient temperature on one component of their food supply than specialist feeders that rely on a small range of prey types. Clearly, there are avenues for further research that are waiting to be explored.

Global warming has produced some interesting geographical patterns of climate change that are not uniform around the world, and these are reflected in the distributional patterns of birds, as discussed by Böhning-Gaese and Lemoine. They cite a number of studies from around the world showing that species distributions are shifting northward and into higher altitudes, but they also note that research in this area is scant compared with research on taxa such as plants and butterflies. There is even less information on bird communities and ecosystems. As species move at different rates, whole new communities will form, potentially leading to instability. Even within species, certain complexities have to be considered. For example, Saether, Sutherland, and Engen discuss how the population dynamics of a species might be affected. Several key questions emerge: Will the climate response be density dependent or density independent? Will climate changes operate primarily through productivity or through survival? Will climate change affect not only average values but also variability? Almost no population modeling has been done in this area yet.

A particularly useful feature of *Birds and Climate Change* is that most chapters include discussions of methodological issues and the sorts of problems that need to be considered and avoided. The availability of large historical data sets—gathered over large geographical areas and for many years by volunteer birdwatchers—has been essential in many studies of birds. Such data sets are equally valuable in the climate-change world, as Fiedler, Bairlein, and Köppen demonstrate in their analysis of data from European bird banding (affixing lightweight, coded, easily identifiable bands to birds' legs) to explore how migratory distances might be changing in response to global warming—a fascinating taste of what might be possible. In North America, data sets put together by organizations such as the Cornell Lab of Ornithology, Bird Studies Canada, and the California-based Institute of Bird Populations are likely to be the basis of many bird studies in that part of the world. I hope that this book inspires such studies on every continent, and especially from areas in the lower latitudes, because conditions and impacts are likely to be quite different in the tropics than they are in northern latitudes.

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THE BROAD VIEW OF LANDSCAPES

Ecosystem Function in Heterogeneous Landscapes. Gary M. Lovett, Clive G. Jones, Monica G. Turner, and Kathleen C. Weathers, eds. Springer, New York, 2005. 489 pp., illus. $59.95 (ISBN 9780387240909 paper).

Ecosystem Function in Heterogeneous Landscapes is the product of a Cary conference held at the Institute for Ecosystem Studies in Millbrook, New York, in 2003. Like other edited conference volumes (Likens 1989, Canham et al. 2003, etc.), it is long (489 pages) and broadly based, with the topics of its 24 chapters ranging from the theoretical and the synthetic to applications such as conservation planning.

I have to admit a certain prejudice against conference volumes of this sort, which tend to be lengthy and cannot avoid disparities of style and focus. One obvious manifestation of this disparity is the great variation in the number, quality, sophistication, and usefulness of the figures used to illustrate the different chapters. My preference would be a "distilled wisdom" version with half the length of this volume and a synoptic approach that eliminates both repetition and contradiction.

Although the jacket blurb hints at a groundbreaking synthesis, the book is more a compilation of current thinking and the present state of research in a number of related fields, including ecosystem science, landscape ecology, and conservation biology. The format, however, makes it difficult to compare chapter material, and it is not easy to follow the thread of a single concept throughout the volume. A flowchart or map of the relationships among the contents of the chapters might have been a useful addition.

That said, I commend the editors for their introductions to each section, which identify the common themes in all of the contributions. This is essential, given the broad range of ecosystems under discussion, from freshwater and oceans to cities and forests. The major theoretical component, which the editors emphasize, is the significance of the configuration of landscape elements, not merely the composition of the landscape, for the functioning of these heterogeneous systems: the flows of ecological processes are facilitated or inhibited by the landscape's configuration.

Although it is useful to have much of the current thinking on this topic collected in a single volume, I was left with the impression that a lot more thinking still needs to be done. Perhaps the most important challenge for this area of study is to develop conceptual and analytic frameworks that take into account the common elements of the broad range of systems studied. The spatial and temporal heterogeneity of ecological systems "nearly always affects processes and functions in ecosystems, and in diverse ways" (p. 414). The strength of this book is that it presents this diversity comprehensively, but diversity is also the book's weakness, inasmuch as general principles that unify the "diverse ways" are not presented.

