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CAN NINEVEH REPENT AGAIN?

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Can Nineveh Repent Again?

One with Nineveh: Politics, Consumption, and the Human Future. Paul R. Ehrlich and Anne H. Ehrlich. Island Press, Washington, DC, 2004. 376 pp. $27.00 (ISBN 1559638796 cloth).

The subtitle of this volume by Paul and Anne Ehrlich—*Politics, Consumption, and the Human Future*—is descriptive of the book's contents; the title, *One with Nineveh,* is evocative of its forebodings. The thrust of *One with Nineveh* is to confirm the thesis of the "World Scientists' Warning to Humanity," issued by the Union of Concerned Scientists in 1992, that "human beings and the natural world are on a collision course." The evidence of that collision course is organized around the useful identity introduced by the authors some time ago:

$$\text{Impact} = \text{population} \times \text{affluence} \times \text{technology},$$

where affluence is gross national product (GNP) per capita and technology is impact per unit of GNP. Much new and old information is clearly and convincingly presented in this framework, interspersed with apt personal recollections. The authors make no attempt to present the scientific or economic first principles from which the world scientists' understanding and consequent warning follow. Instead, they present a wealth of empirical evidence, along with commonsense arguments, to show that the warning is valid.

The textbook written earlier by the Ehrlichs and John Holdren, *Ecoscience: Population, Resources, Environment* (San Francisco: W. H. Freeman, 1977), took a more basic conceptual approach that focused on equipping the student reader to follow the scientific arguments. I mention this not because I think the Ehrlichs should have written a textbook this time around, but to lament the fact that *Ecoscience* has long been out of print; evidently the publishers thought the book should be "dumbed down," and the authors disagreed. As one who taught undergraduates from that book for several years, I can testify that those students found it accessible—sometimes with a little help, but then what was I there for? Also, the Ehrlichs probably felt their time was better spent educating the general public up to some minimum rather than helping dumb down the universities. After all, in a democracy policy cannot rise above the level of understanding of the average citizen, and the Ehrlichs deserve a standing ovation for all they have done to raise that average, as well as for extending the margins of knowledge.

I cannot review here the authors' extensive summary of the facts and issues underlying population policy, immigration, economic growth and its limits, inequality, corporate reform, globalization, and so forth. I can, however, report that the discussion is fair and judicious, gracefully written, and without obeisance to the icons of political correctness or to too-easy, dispassionate consensus.

The book's policy recommendations mostly involve getting prices right, in the many senses of that term. For example, parents should bear most of the cost of having children; growth-inducing subsidies, especially in agriculture, should be eliminated; and consumers should bear the full social and environmental cost of their consumption. The authors' support for a consumption tax is especially welcome, but I would have been happier if, instead of offering a mild critique, they had rejected the value-added tax in favor of a tax on throughput (that is, a tax on "that to which value is added," the metabolic flow from source to sink, not on the value added to that flow by labor and capital, which is really income). Also welcome were suggestions for limiting the power of corporations—their size and their phony status as persons under the Bill of Rights. The authors recognize that more is required than the many good policies they identify: "Nothing less is needed than a rapid ethical evolution toward readjusting our relationship with nature so that the preservation of biodiversity becomes akin to a religious duty" (p. 270). "Preservation of biodiversity" may sound like an innocent technical term, but as the Ehrlichs show, it really means limiting the scale of the human occupation of our finite globe. Neoclassical economists have so far either aggressively ignored this limit or, in effect, treated it as a religious matter by deifying technology as savior.

The last point leads me to the evocative and enigmatic title. The phrase "one with Nineveh" comes from Rudyard Kipling's 1897 poem "Recessional," most of which is prominently reprinted at the beginning of the Ehrlichs' book, with the remaining stanzas supplied in the endnotes. I had not read the poem since freshman English, and I find it even more moving now than I did then. But why did the authors choose it for their title and epigraph? Is it just a literary hook to snag English majors, or a credo foreshadowing the book's message? I think the latter, but it is not easy to spell out the reasons, which may be why the authors left this task to the reader. Speculation is irresistible. A "recessional" is the closing hymn sung as the choir exits the sanctuary. Did Kipling mean that in 1897, Western civilization's "worship service" had already ended, and that in the future the danger would be that we forget what is worthy of worship—hence the refrain "lest we forget"? Kipling's poem is a hymn, in fact a prayer, since every stanza addresses God in an attitude of contrition and supplication. Far from a celebration of imperialism, something often reasonably enough attributed to Kipling, this poem is a prayer of repentance for the national sins of imperialism. Could the

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connection between Kipling's poem and the Ehrlichs' book be that civilization's imperial conquest of the natural world (as well as the related US economic imperialism noted in the book) requires the same kind of repentance that Kipling called for from imperialist Great Britain?

