Riparia: Ecology, Conservation, and Management of Streamside Communities

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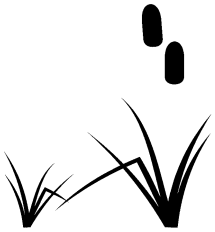
Flowing Landscapes

Riparia: Ecology, Conservation, and Management of Streamside Communities. Robert J. Naiman, Henri Décamps, and Michael E. McClain. Elsevier, Burlington, MA, 2005. 448 pp., illus. $79.95 (ISBN 0126633150 cloth).

Riparia: Ecology, Conservation, and Management of Streamside Communities is an impressive synthesis of the international literature investigating the science and conservation of streamside zones. *Riparia,* the new term offered in the title, is effectively synonymous with "riparian zones." The Latin *ripa,* from which "riparian" derives, refers to riverbanks, and in biology, *riparia* provides the species designation for riverbank organisms such as the bank swallow (*Riparia riparia*). The new term is obviously very useful, and it is likely to be widely adopted.

Riparia (the book) extends the insightful collaboration of Robert Naiman of the University of Washington and Henri Décamps of the Centre National de la Recherche Scientifique in Toulouse, France. The pair produced the excellent article on riparian zones for the *Annual Review of Ecology and Systematics,* in which they describe the zones as biologically rich interfaces between aquatic and terrestrial ecosystems (Naiman and Décamps 1997). Now joined by Michael McClain from Miami's Florida International University, the authors have vastly expanded their analyses of riparian form and function. In the 15 years since the book project began, this field of research has exploded as the value and vulnerability, as well as the scientific intrigue, of riparia have become better appreciated. A comparison of *Riparia* with Malanson's 1993 monograph *Riparian Landscapes,* the former standard in the field, confirms the vigor of recent research: Nearly all of the literature cited in *Riparia* was published after 1993.



Suitable, even essential, for both academics and practitioners involved in river and riparian science and management, *Riparia* is also appropriate for advanced undergraduate and graduate students. The book's structure makes it ideal for use both as a course text and as a resource for scientists who study river ecosystems. Its content is organized by concept and process, not by specific riparian component (e.g., biological organisms). Thus, each chapter relates an interesting story about riparian processes relative to contemporary themes of ecosystem function, which should make the book appealing to a broad audience.

The introduction to *Riparia* emphasizes context and rationale, and it closes with an interesting and somewhat contrarian listing of riparian functions. The next three chapters profile the relevant principles of fluvial geomorphology, the resultant patterns in river and bank form, and the subsequent effects of those patterns, such as the zonation of riparian vegetation. Although some topics, such as river hydrology, get only cursory treatment, these chapters provide valuable insights into the physical processes and spatial structure associated with floodplain systems. This strategy seems appropriate, given that several excellent, accessible texts describing river hydrology and fluvial geomorphology have already been written, such as *A View of the River* (Leopold 1994) and *Stream Hydrology: An Introduction for Ecologists* (Gordon et al. 2004). Readers who are new to the field of river science will find that these other texts nicely complement *Riparia.*

Riparia's middle section elaborates the principles covered in previous chapters, introducing more interdisciplinarity and case studies. The authors examine aspects of biotic function and biophysical connectivity (one chapter to each topic) to analyze water, carbon, and nutrient fluxes; they first consider primary production and decomposition, which naturally lead to energy flow and food webs. The presentation of ecological processes and interactions starts with analyses of riparian plants, then moves to animals, particularly large mammals. The section closes with an overview of the role of salmon as transporters of marine-derived nutrients, an especially interesting study system that links marine, freshwater, and riparian components.

The human dimension of riparia is addressed in the next four chapters. One of these, "Disturbance," I found slightly disjointed because the authors inserted a short section on natural disturbance and disturbance ecology into a discussion of human alteration. Riparian zones are often floodplains, and thus floods—as well as other natural disturbances—merit more emphasis. In a future edition, the authors might consider giving separate, fuller treatment to natural disturbances.

The two ensuing chapters, on conservation and on restoration, overlap, first explaining why riparia are important, then discussing strategies for recovery, with an emphasis on ecosystem services and human values. The authors clearly recognize the challenge of linking scientific knowledge—and its uncertainties—to public policy. They endorse the need to recover more natural river flow regimes, which provide the hydrologic patterns and variations essential for riparian as well as aquatic organisms. They also recognize the complexities of riparian assessment, and the need to coordinate land-use planning and management at both local and watershed scales. In the closing chapter, "Synthesis," the authors highlight and integrate functions, ecological principles, and management guidelines for riparian zones. Two sections near the end of the synthesis chapter, on emerging study tools (particularly remote-sensing instruments) and global environmental change, offer useful discussions but distract somewhat from the book's predominant themes.