Also missing from this collection are the theoretical tools needed to facilitate the research, even though these are available elsewhere. The concept of networks is mentioned in more than one chapter (pp. 39–41, 455–456), but it is never fully developed, and its parent concept, graph theory, does not even appear in the index.

This is a simple yet powerful body of theory in which spatial units are depicted as points (or nodes or vertices), with the connections and relationships between them depicted as lines (or arcs or edges); the points may have quantitative or qualitative characteristics, and the lines may have directions and other properties, such as rates. Graph theory has already been used in a variety of ecological studies (Dale 1977, Ricotta et al. 2000, Urban and Keitt 2001, Proulx et al. 2005, among many), and the subjects covered in this book would have benefited from its application. Discussions sometimes touch on the ideas of graph theory (for example, in reference to "point" processes at particular locations, with flows of energy, materials, and information between them [figure 2.1]), but it could be argued that the raster-based conceptual model depicted in figures 2.1, 2.2 and 2.3 will overly constrain developments in this area. A more open and flexible conceptual model will be important to the study of the function of heterogeneous landscapes, allowing all of the effects of the mechanisms of configuration, not just compositional differences, to be fully realized.

The book's contributors are to be credited for taking on such a difficult and critically important topic. Nonetheless, the current state of research in this field leaves room for considerably more work. I look forward to future developments in this area and to more distillation of the collective wisdom. The effects of spatial heterogeneity cannot be ignored, and they must be accounted for in ways appropriate to the system under study.

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PAYING GOULD TRIBUTE

Macroevolution: Diversity, Disparity, Contingency: Essays in Honor of Stephen Jay Gould. Elisabeth S. Vrba and Niles Eldredge, eds. Paleontological Society, Lawrence, KS, 2005. 210 pp., illus. $25.00 (ISBN 9781891276491 paper).

Stephen J. Gould was probably the most iconic figure in late 20th-century evolutionary biology. Although he is often associated with paleobiology (an association he courted), his personal research was in population biology and the evolution of gastropods. He had a brilliant literary style and wrote numerous popular books. It is probably those books, and the magazine articles from which they were derived, that introduced most of us to his ideas. Many of these ideas seemed revolutionary, but a careful reading of Gould's published works shows that he rarely took them to their most radical extremes. Now two of Gould's closest collaborators and friends, Elisabeth Vrba and Niles Eldredge, have gathered together a set of 14 papers that provide more detailed scientific insight into Gould's ideas and the directions in which they carry evolutionary thought.

If there is a central theme running through *Macroevolution: Diversity, Disparity, Contingency,* it is probably exaptation, the idea that evolution may recruit preexisting adaptations for new and unexpected processes. It is pursued at the level of the genome by Jürgen Brosius, whose article "Disparity, Adaptation, Exaptation, Bookkeeping, and Contingency at the Genome Level" introduces the reader to the transformation of an originally RNA-dominated world into one with DNA-driven evolution. He claims that this was accomplished through a process of retroposition (enzymatic conversion of RNA into DNA), which created what Brosius terms "retronuons." He claims that retronuons produce potential exaptations and may be major agents of genomic change.

Kenneth J. McNamara and Michael L. McKinney explore another possible contributor to macroevolution: heterochrony. They even make a stab at an explanation for the difference between the hands of birds, which have digits II, III, and IV, and those of their putative dinosaurian ancestors, which clearly retain digits I, II, and III. Judging from McNamara and McKinney's contribution, differential development might make morphology so plastic that morphological homology would be difficult to establish.

My favorite contribution to the discussion on exaptation, however, is by a famous invertebrate paleontologist, Adolf Seilacher, who wrote a delightful little essay on exaptation and the evolution of barnacles that infest the skin of whales. He originally intended to write the paper jointly with Gould, but it was put off too long, and Seilacher's regret is expressed in a poignant letter to Steve's ghost at the end of the article. Another essay borrows part of its title ("Tempo and Mode") from George Gaylord Simpson, though it's doubtful that Simpson would really have approved of the approach taken by Kevin J. Peterson, Mark A. McPeek, and David A. D. Evans to external and internal evolutionary "triggers." In much the same vein, Hugh Patterson looks at directional selection in "The Competitive Darwin," and Michael J. Donoghue takes up macroevolutionary processes in the evolution of plants. The latter author has some very interesting insights into the role of convergence in understanding evolutionary theory.