In comparing his own nation's "pomp of yesterday" with that of Nineveh, Kipling refers to the biblical story of the reluctant prophet Jonah. Jonah preaches God's message to the Ninevites, "Repent or be smitten," and is both surprised and peeved when the Ninevites (temporarily?) repent and are forgiven. Like Jonah, many of us, including the Ehrlichs, have been preaching to the modern Nineveh in which we live. Our message is similar: "Change your outlook and behavior or suffer the consequences"—in other words, "repent or be smitten."

Unlike the ancients, our modern Ninevites retort, "There is nothing to repent. Guilt is a Judeo-Christian hangup, or perhaps just a chemical imbalance. Even if one felt like repenting, to whom would we offer repentance? Who is going to smite us if we don't repent? You say the unintended collective consequences of our own actions will smite us? We are too smart for that old Greek trap of judgment by hubris! Look at how our economists have proved by rigorous mathematics, over and over again, that the free market converts private greed into public beneficence. Here, Jonah, have a Prozac and chill out."

If we liken our scientific arguments and evidence to a lever that we prophets want to use to move the world, and further arguments and evidence to an extension of the lever, then we still need a fulcrum, a fixed point of value or right purpose against which to pivot the lever of science, or else the world will not be moved. Extending the lever does not create a fulcrum. I suspect that the lure and appeal of Kipling's poem is that he is praying for such a fixed point on which to rest the unwieldy scientific lever, the "reeking tube and iron shard" in which "the heathen heart puts her trust." Physicist Richard Feynman raised the same question in a 1963 lecture, "The Meaning of It All":

> The great accumulation of understanding as to how the physical world behaves only convinces one that this behavior has a kind of meaninglessness about it ["all valiant dust that builds on dust," in Kipling's words].... The source of inspiration today, the source of strength and comfort in any religion, is closely knit with the metaphysical aspects. That is, the inspiration comes from working for God, from obeying His will,... so when a belief in God is uncertain, this particular method of obtaining inspiration fails. I don't know the answer to the problem, the problem of maintaining the real value of religion as a source of strength and courage to most men while at the same time not requiring an absolute faith in the metaphysical system.

I don't know the answer either—how does one conjure inspiration, purpose, and ethical behavior from a materialist metaphysics ending in meaninglessness? Whether the authors' choice of epigraph and title was intended to evoke these deep issues, I don't know, but for me it did. In any case, I am grateful to Paul and Anne Ehrlich for the sanity, clarity, and goodness they continue to bring to the world. Maybe Nineveh will indeed repent again.

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MAKING THEMSELVES AT HOME

Niche Construction: The Neglected Process in Evolution. F. John Olding-Smee, Kevin N. Laland, and Marcus W. Feldman. Princeton University Press, Princeton, NJ, 2003. 468 pp., illus. $75.00 (ISBN 0691044384 cloth).

Niche Construction: The Neglected Process in Evolution achieves three objectives. It describes and celebrates the ways organisms profoundly influence their own and others' physical environments; it advocates placing these effects within the context of evolutionary ecology (the ecologies of organisms emerge as adaptations to these feedbacks between the biotic and abiotic); and it suggests a novel worldview. Phenomena such as "ecological inheritance" and abiotic–biotic feedbacks create a kind of coevolution in which the abiotic environment becomes analogous to a living, evolving partner with life. Written by F. John Olding-Smee, Kevin N. Laland, and Marcus W. Feldman, the book is masterly and scholarly in its treatment of niche construction. Its theory for modeling niche construction is less satisfying, at least to me, and the unorthodox aspects of the authors' worldview seem unnecessary and perhaps indefensible. Overall, however, the book is easy to read, highly informative, thoughtful, and provocative.

Reading *Niche Construction* reminded me of river rafting. Parts of the book flow smoothly, with detailed perspectives on prior work, nice modeling examples, and descriptions of a central role for natural selection in shaping feedbacks between organisms and their environment. In between run the exhilarating rapids of contentious perspectives on new forces of natural selection, Maxwell's Demon (you will have to read the book; this was a new beast for me), and environments adapting to their organisms. Together, these topics add up to a complete conceptual and research package, replete with observations, theory, and predictions.

