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SUSTAINING HOPE FOR FISHERIES IN THE 21ST CENTURY

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The New "Just So" Stories

Endless Forms Most Beautiful: The New Science of Evo Devo and the Making of the Animal Kingdom. Sean B. Carroll. W. W. Norton, New York, 2005. 350 pp., illus. $25.95 (ISBN 0393060160 cloth).

This book is unique in that it is the first in the field to be written at a level and in a style that students, K–12 teachers, and the general public, as well as researchers, will enjoy and understand. Catchy chapter titles (e.g., "Making Babies: 25,000 Genes, Some Assembly Required"; "The Dark Matter of the Genome: Operation Instructions for the Tool Kit") entice the reader, and clever analogies enable Carroll to progressively build a logical understanding of what may be new concepts (e.g., the developmental genetics of gene regulation). Researchers and graduate students, particularly in fields peripheral to evolutionary developmental biology, or evo devo, will also find that this book broadens and deepens their perspective on the field.

Although a number of other evo devo books have been published in the past several years (Arthur 2000, Davidson 2002, Wilkins 2002, Minelli 2003), the refreshingly noncomprehensive format of this book (from the standpoint of the field's history and of the increasing volume of examples) makes it a delightful read. It is well illustrated with gorgeous color plates of gene expression patterns and butterfly wings, and black-and-white drawings and photographs, among which are phylogenies, body plans, monstrosities, and gene switches and networks.

For the title of the book, Carroll chose *Endless Forms Most Beautiful,* the only four words of the last sentence of Darwin's *Origin of Species* that remained completely untouched throughout the many versions and editions of that classic. The diversity and beauty of the organisms is captivating, and Carroll uses readers' natural fascination to lead us through the stories coming from the field of evo devo.

Carroll argues that it is from the form-based perspective of evo devo that evolutionary principles can be compellingly taught. "The evolution of form is the main drama of life's story, both as found in the fossil record and in the diversity of living species," he writes. "So, let's teach that story. Instead of 'change in gene frequencies,' let's try 'evolution of form is change in development'" (p. 294). Evo devo's methods of illustrating how animal forms evolve, he argues, offer a much more powerful explanatory vision than the abstract extrapolations of the era of the modern evolutionary synthesis. As Carroll points out, most students can conceptualize (a) the small leap from understanding the building of complexity in one generation from egg to adult, to appreciating how modifications of development over greater evolutionary time have produced a diversity of forms; (b) the molecular genetic details of developmental control (tool kit genes are shared by all animals, and differences in form come from changing the way they are used); and (c) the visually appealing nature of the evo devo perspective. By focusing on the drama of the evolution of form and illustrating how changes in development and genes are the basis of evolution, the evo devo approach allows the deep principles underlying the unity and diversity of life to emerge.

Evolutionary changes in development ultimately occur at the level of the genome, and with analogies to astronomy in chapter 5—"Just as dark matter in the universe governs the behavior of visible bodies, the dark matter in our DNA controls where and when genes are used in development" (p. 110)—the author gets into the meat of gene regulation: the operating instructions for the tool kit. He compares the instructions embedded in the dark DNA to "genetic switches" (p. 111) and points out that the anatomy of animal bodies is encoded and built by constellations of switches distributed all over the genome. Carroll anticipates that the facts of gene regulation will be unknown, intimidating, and difficult for many readers, and he does an admirable job of breaking them down into their logical components. For example, the length of a switch is several hundred base pairs; each switch contains 12 to 20 signature sequences to which other proteins bind; multiple switches control each tool kit gene; and sets of interconnected switches and proteins form local circuits that are part of larger networks. The general function of switches is to transform the existing pattern of gene activity into a new pattern of gene activity, and ultimately animal body plans are the product of this dynamic regulatory architecture.

The flavor of Carroll's prose is captured in his description of gene regulation: "The making of an animal involves one more set of genetic invisibles—little devices in the DNA that govern where and when genes are activated.... I will describe the fantastic little devices in the genome that draw the beautiful patterns of gene expression...and that are the key links between the chains of tool kit genes that build animal complexity and diversity" (p. 107). He explains that it is the modification of switches over evolutionary time that has resulted in the spots, stripes, and bumps of Kipling's *Just So Stories:* "Differences in form arise from evolutionary changes in where and when genes are used, especially those genes that affect the number, shape, or size of a structure" (p. 11). This solid understanding of gene regulation is necessary for understanding the effects of environment on development (mediated through genetic switches; chapter 8), as well as modularity and combinatorial gene logic (chapters 5–11).