Gould's book *Wonderful Life* is reprised in an article by Derek Briggs and Richard Fortey, "Wonderful Strife," which also features the Cambrian diversity explosion. In this article they correct some of the mistakes made in Gould's book and discuss the real meaning of the Cambrian community revolution. The article by Bruce Lieberman and Vrba on species selection was another high point for me, as the authors delve into the somewhat controversial fields of macroevolution and group selection. Lieberman continues with Eldredge and a host of other authors in a related article, "The Dynamics of Evolutionary Stasis." Vrba addresses mass turnover and heterochronic events, while David Jablonski looks at mass extinction and macroevolution. It seems to me that the term "macroevolution" is a concept that doesn't translate well, and it varies in meaning from one author to another.

Lynn Margulis, Michael Dolan, and Jessica Whiteside explore the origin of the cellular nucleus in terms of Darwinian "imperfections and oddities." Daniel McShea looks at the evolution of complexity without natural selection. Stephen Hubbell discusses Gould's influential neutral theory of biodiversity. And in McShea's article, a kind of internal evolutionary drive, "the internal variance principle," is proposed.

It is worth noting that, while Gould flirted with many radical ideas—including saltatory evolution, the neutral theory of evolution, group selection, and the reversal of the biodiversity increase expectation—a careful reading of his published works reveals him to be, in the end, a little more conservative and closer to Darwin or Simpson than are the articles in this book.

Gould's mind ran the full spectrum of evolutionary theory, and this volume manages to address many of the subjects that we identify with him. It is worth noting that, while Gould flirted with many radical ideas—including saltatory evolution, the neutral theory of evolution, group selection, and the reversal of the biodiversity increase expectation—a careful reading of his published works reveals him to be, in the end, a little more conservative and closer to Darwin or Simpson than are the articles in this book. This is perhaps the greatest strength of the volume. It allows us to get an insight into what many suggestions and inferences found in Gould's work might look like if extended to their full potential. I congratulate the editors on their choice of authors and can only speculate that if

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Gould's spirit should choose to answer Seilacher's letter, it would be to say, Well done!

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WICKED PROBLEMS

Sustainability: A Philosophy of Adaptive Ecosystem Management. Bryan G. Norton. University of Chicago Press, Chicago, 2005. 608 pp., illus. $37.50 (ISBN 9780226595214 paper).

Sustainability: A Philosophy of Adaptive Ecosystem Management is simultaneously brilliant and highly frustrating. Bryan G. Norton brilliantly integrates insights from economics, environmental ethics, pragmatist philosophy, postnormal science, discourse ethics, decision theory, valuation, and more to help readers understand the problem of sustainability and to propose an adaptive management process to address the problem. But Norton couches his arguments in highly academic prose, which is bound to frustrate the nonspecialist reader, and is in direct contradiction to his assertion that to address the problem of sustainability, we must discuss it in ordinary language that anyone can understand. Ultimately, this is a philosophy text, when what the world really needs is a functional guide to adaptive management.

Norton recognizes that sustainability is a wicked problem: It is difficult to formulate, the way we formulate it influences how we try to solve it, different stakeholders understand and formulate it in different ways, the problem changes over time, and it can never be definitively solved. Facts are uncertain, decisions are urgent, stakes are high, and values matter. A multiplicity of values and goals means that sustainability must be judged by multiple criteria. Though most scientists strive to separate facts from values, this approach fails for wicked problems. How can we know what is important, what facts to gather, if we do not integrate our discussion of facts and values, as is done in everyday discourse and in policy discussions? We must accept that there is no one clear "solution" to sustainability—it is instead a process in which steps forward must be judged as better or worse, not right or wrong.

Unfortunately, most formulations of the sustainability problem are driven by ideology. For example, environmental ethicists focus on the intrinsic value of nature, and welfare economists on the instrumental value of nature in sustaining human welfare over time. Both disciplines bring nonnegotiable assumptions and values to the table, couched in academic jargon. Both attempt to evaluate a complex array of values by a single criterion and frame the problem in a way that predetermines solution paths. These assumptions and values conflict, so no cooperation emerges and no progress is made toward sustainability.