So what is niche construction? The book shows an excellent appreciation for Jones and colleagues' (1994) ecological concept of "ecosystem engineers," and for the many ways in which organisms modify their environments. While giving a central role to the evolutionary feedbacks created by ecosystem engineering, the book shows less interest in concepts of environmental feedback taken from evolutionary game theory and adaptive dynamics (Heino et al. 1997). Like other terms in this volume (*adaptation, fitness,*

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and *niche*), the phrase *niche construction* is sometimes used in an operational sense that conflicts with the definition in the glossary (an immensely useful and important part of the book—keep it handy).

Niche construction broadly includes all of the intentional, adaptive, and collateral effects that organisms have on their own and others' physical environments. The authors highlight these effects in a series of tables in chapter 2. Table 2.2 shows broadscale effects produced by diverse taxa, including the production of oxygen by plants and the weathering of rocks by protists. In tables 2.3–2.7, the animal examples focus on niche construction as an adaptation by which the organism modifies its environment in a manner that is favorable for itself, with collateral positive or negative effects on other organisms (e.g., burrows, nests, and beaver dams). The subdiscipline of habitat selection is charmingly categorized as "relocational niche construction." Despite the many excellent examples that imply a difference between adaptively intentional and unintentional habitat modifications, the book never fully makes the distinction. *Niche Construction* provides a nice review of niche concepts; although the glossary defines the niche as the "sum of all natural selection pressures" (complete with a niche function that has unspecified units), the book presents and seems to prefer Leibold's (1995) concepts of the "impact niche" and "requirement niche."

Given chapter 2's delightful and comprehensive treatment of niche construction as empirical fact, I looked forward in the next chapters to the development of a comprehensive framework for studying the ecological and evolutionary consequences of these modifications. However, chapter 3, which offered examples of modeling niche construction, seemed nevertheless to fall short of providing a theory of niche construction. The use of simple models based on population genetics did not satisfy me. Perhaps this was because the theory, although genetically rigorous, offered little ecological sophistication in terms of such considerations as population sizes and per capita growth rates; or perhaps it reflected my personal bias of solving problems in niche construction with evolutionary game theory. Chapter 8 provided welcome and more sophisticated evolutionary models of niche construction.

Chapters 4 and 5 raise provocative questions such as "How can organisms exist?" and how current theories of Darwinian evolution are wanting. Someone who is dissatisfied and searching for a different or expanded worldview may find inspiration and solace in these chapters. However, as in a carnival funhouse, concepts of natural selection and niche construction seem distorted by their reflection in a wavy mirror. By pushing the idea of ecological inheritance too far, the book seems to go "through the looking-glass," making the metaphor of ecological inheritance analogous to the biotic inheritance of traits. Perhaps there is something profound and useful in this approach. I missed it, but others may be inspired.

The remaining chapters—until the controversial conclusions in chapter 10—provide smooth sailing, with thoughtful discussion of the applications of niche construction to human cultural evolution, additional modeling, and, much to the authors' credit, serious attention to how a niche-construction approach to evolutionary ecology might produce novel, interesting, and testable predictions.

The final chapter remains true to the book's conceptual thrust, but I found myself drawing quite different conclusions about what an evolutionary ecology of niche construction should look like. A population-genetics approach seems cumbersome and undesirable for addressing a problem that simultaneously includes the coadaptation of multiple traits within the organism, the frequency dependencies that occur within and among species, the direct and indirect coevolutionary processes among species as they modify their environments, and the temporal dynamics of resources and state variables representing the physical environment. For me, game theory provides a modeling tool that simplifies this Gordian knot, a tool that is not addressed in this volume.

Yet I gained much from reading the book, and my mixed reaction to it is biased in part by my own theoretical background. Because *Niche Construction* is rich in examples and concepts, and provides a richly textured worldview, other readers with different perspectives and biases are likely to debate its conclusions and gain from it in other valuable ways.

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DIVING FOR CHOCOLATE

The Biology of Traditions: Models and Evidence. Dorothy M. Fragaszy and Susan Perry, eds. Cambridge University Press, Cambridge, United Kingdom, 2003. 474 pp., illus. $95.00 (ISBN 0521815975 cloth).

How do we identify animal traditions? Imagine two monkeys—white-faced capuchin monkeys—quietly playing a game. The game is played with apparent intensity and concentration, and always involves two participants. Despite the nature of the game, which frequently has one monkey prying its finger or hair out of the other monkey's mouth, participation is clearly voluntary, and apparently desirable. One monkey learns it from another, and group members have played it for 10 years. No other white-faced capuchin group plays this game. What is an ethologist to think?