The bibliography—more than 50 pages of resources, primarily journal

papers—represents a vast contemporary literature base. The research papers are extensively cited throughout the text, enabling interested readers to verify the authors' conclusions and pursue various topics further. The authors' capacity to summarize and integrate very different research subfields accurately and insightfully is an extraordinary feature of this book. I highly recommend *Riparia* to all river and riparian scientists and to others interested in the topic, an emerging focus of ecology and natural resource management. This book is sure to become a classic.

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DO FLIES HOLD ALL THE ANSWERS?

The Evolutionary Biology of Flies. David Yeates and Brian Wiegmann, eds. Columbia University Press, New York, 2005. 430 pp., illus. $89.50 (ISBN 0231127006 cloth).

Anyone who's ever visited a feedlot knows about flies. With 120,000 described species in 150 families, the Diptera comprise some 12 percent of known insect diversity, exceeded only by beetles (350,000 species), bees and wasps (125,000 species), and moths and butterflies (150,000 species) (Grimaldi and Engel 2005). But if you're familiar with flies' ubiquity, their unmatched structural, developmental, and ecological diversity, their impact on humans as vectors of disease, and the countless contributions of *Drosophila melanogaster* to knowledge of modern biology, then you know that flies are important even if you can't abide them. In *The Evolutionary Biology of Flies,* editors David Yeates, a research systematist at the Australian National Insect Collection, Commonwealth Scientific and Industrial Research Organisation, and Brian Wiegmann, associate professor of entomology at North Carolina State University, and 20 other biologists review many aspects of fly phylogeny and biology with two goals in mind: (1) to document the impact of the study of flies on all aspects of evolutionary biology and (2) to support the case for this order becoming a "model clade" for more intense future examination.

Although cladistic analysis pervades all branches of comparative biology, medicine, and agriculture because of its historical and predictive power, it is not well known that its basic concepts and methods were devised by a dipterist, Willi Hennig, and first published in German in 1950; not until the publication of Hennig's English summary in the *Annual Review of Entomology* (vol. 10: 97–116) in 1965 and his book *Phylogenetic Systematics* in 1966 did cladistic analysis come into wide use. Rudolf Meier critically examines the development of Hennig's methods, their increasing influence on the practice of systematic and evolutionary biology, and the later abandonment of some of his principles (e.g., a stem species ceases to exist when it speciates and always gives rise to two descendant species; ranks in the taxonomic hierarchy should be assigned on the basis of their first appearance in the fossil record).

Hennig's numerous comparative studies of wing venation, genitalic structure, and larvae led him to propose many of the higher dipteran taxa recognized today, and others represent important contributions to knowledge of their fossils and biogeography. He also helped significantly in the unraveling of the phylogeny of other insects (Hennig 1969).

Michael Whiting summarizes the convoluted history of evolutionary relationships of the flies to other insects and concludes that the evidence indicates that the Diptera constitute the sister group of the Strepsiptera (twisted-wing insects) within the higher taxon Mecopterida (with scorpionflies and fleas), these, in turn, constituting the sister group of the Amphiesmenoptera (caddisflies, moths, and butterflies) within the subclass Endopterygota (insects that undergo a complete metamorphosis). The editors then subject the 19 currently recognized major lineages of Diptera to a supertree analysis, examine relationships within each clade, and compare the estimated divergence times indicated by their earliest appearance in the fossil record with those inferred from cladistic comparison of homologous nucleotide sequences of nuclear genes. Though these dates agree in sequential order, the molecular data provide earlier estimates than the fossils (e.g., basal Diptera: 248–283 versus 233 million years ago [Ma]; Drosophilidae: 99 versus 30 Ma), as is usual in such comparisons. The editors find strong support for monophyly of some major clades—the Brachycera, Eremoneura, Cyclorrhapha, Schizophora, and Calyptrata—but not for some basal dipteran clades, and less for the acalypterates, a large assemblage of mostly nondescript little flies, including *D. melanogaster.*

Conrad Labandeira reviews and illustrates 233 million years of dipteran evolution and ecology from the standpoint of his encyclopedic knowledge of their way of life, phylogeny, and fossil record, as well as his analysis of family-level feeding guilds. These he infers from examination of fossil insect and plant assemblages from different levels in the rock record. This evidence suggests that diversification of basal (nematoceran) lineages began in the Upper Triassic, of brachycerans in the Upper Jurassic, of eremoneurans in the Lower Cretaceous

just before the major angiosperm radiation of 115 to 95 Ma, and of schizophorans in the Lower Cenozoic. The last of these was partly influenced by the radiation of mammals.