To address these problems, Norton offers a philosophy of adaptive management that builds from three basic principles. First is experimentalism: all knowledge, both facts and values, must be tested by experience, ruling out nonnegotiable ideological assertions. Second is multiscalar analysis: sustainability concerns changes that occur across different spatial and temporal scales, with different value systems emerging at these different scales. In particular, Norton distinguishes between (a) communal values relevant to intergenerational bequests and species survival and (b) economic values appropriate for short-term individual impacts. Third is place sensitivity: the starting point for adaptive management must be locally grounded values about what is important to sustain for a given community. This emphasis on place sensitivity keeps Norton's discussion fairly abstract, as one cannot specify, independent of a specific community, precisely what needs to be sustained.

Norton defines sustainability as "a relationship between generations such that the earlier generations fulfill their individual wants and needs so as not to destroy, or close off, important and valued options for future generations" (p. 363). Preserving valued options demands that we leave concrete physical resources for future generations (i.e., strong sustainability), which goes beyond the utilitarian requirement of simply ensuring a nondiminishing level of welfare (weak sustainability). This requires a hybrid approach to sustainability, in which the decision of what resources to leave takes precedence over economic reasoning and analysis. As ecological economists (wrongly accused by Norton of belonging to the weak-sustainability camp) put it, a sustainable scale must be price determining, not price determined (Daly and Farley 2004).

Adaptive management is the active process required to achieve this goal. The need to assess multiple criteria and to integrate facts and values demands the participation of multiple disciplines along with representative community stakeholders. Everyone from a given community who is interested in sustainability must come to the table to discuss precisely what that community needs to sustain, abandoning beforehand all a priori assumptions and bringing with them a commitment to experimentalism. A major challenge is to overcome the barriers to communication, achieved by abandoning academic jargon (facilitated by discussing real problems) and communicating in plain language, in which there are no artificial distinctions between facts and values. Even if participants fail to agree on ultimate goals, they can agree on initial actions that contribute to a variety of different goals. Action tests both facts and values and provides new information. Reflection on the outcomes of action through continued debate leads to new actions. It is this iterative process of action and reflection, empirical testing of both facts and values in a process of social learning, that constitutes adaptive management.

I strongly agree with Norton's analysis of the problem and the democratic adaptive management process he proposes,

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but some serious issues remain unresolved. First, his proposed process will be hard to implement, and once implemented may move too slowly to address problems that demand urgent action, such as global climate change and biodiversity collapse. Second, the process relies on social learning, which in turn depends on a willingness to empirically test all convictions. Will this approach work in societies (such as the United States) where faith-based beliefs in religion, markets, and economic growth often trump empirical evidence? Norton himself seems to assume that economic growth enhances individual welfare, ignoring empirical evidence that in wealthier countries, at least, growth fails to improve health, education, or subjective well-being (Costanza et al. 2007).

Perhaps more serious, Norton's principle of multiscalar analysis appears to conflict with his principle of place sensitivity. Efforts to sustain one hierarchical scale for too long may suppress the renewal cycle found in nature, and thus threaten the sustainability of systems at higher scales. If this is true, then efforts to sustain local communities for too long may threaten the larger system, the global community (Voinov and Farley 2007). If sustainability at higher hierarchical scales does not automatically arise from sustainability at lower scales, then Norton's philosophy may be dangerously incomplete.

My major criticism of *Sustainability,* however, lies in the highly academic language. I make my point using Norton's own words: "Building on Peirce's ideas of a science of semiotics, and incorporating breakthroughs by positivist and other philosophers of language, this group has offered a strong emphasis on public discourse, embedding this discourse in social praxis by focusing attention on the preconditions of intelligible language and discourse" (p. 279). Intelligible language is a precondition of public discourse, and Norton's frequent failure to meet this standard makes *Sustainability* much less accessible and less rewarding than it could have been. Perhaps the real culprit here is the perversity of the academic system, which forces scholars to write in disciplinary jargon if they wish to be taken seriously. I wish that Norton, who is already a highly respected scholar, had shown the courage of his convictions and written this book in ordinary language. Had he done so, this review would have given a wholehearted recommendation for an excellent book.

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NEW TITLES

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