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This kind of question became the genesis of *The Biology of Traditions: Models and Evidence.* The editors, Dorothy Fragaszy and Susan Perry, were well aware of the assignment of "cultural" designations to some animal behaviors; they had a different agenda, one rooted in ethology and in Tinbergen's (1963) classic questions of causation, ontogeny, evolution, and survival value, which in turn were rooted in the activities of nonhuman animals. Resisting the temptation to coin new jargon, Fragaszy and Perry define traditions in an ethological context: "enduring behavior patterns shared among members of a group that depend to a measurable degree on social contributions to individual learning, resulting in shared practices among members of a group."

Those who study animal traditions have set themselves a difficult task. What are researchers to make of group-specific behaviors? How can they distinguish a tradition from repeated innovation? What is the role of genetics in shared behaviors? These and other questions are difficult to answer in field settings, especially when directed at the long-lived, slow-developing animals that are most likely to have traditions. Every chapter in this book is thought-provoking because of the devotion to rigor that these authors bring to their work and because of the difficult questions they ask.

The chapters range across taxa (primates, birds, rats, and dolphins) and behaviors (vocalization, games, tool use, and more foraging modes than most of us can imagine). In so doing, they collectively address Tinbergen's questions, with examples ranging from suggestions that games involving the prying of fingers out of mouths (see above) might indeed have survival value to studies of brain size and social learning, and from the development of birdsong to the ontogeny of dolphins' foraging behavior. Unlike many edited volumes, *The Biology of Traditions* includes careful cross-referencing between chapters. Several chapters are rich with tables, offering a resource to be mined repeatedly for reports of possible traditions and tests of behavioral hypotheses. Although many chapters are organism centered, there is also a review of models of social learning, and an intriguing suggestion about the use of cue reliability to assess possible traditions. Likewise, although many chapters are devoted to field explorations, it is also clear that laboratory investigation offers great precision. As a fan of cockroach diversity and what it can tell us, I appreciate Bennett Galef's paean in chapter 6 to that great social learner, the Norway rat. It is not only the "charismatic megafauna" that are worthy of our attention; the not-so-charismatic fauna have news for us as well.

This brings us to chocolate. The story begins along the banks of the River Po, where members of some rat colonies dive into the water to feed on mollusks; members of other colonies never dive for food. Is this intriguing bimodal distribution of behavior in the field evidence for social learning? One might think so, but in the laboratory, Galef found that adult rats do not dive for food (chocolate), even if they observe that other rats do so. In contrast, about 20 percent of juvenile rats will dive to retrieve chocolate with or without exposure to other diving rats; in fact, if juvenile rats are taught to swim, almost all of them (90 percent) will spontaneously dive for food. The diving question may actually be one of swimming and, ultimately, food availability.

It is this little surprise, as well as countless others like it throughout the chapters, that makes this book a treasure. For that reason, I intend to use this book the next time I teach a graduate seminar in behavior. Although cetaceans and orangutans are a bit thin on the ground at the Midwestern campus where I teach, the questions that emerge from considering traditions in these and other animals encourage critical thinking. I only wish Cambridge University Press had invested in a species index; there are abundant examples throughout the book, and I would like to be able to access them efficiently.

The editors preface *The Biology of Traditions* with the statement that it is "intended for individuals interested in

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understanding social learning...from a biological perspective." I believe they have overshot their mark in the best way possible. By inviting experts in the field to focus their best thoughts and experience on untangling some of the more difficult problems in behavioral ecology, and by encouraging those experts to contribute to a truly synthetic and integrated volume, Fragaszy and Perry have generated a book that is likely to reward any scientist—and certainly any behavioral scientist—interested in the nature of evidence and in relationships between appearance and reality.

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THE EVOLUTION OF CONSERVATION THOUGHT AND PRACTICE

Reconstructing Conservation: Finding Common Ground. Ben A. Minteer and Robert E. Manning, eds. Island Press, Washington, DC, 2003. 417 pp. $27.50 (ISBN 1559633557 paper).

Most biologists are little aware of the rejuvenating but often acrimonious debates waged among academics from the fields of environmental history and philosophy. Those debates are central to *Reconstructing Conservation: Finding Common Ground,* a beautifully written book that attempts to build bridges between the scholarly practitioner and the conservation community. As a conservation and population biologist, I am perhaps just outside the intended audience for the volume, which I judge to be environmental philosophers and historians. Nevertheless, it is evident that the editors, Ben Minteer and Robert Manning (assistant research professor at Arizona State University and professor of natural resources at the University of Vermont, respectively), have brought together rigorous scholarship from some of the most influential writers in those fields.