Although modularity—the idea that an organism is composed of discrete parts that are built by integrated developmental networks—might be intuitive at the anatomical level, the modularity of the genetic switches underlying it is underappreciated. Modular switches are used for building modular animals, and therein lies the critical connection to evolution: switches allow evolutionary change to

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occur in one part of a structure, independent of other parts. Switches are the secret to modularity, and modularity is the key to building complexity. The key to making endless forms (illustrated with arthropods and vertebrates) is in the astronomical number of possible combinations of regulatory inputs and switches. The "Big Bang" (Cambrian explosion; chapter 6) and the "Little Bangs" (subsequent diversification; chapter 7) of animal evolution are stories of the evolution of different numbers and kinds of repeated body parts due to shifting of *Hox* zones (ultimately caused by changes in DNA sequences of *Hox* gene switches).

Carroll attributes the unexpected nature of the discoveries in evo devo to the field's revolutionary character. As he notes in the introduction, "Contrary to the expectations of *any* biologist, most of the genes first identified as governing major aspects of fruit fly body organization were found to have exact counterparts that function similarly in most animals, including ourselves" (emphasis in original). Before the emergence of evolutionary developmental biology, nothing was known about how genes affect form, which genes affect the evolution of form, or what kinds of changes in genes were responsible for evolution.

The author uses helpful metaphors of mapping and geography to explain the progression of gene expression and action in development. Maps of gene expression and development reveal the order and logic of how tool kit genes work progressively to construct complex animals from a simple egg. The expression patterns of tool kit genes are related to the dynamic map of development in terms of, for example, longitudes, latitudes, and the East–West axis.

Endless Forms Most Beautiful could be used as a supplement to a textbook in general courses in developmental biology, animal diversity, and evolution, as it engagingly explains how the forms of individual species develop, how so many different forms have evolved, and how the various patterns and trends in animal design have arisen. Readers need not be expert in the field, however. Most general readers will want to know why evo devo is relevant to them, and the question "Why should I get excited about a fruit fly?" is answered for many at the end of the book: "because the same old genes were taught some new tricks" in human evolution.

Carroll deserves credit for tackling human evolution (chapter 10). In fact, the logic of the first chapters sets the stage so solidly that the key concept—"there is no need to invoke single dramatic mutations as causes of great leaps in form and function or as explanation for the origins of human traits" (p. 377)—should be easy to accept. By the end of the book, readers will be knowledgeable enough to appreciate the "the grandeur of the evolutionary view of life." The fundamental lessons of evo devo about modularity, genetic switches, and the evolution of form are well taught; Kipling would be riveted.

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References cited

Arthur W. 2000. The Origin of Animal Body Plans: A Study in Evolutionary Developmental Biology. London: Cambridge University Press.

Davidson EH. 2002. Genomic Regulatory Systems. San Diego: Academic Press.

Minelli A. 2003. The Development of Animal Form: Ontogeny, Morphology, and Evolution. London: Cambridge University Press.

Wilkins AS. 2002. The Evolution of Developmental Pathways. Sunderland (MA): Sinauer.

SUSTAINING HOPE FOR FISHERIES IN THE 21ST CENTURY

Sustainable Management of North American Fisheries. E. Eric Knudsen, Donald D. MacDonald, and Yvonne K. Muirhead, eds. American Fisheries Society, Bethesda, MD, 2004. 281 pp. $69.00 (ISBN 1888569654 paper).

Human use of the bounty of Earth's oceans and fresh waters has most likely reached its precipice. A startling, often cited statistic is that about 70 percent of the world's fishery resources are fully exploited, overfished, depleted, or recovering (FAO 2002). Yields of wild fish have remained stagnant at about 90 million metric tons for several years, suggesting that global production is near its maximum capacity. The challenge for the future is maintaining this production while restoring collapsed populations, protecting intact fisheries, and sating the demand of a growing human population with increasing access to resources.