This diversification occurred in a world of changing continental position, climate, and biota following the breakup of Pangaea. Peter Cranston documents how these disruptions continually influenced the distributions of flies and addresses the historical biogeography of various groups of chironomid midges, from ecologic, phenetic, dispersalist, and vicariant points of view. He summarizes the pitfalls of each approach and ends with a detailed historical account of chironomid distributional patterns.

The first insect to have its genome sequenced was *D. melanogaster,* in the year 2000. This was followed by 12 other *Drosophila* species, the malaria mosquito *Anopheles gambiae,* and the yellow fever mosquito *Aedes aegypti.* Michael Ashburner reviews what is known about dipteran genomes, particularly of *D. melanogaster* and relatives, and provides copious information on genome size, organization, and composition. Ashburner also discusses transposable elements (treated more fully by Margaret Kidwell). These were originally thought to be selfish DNA, but are now known to induce, rarely, adaptive change in the genomes of recipients; a few are widely used as vectors to transfer genes between species. In addition, Ashburner covers sex chromosomes. These are further discussed by Rob DeSalle and, in greater detail, by Neil Davies and George Roderick. Rob DeSalle addresses from a phylogenetic context the "molecular toolkit" governing development of larval and imaginal body plans in *D. melanogaster;* the distribution and evolution of early-acting pattern control genes such as *bicoid;* and the origin of long- and short-germ embryos, wing veins and wing pigmenation, sex determination, and bristle pattern.

Larval flies are among the most diverse and highly specialized of insects, and differ substantially in form and behavior from their adults, particularly in advanced species. They are mostly adapted to life in moist or aquatic habitats. Correlated with this divergence are major structural differences between the larval and adult central nervous system (CNS) and peripheral nervous system, as summarized in an evolutionary context by David Merritt. Unlike the nervous systems of ametabolous and hemimetabolous insects, those of flies and of other advanced holometabolous insects undergo two bouts of neurogenesis: one in the embryo, to generate the larval system, and the other in the late larva and early pupa, to replace it with a quite different imaginal system. The embryonic nerve mother cells (neuroblasts) that produce neurons for the CNS of larvae, rather than degenerating as in other insects, become quiescent in late embryogenesis and reactivate in older larvae to produce imaginal neurons. Though many larval neurons degenerate, most larval motor neurons are respecified to control the dispersive and reproductive behavior of a totally reorganized adult. Moreover, some larval sensory neurons persist thoughout metamorphosis. Because of the seamless continuum in nervous system metamorphosis between basal and derived flies, our extensive genetic and molecular understanding of neurogenesis in *D. melanogaster* can be applied to other flies.

Other topics addressed comparatively in the book, though not in a phylogenetic context, are sexual selection and the evolution of mating systems (Gerald Wilkinson and Philip Johns), ecological genetics of host use (Kenneth Filchak, Bill Etges, Nora Besansky, and James Feder), the use of molecular markers to investigate cryptic species, and the sites of origin and rates of spread of invasive species (Sonja Scheffer). Roger Kitching, Daniel Bickel, and Sarah Boulter provide feeding-guild analysis at the family level of larval and adult fly assemblages active at different levels and seasons in the rainforests of Papua New Guinea and Queensland, Australia.

The book's dust jacket bears a color photo of a deerfly resting on a marigold. Its page size, format, and heft resemble those of an *Annual Review* volume, although the print size is smaller. Though it is authoritative, well written, and typo-free, there is little linkage between some chapters, and an obvious divide between those that are historically oriented and those that are process-oriented. The 14 tables and 43 figures are clear and well produced, but some are greatly reduced and require careful study. Most of the essays, which range from brief to encyclopedic, provide suggestions for future work and detailed entry points to the primary literature. Dipterists will profit from having this diverse material in one volume but should read it in conjunction with chapter 12 in Grimaldi and Engel (2005), who provide a far more effective and beautiful overview of dipteran life history and evolution.