Minteer and Manning argue that a book edited by William Cronon and published by W. W. Norton in 1996 (*Uncommon Ground: Rethinking the Human Place in Nature*) debunked the idea of an "American wilderness" and raised fundamental questions about the roots and future direction of the conservation movement. *Reconstructing Conservation* is an attempt to sift through the rubble left after Cronon (and many others) collapsed long-cherished utopian ideals. The book examines the bad, the outdated, and even some of the useful conservation ideas that existed before the "deconstruction." More important, it points the way toward the "reconstruction" of conservation.

The past decade has witnessed a sea change in the way conservation biologists go about trying to save Earth's biodiversity. One of the most significant trends is the greater consideration now given to human needs and local culture in conservation planning. The principal theme of *Reconstructing Conservation* will therefore not be new to anyone involved in international or even national conservation efforts: For long-term conservation initiatives to succeed, the human dimension must be considered and humans must be recognized as a part of nature, rather than separate from it. The book shines most in its discussion of how negotiating the coexistence of *Homo sapiens* and wild nature is fostered by democratic discussion, by an increased sense of community, by recognition of the importance of social justice, and by a willingness to sever the link between conservation issues and political ideology.

The emphasis on community is especially strong. Several chapters could be summarized as follows: If you encourage people to decide what conservation goals they want to achieve in their communities, they become more significant as stakeholders and so are more likely to facilitate the achievement of those goals. The conservation effort, in turn, builds a stronger sense of community by bringing people together in the decisionmaking process. The constructive feedback between conservation ideals and social networks is a recurrent theme of the book.

Reconstructing Conservation also furthers thought on a wider set of conservation themes by providing insights into the relationship between nature and culture. It offers novel views of some well-known conservation figures (such as Aldo Leopold) as well as some not-so-well-known figures (such as Scott Nearing). The book also offers worthwhile observations on the nature of the rural-agrarian landscape. The last chapter, written by the editors, summarizes the major concepts of the previous chapters and synthesizes them into 12 general principles for "reconstructing conservation thought and practice."

I would disagree with the authors' claim that conservation has undergone a recent and definitive "deconstruction." I have heard biologists questioning aspects of the wilderness paradigm and calling for greater collaboration with social scientists ever since I began pursuing my PhD in 1993. From a biologist's point of view, any paradigm shift has been gradual, not sudden. In fact, as Stephen C. Trombulak notes in chapter 16, the designation of wilderness is still considered useful in many contexts. Yes, the consideration given to human culture and the economy in conservation efforts is now firmly established as indispensable, but I would say the change has been more of an evolution than a revolution. Old ideas have been discarded by something akin to natural selection as their utility declined with changing social conditions. The old ideas have been supplanted by more useful ones, and *Reconstructing Conservation* represents another step in the evolution of conservation thought.

I thought the strongest chapters were those by J. Baird Callicott ("The Implication of Shifting Paradigms in Ecology for Paradigm Shifts in the Philosophy of Conservation"), Curt Meine ("Conservation and the Progressive Movement: Growing from the Radical Center"), Ben A. Minteer ("Regional Planning as Pragmatic Conservationism: Refounding Environmental Philosophy"), Bryan Norton

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("Conservation: Moral Crusade or Environmental Public Policy?"), and Stephen C. Trombulak ("An Integrative Model for Landscape-Scale Conservation in the Twenty-First Century"). I was, however, disappointed by the book's lack of discussion of international aspects of conservation, even though many of the ideas discussed cross-cultural lines.

Most people want to protect Earth's ecosystems and biodiversity. *Reconstructing Conservation* succeeds because it suggests ways of accomplishing conservation objectives by tying them to other populist social agendas, such as promoting democracy, making the world a better place for future generations, and preserving indigenous culture. I have already found some of its ideas informing my classroom lectures. It represents a vital contribution to conservation scholarship.

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FROM LAND AND LAKE AND AIR: THE ECOLOGICAL BREADTH OF HARVARD FOREST

Forests in Time: The Environmental Consequences of 1,000 Years of Change in New England. David F. Foster and John D. Aber, eds. Yale University Press, New Haven, CT, 2004. 496 pp. $45.00 (ISBN 0300092350 cloth).

Little more than 20 years ago, when the ink was barely dry on my PhD certificate, David Foster and John Aber were already well on their way to joining the elite of North American forest ecologists. David Foster received his doctorate from the University of Minnesota and quickly established his reputation in forest history and disturbance ecology; he is now the director of Harvard Forest. John Aber earned his PhD from Yale University and made major contributions in the nutrient cycling arena while working with the Hubbard Brook team; he is currently a professor in the University of New Hampshire's Department of Natural Resources and the Institute for the Study of Earth, Oceans, and Space. Aber is also a principal investigator for the Hubbard Brook and Harvard Forest Long Term Ecological Research (LTER) sites. There are few disciplines in ecology not covered in Foster and Aber's research programs; they list over 300 scientific publications on their Harvard Forest Web sites.