The editors of this compilation of articles are all seasoned fisheries biologists working in western North America, and are certainly not strangers to the many pressing issues facing fisheries in these heady days of instant access and unprecedented consumption. *Sustainable Management of North American Fisheries* summarizes the presentations and conversations that occurred at a symposium on sustainable management held at the national conference of the American Fisheries Society in 2001. Each chapter generates a unique perspective proffered by expert participants from academe, government agencies, and nongovernmental organizations. Hence, this volume provides an opportunity to view the present and future states of fisheries through the lenses of esteemed fisheries scientists, fish culturists, ecologists, climatologists, evolutionary biologists, and demographers.

Although the terms *fisheries, sustainable,* and *management* are all included in the title of this book, the authors often adopt different explicit or implicit definitions of each term. The back cover displays an illustration of the classic Venn diagram used in most introductory fisheries courses to define a fishery, which occurs at the intersection among the physical environment, human activities, and the fish assemblage. Although one might think that this book would be about fish, most of the authors rightly focus on the human component of the fishery, because this is the portion that must be actively managed. All the chapters make it clear that the concept of sustainability is mutable and approaches fisheries management in a

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considerably different way than do methods used in the past.

The opening chapter by Henry Regier sets the foundation for this book by illustrating how resource conservation and management have evolved through the centuries. Regier argues—quite correctly, in my view—that fisheries have been managed to maximize production, with the belief that technology such as hatchery supplementation will mitigate any deficiencies. Realizing that this is not feasible, we are still locked in an ongoing struggle between reliance on technological advances and strict restrictions on access (e.g., closures, reserves). At the heart of this struggle is the goal of sustainability. A distillation of the authors' many views can be summarized thus: sustainability should provide renewable yield in the face of uncertainty and meet the needs of the present generation without compromising opportunities for future ones. Adding another dimension to this concept, Tony Pitcher and colleagues argue that fisheries must be restored to historical conditions before they can meet their potential for sustainability. They note that sustainable yields of restored systems will typically be less than current yields, because current systems are considerably out of ecological balance and clearly overfished.

The statement by several authors that human needs must be met for current and future generations (World Commission on Environment and Development 1987) implies that all the demands of the human population can be met by the planet's capacity to produce fish and shellfish through both natural and cultured pathways. Given that human population density will rise and productive capacity seems to be at a ceiling, I agree with those who accept that limits exist, and seek to develop sustainable management practices rather than assume some human-generated expectation will be met. This risk-averse approach is more likely to protect resources by moving away from the goal-oriented motivations that have driven fisheries in the past.

To learn from our mistakes and reward our successes, professionals within fisheries management must look at the performance record. The chapters by Daniel Hayes and colleagues and by John Musick and Julia Ellis provide detailed case studies demonstrating that issues within fisheries are largely system specific. Their collective arguments suggest that no one overarching problem is responsible for fishery failures. Although the science used to assess fisheries responses is typically sound, the way the human dimension and habitat are managed is largely responsible for the degradation of populations. The few fisheries successes are marked by a strong, self-organized conservation ethic within the fishing public or by very strict, strongly enforced regulations.

This book reflects a timely transition in thinking. As Robert Engelman points out in his chapter, human populations

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will continue to grow for many years to come, and recent increases in human density probably are primarily responsible for the increased demand for fish and subsequent declines. How fishery sustainability will be maintained in the face of increasing human populations will largely depend on how humans handle their own growth trajectory. Several authors note that as humans' affluence grows, they consume more, causing an increasingly disproportional effect on their environment. In addition to bigger harvest, loss of habitat and increased transport of exotic species occur, with further negative effects on fishery resources.

What are fisheries professionals to do, given the certainty of globalization and human population growth and the uncertainty of environmental change? Christine Moffitt outlines positive ways that products from aquaculture can potentially reduce demand for wild-caught fishes. However, the chapter by Eric Hallerman demonstrates that the limits of aquaculture production and its role in providing food or aiding in conservation are still being explored. And Robert Engelman suggests that the contribution of aquaculture may produce more detrimental environmental effects than benefits. With borders for trade falling, the probability that exotic species will be transported and successfully established is increasing. Cathleen Short and colleagues note that this problem will threaten the sustainability of many fisheries by negatively affecting native fishes through pathways such as food web changes, habitat loss, and direct competition.

Although most fisheries professionals are formally trained in biology, all of the chapters make it clear that an understanding of the human component is necessary to ensure sustainable management. A common conclusion is that fostering a sense of ownership or stewardship of the resource among its users is necessary to curb overfishing and ecosystem degradation. Although improved human economic conditions may result in increased consumption, they also lead to better education and empowerment of women to control reproduction. Hence, greater prosperity may enhance public awareness of resource limits and curb human population growth. Paul Pajak suggests in his chapter that although government has a large role to play in regulating use, the relationship between humans and the environment is a moral one—and thus, for many people, largely a religious one. In his view, much can be gained by involving religious organizations in partnerships for sustainable management. Other authors voice similar views about the apparent disconnect between humans' use of fish resources and the ultimate impact of their decisions. Unless this is resolved, successful attempts at sustainable use will be rare.

Many of the chapters focus on salmonids or on specific systems. However, the lessons within each chapter can be applied globally. The fisheries discipline needs to embrace outreach programs and better incorporate human effects into current approaches. The chapters provide several compelling directions for future work and should serve as a wake-up call to the profession. If the status quo continues, prospects for the future of many of the world's fisheries will be grim. However, hope does exist in the form of human intervention, accomplished through the efforts of professionals trained to think beyond the merely biological.

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References cited

[FAO] Food and Agriculture Organization of the United Nations. 2002. The State of the World's Fisheries and Aquaculture. Rome: FAO.

World Commission on Environment and Development. 1987. Our Common Future. New York: Oxford University Press.

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GROWING THE FUTURE

Biomass and Agriculture: Sustainability, Markets, and Policies. Organisation for Economic Co-operation and Development (OECD). OECD, Paris, 2004. 565 pp. $86.00 (ISBN 9264105549 paper).

Biomass, particularly in the form of plants and animal waste, is expected to play an increasing role as a source of energy, fuels, and chemicals as humans deplete petroleum resources and search for ways to reduce carbon dioxide concentrations in the atmosphere. Whereas economic development and growth in the 20th century were driven by the use of fossil resources as the raw materials for chemicals, fuels, materials, and energy, some believe sustainable economic development in the 21st century requires that biorenewable resources provide a new foundation for the economy. The book *Biomass and Agriculture: Sustainability, Markets, and Policies* is therefore timely in its examination of two broad themes: first, the impacts on sustainability of agricultural biomass production; and, second, policy approaches for developing production of agricultural biomass and its use in industry. This collection of articles, which covers both bioenergy and biomaterials applications in Organisation for Economic Co-operation and Development (OECD) countries, grew out of the OECD Workshop on Biomass and Agriculture held in June 2003 in Vienna.

This large volume has a pleasing, logical structure. The first of three main sections contains a set of four overview papers introducing key concepts and issues about the industrial use of biomass. In the second, sustainability is addressed through three sets of papers organized around the economic, environmental, and social dimensions of sustainability. The final major section is dedicated to examining policy approaches, impacts, and options; its articles are organized geographically into three subsections addressing Europe, North America, and other OECD countries, respectively. Given the scope and origin of the book, it is necessarily confined to presenting a series of snapshots that reflect different disciplinary, geographic, and cultural viewpoints, rather than a cohesive look at the viability of the industrial use of biomass.

One of the book's greatest strengths is its collection of perspectives from a broad range of countries and geographical regions. It is often noted that, like politics, all biomass is local. Location-specific climate, soil, and hydrology make for unique biomass production capacity, and factors such as population, industrialization, and resource endowments result in unique possibilities for biomass utilization. The range of perspectives represented by the papers in this volume give one an appreciation of the way systems of biomass production and use may be tailored to local conditions. The book is, however, biased toward descriptions of existing practices rather than analysis of new approaches. The drawback of this is that the reader cannot get a feel for the overall potential of biomass to meet future needs for fuel, power, and

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chemicals. There is also a bias toward energy production—through combustion, anaerobic digestion, and fuels such as ethanol—rather than toward the emerging field of chemical production. For instance, production of chemicals is mentioned only in a general way, in overview articles. This omission is understandable, however, in a broad-brush text with a focus on agriculture.

The focus of the book is on the production of biomass as the feedstock of a bioeconomy. The promises and pitfalls of a biobased economy rest in large measure on the sustainability of the underlying agricultural production systems. Although this volume has "sustainability" in its subtitle, it never addresses agricultural sustainability in a direct or comprehensive manner. Agriculture has experienced a century of unprecedented intensification in the effort to satisfy growing demands for food and fiber, and new demands for biomass feedstocks for energy and chemicals can only increase the strain created by high-input agriculture. Most of the world's agricultural systems are heavily dependent on petrochemical inputs for mechanization, chemical fertilizers, and pesticides, and the resulting impacts on soil, water, and human and environmental health have raised serious concerns worldwide. Among the vital questions that need to be answered about biomass and agriculture are these: Can agriculture continue to supply needed food and fiber, as well as the industrial feedstocks on which a bioeconomy will depend? And can it do so in a manner that supports rural communities, maintains biodiversity, and provides vital ecosystem services?