Although Foster and Aber credit themselves mainly as editors of *Forests in Time,* it soon becomes clear that they are the primary authors as well. The work is organized into 5 major sections and 20 chapters. Foster and Aber are either lead author or coauthor of 15 of the chapters. There are approximately 50 other contributing authors, including several other Harvard University professors and many past and present research scientists and graduate students at Harvard Forest. The major sections of the book are "Forest Ecology and Change," "Regional History and Landscape Dynamics," "Modern Forest Landscape and Ecological Legacies," "Forest Ecosystem Dynamics through Long-Term Experiments," and "Lessons from the Forest and Its History." Although the title of the book suggests that it covers all of New England, it really focuses on the long-term research conducted in and around Harvard Forest. That this site is located in Petersham, Massachusetts, in central New England, makes many of the findings relevant to the region as a whole.

The book starts with the background and framework for long-term ecological research at Harvard Forest, which was founded in 1907. The authors credit *Walden,* Henry David Thoreau's classic book about life on Walden Pond in Concord, Massachusetts, for the widespread interest in ecological research on human impact and land-use history in the New England countryside. In 1988, Harvard Forest became an LTER site funded by the National Science Foundation. The early

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chapters of *Forests in Time* discuss the period of New England's human settlement (first by Native Americans and then by Europeans), the physical environment (soils, topography, and climate), and natural disturbance factors (wind and fire). The authors synthesize this information using a discussion of witness-tree distribution (recorded in early land surveys) and paleoecology (pollen and charcoal profiles of bogs and lakes) to describe the original composition of the two major forest regions in New England: beech, maple, hemlock, and spruce forests to the north, and oak, chestnut, hickory, and pine forests to the south. The dramatic alteration of the New England forest landscape through logging, land clearing, and farming is discussed in detail, and the effects of this alteration in Petersham are illustrated with photographs of the well-known dioramas and models from the Harvard Forest museum.

Chapters by J. Fuller and colleagues and J. McLaclan and colleagues present a more detailed discussion of paleoecological data to illustrate forest responses and dynamics to land-use and climate change around the forest. These data are coupled with information on tree rings (dendroecology) and tree age structure to discern the relationship between tree recruitment and disturbances, and to learn how modern-day forests differed from forests of the past. Although the book is almost exclusively dedicated to plant and forest ecology, a chapter on wildlife dynamics is included to further illustrate species change in a constantly altered landscape. It contains a useful table on New England wildlife species that are now extinct or extirpated, declining, increasing, or introduced to the region. The research of a long-time Harvard Forest scientist, Glenn Motzkin, is synthesized in a subsequent chapter on forest landscape patterns, structure, and composition. The impacts of previous cultivation on soils and vegetation patterns in and around central Massachusetts are emphasized in this chapter. A related chapter follows on land-use legacies in soils. It discusses the long-term impacts of anthropological history on soil nutrients, nutrient cycling processes, and nitrogen storage.

The emphasis then changes from land and lakes to the forest–atmosphere interface. Over the last decade, a significant amount of the ecophysiological research conducted at Harvard Forest has emphasized canopy-level carbon and water vapor fluxes for the major tree species. Much of this research has been done in tower experiments using eddy flux measurements, and has documented diurnal, weekly, seasonal, and yearly variation in canopy fluxes. These data are used to model ecophysiological responses to climatic variation, including phenomena related to global change such as elevated carbon dioxide in the atmosphere and increasing temperature. They are also compared to data from other types of forest in North America.

The fourth major section of the book, on long-term ecosystem dynamics, begins with a chapter on the impacts of catastrophic hurricanes, a major recurring disturbance factor in New England. Research at Harvard Forest, including the early work of David Foster, led to a series of excellent papers documenting the effects of and responses to the 1938 hurricane that leveled the old-growth forests there and in the Pisgah tract in southern New Hampshire. So that scientists could better understand this phenomenon under more controlled conditions, trees were mechanically pulled down in an experimental hurricane simulation study, and the vegetation and soil impacts were monitored over a subsequent 12-year period as part of the LTER study. A major finding of this research is the remarkable ability of the affected ecosystem to "maintain internal functioning and resist major compositional changes." This contrasts with other major findings reported throughout the book, suggesting that the imprint of human land use on the New England landscape is profound and very long lasting. It includes the homogenization of tree species distribution across central Massachusetts and other long-term legacies of past land use, such as

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Native American and early European settlement impacts.