As a researcher interested in sustainable agriculture and industrial ecology, I found the first paper in the environmental subsection of part I particularly interesting, as it presents a useful framework for evaluating the environmental impact of biofuel use. This framework is intended to facilitate an integrated, holistic assessment of the impacts of increased biomass production, and thus lays out one approach to answering the questions posed above.

Ecologists and biologists are likely to be disappointed by the absence of articles addressing topics such as biodiversity in biomass agroecosystems, the impacts of biomass harvesting on soil fertility, or the agronomics of biomass crops. Engineering, business, and economic viewpoints are well represented in this collection, but there is little contribution evident from the natural sciences. A notable and welcome exception is an interesting article on the effects of bioenergy crops on farmland birds in the United Kingdom (the outlook is not good, particularly if bioenergy crops are grown on land with high wildlife value, such as arable lands left uncultivated under the European Union's set-aside program).

Readers interested in resource issues associated with biomass production for power, fuels, and chemicals will be disappointed that there is little discussion of future needs for biomass and of the potential to increase global agricultural production. However, the ninth chapter does present an insightful discussion of the possibilities and limits of bioenergy crops in Flemish agriculture. It examines conversion technologies, Flemish biomass production capacity, and energy demand, and concludes that from the standpoint of efficiency and bioenergy, crops are not very attractive in such a small, densely populated northern country. The chapter concludes that importing bioresources and products from countries with scale advantages makes sense for a country with so little open space. Energy conservation is also seen as desirable, because it saves the environment and open space—in other words, the greenest energy is that which is not used.

Although the environmental impacts of biomass production are not well understood, it is generally believed that in some dimensions (e.g., soil erosion, fertilizer and pesticide use), biomass crops are preferable to certain high-input commodity crops. What also seems clear is that in today's agricultural markets, the economic attractiveness of biomass products (as opposed to fossil fuel alternatives) depends critically on how the environmental costs and benefits are valued and reflected. Agricultural markets are distorted by government price supports and other agricultural subsidies, which may lead to underproduction of biomass crops. Bioproducts have their roots in agriculture, and so are naturally the subject of much policy interest.

The final section of this volume contains an interesting collection of chapters describing the biomass and bioenergy policies of different countries on several continents. For those who are interested in policy issues, this is a unique, valuable resource. Financial incentives are the most common policy instruments for stimulating biomass markets in OECD countries. Policies tend to focus on closing the gap between biomass and fossil fuels, with the implicit assumption that biofuels are desirable. Instead, greater efficiency gains could be achieved if policies focused on rewarding real environmental and economic benefits, thus creating an incentive for innovation and agricultural and product improvement. As noted in the executive summary, indirect production support for agricultural biomass feedstock also can lead to production, trade, and price distortions with respect to other food and raw material commodity materials.

Biomass and Agriculture: Sustainability, Markets, and Policies is a good introduction to the topic of biomass and agriculture, and could serve as a useful reference for those interested in current production and policy. The book is clearly organized around the topics of sustainability and policy. It provides descriptive information rather than predictive models about future biomass utilization and its impacts, and it may not explore agricultural sustainability issues in as much depth as some readers might hope. Nevertheless, I would recommend the book as a general introduction to biomass use with an international perspective.

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Benthic Habitats and the Effects of Fishing. Peter W. Barnes and James P. Thomas, eds. American Fisheries Society, Bethesda, MD, 2005. 890 pp., illus. $75.00 (ISBN 1888569603 cloth).

Biogeography. 3rd ed. Mark V. Lomolino, Brett R. Riddle, and James H. Brown, eds. Sinauer, Sunderland, MA, 2005. 752 pp., illus. $89.95 (ISBN 0878930620 cloth).

Birds of Southeast Asia. Craig Robson. Princeton University Press, Princeton, NJ, 2005. 304 pp., illus. $29.95 (ISBN 0691124353 paper).

Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Crustaceans. Patsy A. McLaughlin et al. American Fisheries Society, Bethesda, MD, 2005. 545 pp., illus. $60.00 (ISBN 1888569646 paper).

Entering Mentoring: A Seminar to Train a New Generation of Scientists. Jo Handelsman, Christine Pfund, Sarah Miller Lauffer, and Christine Maidl Pribbenow. University of Wisconsin Press, Madison, 2005. 152 pp. $29.95 (ISBN 0299215709 cloth).

The Eugenics Movement: An Encyclopedia. Ruth Clifford Engs. Greenwood Press, Westport, CT, 2005. 304 pp., illus. $75.00 (ISBN 0313327912 cloth).

The Evolution of American Ecology, 1890–2000. Sharon E. Kingsland. Johns Hopkins Press, Baltimore, 2005. 328 pp., illus. $50.00 (ISBN 0801881714 cloth).

Fire and Avian Ecology in North America. Victoria A. Saab and Hugh D. W. Powell, eds. Cooper Ornithological Society, Camarillo, CA, 2005. 193 pp., illus. $18.00 (ISBN 0943610648 paper).

Forest Pathology: From Genes to Landscapes. John E. Lundquist and Richard C. Hamelin. APS Press, St. Paul, MN, 2005. 175 pp., illus. $69.00 (ISBN 0890543348 paper).

From Resource Scarcity to Ecological Security: Exploring New Limits to Growth. Dennis Pirages and Ken Cousins, eds. MIT Press, Cambridge, MA, 2005. 280 pp., illus. $24.00 (ISBN 0262661896 paper).

Harry Marshall Ward and the Fungal Thread of Death. Peter Ayres. APS Press, St. Paul, MN, 2005. 168 pp., illus. $79.00 (ISBN 089054333X cloth).

Historical Changes in Large River Fish Assemblages of the Americas. John N. Rinne, Robert M. Hughes, and Bob Calamusso, eds. American Fisheries Society, Bethesda, MD, 2005. 612 pp., illus. $69.00 (ISBN 1888569727 paper).

Intoxicating Minds: How Drugs Work. Ciaran Regan. Columbia University Press, New York, 2005. 176 pp., illus. $18.95 (ISBN 0231120176 paper).

Macroevolution: Diversity, Disparity, Contingency: Essays in Honor of Stephen Jay Gould. Elisabeth S. Vrba and Niles Eldredge, eds. University of Chicago Press, Chicago, 2005. 210 pp., illus. $25.00 (ISBN 1891276492 paper).

Modularity: Understanding the Development and Evolution of Natural Complex Systems. Werner Callebaut and Diego Rasskin-Gutman, eds. MIT Press, Cambridge, MA, 2005. 455 pp., illus. $55.00 (ISBN 0262033267 cloth).

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Molecular Chaperones and Cell Signalling. Brian Henderson and A. Graham Pockley, eds. Cambridge University Press, New York, 2005. 352 pp., illus. $100.00 (ISBN 0521836549 cloth).

Outbreeding Mechanisms in Flowering Plants: An Evolutionary Perspective from Darwin Onwards. Carolyn Leach and Oliver Mayo. J. Cramer, Stuttgart, Germany, 2005. 152 pp., illus. EUR 24.00 (ISBN 3443500293 paper).

Plant Conservation: A Natural History Approach. Gary A. Krupnick and W. John Kress, eds. University of Chicago Press, Chicago, 2005. 384 pp., illus. $30.00 (ISBN 0226455130 paper).

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Seeing the Forest and the Trees: Human–Environment Interactions in Forest Ecosystems. Emilio F. Moran and Elinor Ostrom, eds. MIT Press, Cambridge, MA, 2005. 466 pp., illus. $35.00 (ISBN 0262633124 paper).

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Tropical Forests and Global Atmospheric Change. Yadvinder Malhi and Oliver Phillips. Oxford University Press, New York, 2005. 288 pp., illus. $34.95 (ISBN 0198567065 paper).

Tropical Forests: Regional Paths of Destruction and Regeneration in the Late Twentieth Century. Thomas K. Rudel. Columbia University Press, New York, 2005. 234 pp., illus. $32.50 (ISBN 023113195X paper).

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. Carl N. McDaniel. Trinity University Press, San Antonio, TX, 2005. 288 pp. $17.95 (ISBN 1595340092 paper).

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