The chapters that follow deal with pollution-mediated nitrogen saturation of ecosystems, with the impacts of soil warming as a consequence of global climate change, and with the DIRT (Detritus Input Removal and Transfer) experiment. Included here are a wide range of data and discussion of topics, including above- and belowground biomass, plant and soil nutrients, nitrogen mineralization, methane flux, and soil respiration. The far-reaching impacts of pollution, elevated levels of atmospheric carbon dioxide, increasing global temperatures, and manipulation of litter and root inputs on ecosystems processes are well developed in this section. The remainder of the book includes a chapter on experimental approaches to understanding forest regeneration and four synthetically oriented chapters on remote sensing, insights for ecology and conservation, global carbon budgets, and environmental change and the future health of regional forests.

Forests in Time is written in a concise and clear style. It can be understood and appreciated by a wide audience, from the weekend naturalist to the professional ecologist. The major strength of the book is that it synthesizes and discusses approximately two decades of intensive research on a wide variety of ecological topics. This is done in a step-by-step, chronological narrative that takes the reader from the pre-Columbian forests of New England, through the early European settlement period of logging, land clearing, and agriculture, to the present day. It covers many important ecological topics, ranging from land-use history to paleoecology and from nutrient cycling to ecophysiology. The book also assesses the impacts of major natural and anthropogenic disturbance factors (fire, wind, insects, and disease) and of ecosystem stressors (pollution and exotic invasive species).

One important message that I gleaned from the book echoes one that I have been writing about in my recent papers. Forests of the eastern United States undoubtedly have been affected by global change phenomena, but to date these impacts are not nearly as severe as the disturbances and stressors that resulted from the activities of European settlers. Anthropogenic effects on the ground have greatly outweighed those in the atmosphere. I believe, as I think the authors of the book do, that a dynamic equilibrium that existed for thousands of years in the forests of the eastern United States as a result of Native American activity and postglacial climate change was dramatically altered in the few centuries after European settlement (Abrams 2003). Indeed, this pattern now exists throughout much of the world. Evidence presented in this book suggests that the composition, structure, and ecology of New England forests will not return to anything that resembles the pre-European settlement condition in the foreseeable future. The loss of forested area to agriculture, the intensive logging and land-clearing, the introduction of exotic insects and diseases, and the suppression of fire that followed in the wake of the Europeans resulted in, among other things, the decline or extirpation of the once dominant chestnut, white pine, white oak, beech, sugar maple, and hemlock.

I probably wouldn't be doing my job if I didn't mention a few minor criticisms. The inclusion of some of the chapters seems a bit contrived, in that they don't fit well with the overall theme of book. For example, the wildlife chapter stands alone and is not well integrated. The chapter on experimental approaches to understanding forest regeneration likewise seems out of place in a section dominated by chapters on belowground processes. This chapter also lacks the historical bent and broad scope of the others. Nonetheless, all the chapters are of high quality. I should mention that anyone who has followed Foster and Aber's published work over the years would recognize many of the tables and figures included in the text. I was a bit disappointed by this, but others may find it helpful to have all this information available in one source.

Even more important than the data reported here are the approach and methodology used by the authors in conducting multiscale, multidisciplinary, long-term ecological research. You don't have to be from New England to appreciate the lessons, opinions, and other content. Any researcher in the field could be forgiven for feeling envious of the quality and quantity of the work that Foster and Aber have completed over the last 20 years. Harvard Forest has become a great venue for diverse scientists and for complex, multidisciplinary research. This book will become a must-read for anyone interested in the study of historical forest ecology and anthropogenic impacts on ecosystem dynamics.

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FLYCATCHER EXPLAINS IT ALL

The Sandwalk Adventures. Jay Hosler. Active Synapse, Columbus, OH, 2003. 159 pp., illus. $20.00 (ISBN 0967725518 paper).

Toward the end of his life, Charles Darwin, author of the *Origin of Species,* found himself explaining the rudiments of deep time, common descent, and natural selection to a charming, befreckled adolescent named Mara. Standing in the way of her acceptance of evolution was her adherence to her family's traditional creation myths. Unusually, these myths focused not on Genesis but on the heroic demigod Flycatcher, who—as legend has it—vomited forth the oceans of the world over five years and then proceeded to name the animals. Or perhaps not so unusually, since Mara and her family were mites inhabiting the left eyebrow of Darwin himself—whose nickname, bestowed by the crew of the *Beagle,* was "Flycatcher."

Such, at any rate, is the premise of Jay Hosler's graphic novel *The Sandwalk Adventures.* (The title refers to the sand-

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covered path on the grounds of Down House, a trail along which Darwin often pensively ambled; the allusion is characteristic of Hosler's extensive research, described in a 30-page section of notes.) In a previous venture, *Clan Apis* (2000), Hosler managed to explain a remarkable amount about honeybee development, behavior, and ecology—his professional specialty as an associate professor of biology at Juniata College in Huntingdon, Pennsylvania—while overlooking no opportunity to crack a joke. *The Sandwalk Adventures* follows in the same delightful vein.

For anyone seeking to appeal to adolescents and to present a simple message in a striking way, comics are the way to go. Unsurprisingly, then, the creationist literature is rife with comics, ranging from the crude young-Earth creationist tracts of Jack T. Chick, such as *Big Daddy?* (2000), to the intelligent-design creationist primer *What's Darwin Got to Do with It?* (Newman and Wiester 2000). Antievolutionism even surfaces from time to time in the syndicated comic "B.C.," whose creator Johnny Hart is a fervent supporter of the young-Earth ministry Answers in Genesis. The response from defenders of evolution is unimpressive: *Darwin for Beginners* (Miller and Van Loon 1982), the first example that springs to mind, is wordy, arty, and not especially narrative-driven—not the ideal treatment of evolution to hand to a teenager or a bright preteen.

The Sandwalk Adventures is quite another cup of tea. There is not only a strong and engaging narrative line, but also jokes that are decidedly adolescent: A zit plays a major plot role in one chapter; the mites engage in hilarious family banter throughout; and there's a running gag about their butt-lessness that culminates in a burst of verbal fireworks worthy of the Marx Brothers. It is not all fun and games, though. Coughing, stumbling, and feverish, Darwin is clearly near the end of his life, and the intellectual pathos of his failure to explain inheritance occupies several pages of the final chapter. Mara herself is persecuted by her brothers for her doubts about the traditional myths concerning Flycatcher's creation, which leads her mother, though a believer, to protest, "You defended the sanctity of creation and wonder with acts of fear and intimidation?" A brotherly answer, in which Hosler's trademark humor reasserts itself: "Yes. Plus I poked her in the eye."

Beyond its engaging art and its snappy dialogue, *The Sandwalk Adventures* is pedagogically sophisticated; Hosler obviously is aware of the likely misconceptions that his readership will have about evolution (Alters and Nelson 2002). That fitness is a matter of strength (rather than reproductive success), that individuals (rather than species) evolve, that evolution is predictable and progressive (rather than opportunistic and branching)—all of these are misconceptions about evolution that Hosler takes pains to address and debunk. (The last one gives him the excuse for a typical display of visual humor: While expounding the nonprogressive nature of evolution, Darwin stumbles, falls, and struggles to rise, producing a scrambled caricature of the familiar series of marching hominids.)

Hosler is also sensitive to the fact that neophytes are likely to have already encountered, and perhaps imbibed, creationist propaganda. In a central Socratic discussion with Darwin, Mara's position swiftly changes from young-Earth creationism (or its mite equivalent) to old-Earth creationism and then to evolution. Unfortunately, there is a key ambiguity in the discussion, when Darwin rejects Mara's suggestion that he, as the mite equivalent of God, allows evolution to occur under his guidance. Hosler puzzlingly describes such a position in the notes as "progressive evolutionism," thus failing to distinguish between progressive creationism, the creationist position that God sporadically intervenes in the career of life to create new lineages, and theistic evolutionism, the position (or family of positions) that God continuously super-

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vises evolution. The latter position, as espoused by, for example, cell biologist Kenneth R. Miller (1999), is not intended as a scientific rival of evolution but as a theological accommodation of it. Thus, by conflating theistic evolutionism with progressive creationism, the text regrettably leaves the impression that evolution is not just agnostic, like any other scientific theory, but atheistic.

The Sandwalk Adventures serves as a rebuke to creationism, but it is sympathetic to the feelings behind it, the social and emotional significance of the creation myths by which people live. Mara's family is held together by storytelling, and the character Darwin himself acknowledges that evolution is not as emotionally satisfying a narrative as are the gee-whiz tales that the mites tell among themselves (featuring the heroic Flycatcher and his wonder dog Polly doing battle against malign space aliens). Yet, as Darwin himself reminds his readers, "There is grandeur in this view of life." In *The Sandwalk Adventures,* Hosler successfully reveals its grandeur with humor.

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