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HABITAT LOSS FROM THE PERSPECTIVE OF POPULATIONS

The Shrinking World: Ecological Consequences of Habitat Loss. Ilkka Hanski. International Ecology Institute, Oldendorf/Luhe, Germany, 2005. 307 pp. EUR 47.00 (ISSN 09322205 cloth).

Ilkka Hanski, professor of ecology and systematics at the University of Helsinki, has championed the importance of incorporating a spatial perspective into the study of populations for more than 25 years. Recognizing his leadership in this area—a field of study now known as metapopulation dynamics—the International Ecology Institute of Oldendorf/Luhe, Germany, awarded

Hanski its Ecology Institute Prize in 1999. Awarded annually since 1987, this prize comes with the expectation that the recipient will write a book for the institute's Excellence in Ecology (EE) book series, which consists exclusively of books by award recipients. *The Shrinking World: Ecological Consequences of Habitat Loss* represents Hanski's contribution to this series.

The stated purpose of the EE book series is to describe the current understanding of ecological patterns and processes, to show how ecological knowledge can be used effectively to benefit nature and humankind, and to bring all this to the attention of a broad audience, including fellow scientists, teachers, students, and decisionmakers. In explaining his goals for this book, Hanksi makes it clear what he tried to do and what he did not try to do. He did not want to attempt a comprehensive review of the extent and nature of habitat loss worldwide. Nor did he want to document and describe in detail past and current species extinctions. Rather, Hanski's aim was to write a book on habitat loss and its ecological consequences that would focus largely on populations rather than on species, and would describe the ecological processes by which species persist, or fail to persist, in natural landscapes consisting of multiple and connected populations. To my mind, Hanski has accomplished his goal, although given the book's focus, I would have changed one word in the subtitle so that it read "Population Consequences [instead of "Ecological Consequences"] of Habitat Loss." I suspect that individuals who pick up the text solely on the basis of its title may be expecting something different from what is presented.

Most ecologists should find *The Shrinking World* a highly readable introduction to and overview of the basics of metapopulation ecology. Since 1991, Hanski has edited three other books on the subject, most recently *Ecology, Genetics and Evolution of Metapopulations,* coedited with Oscar Gaggiotti and published in 2004, which the editors suggested could be used as a textbook. Personally, I found the current book much more amenable to class usage than the 2004 volume, at least for classes being introduced to metapopulation ecology.

The Shrinking World consists of only five chapters. The first two lay the groundwork by discussing the nature of habitats (including the important distinction between macrohabitats and microhabitats) and habitat loss, and distinguishing between the consequences of habitat loss at the macro and micro levels. Hanski describes four kinds of habitat loss: loss of quality, loss of area, loss of connectivity, and loss of continuity. Chapters 1 and 2 will probably be of more interest to readers who come to the book with only a modest ecological background. Chapters 3 and 4 are the heart of the book; this is where Hanski addresses population responses (e.g., increase, decline, extinction, and persistence) to the different types of habitat loss. The material included in these chapters ranges from descriptive overviews of particular systems to the presentation of mathematical models that Hanski and his colleagues have developed to simulate various aspects of metapopulation dynamics. The final chapter addresses a variety of issues, including the impacts of climate change on habitat loss, the possibilities and limitations of habitat restoration, the role of conservation in society, and the importance of engaging children with nature.

The most important contribution of this book is its consistent emphasis on understanding persistence and extinction as a metapopulation process. In making this case, Hanski calls for more protection of "ordinary" habitats, noting the limitations and drawbacks of focusing conservation efforts solely on individual biodiversity hotspots. In addition, Hanski provides information that may be new, and perhaps surprising, to some readers. For example, the species richness of birds in many cities throughout the world has noticeably increased during the past 50 years, because the growth of urban area is often accompanied by an increase in birds' habitat quality (more foraging and breeding sites) and a decrease in the number of predators. Another counterintuitive finding is that large-bodied animals may actually be less affected by habitat fragmentation and alteration than many small-bodied animals. The reason, Hanski explains, is that large-bodied animals are often more likely to be generalists and also more flexible in their habitat requirements—that is, better able to accommodate habitat change through alterations in their behavior—whereas many small animals are habitat specialists, frequently microhabitat specialists, and are unable to negotiate any abrupt change in their habitat. For this reason, although bird and mammal diversity may be surprisingly high in many urban settings, as urban parkland may provide adequate macrohabitat structure, the diversity of many invertebrate and fungal species may be considerably reduced in human-altered landscapes because necessary microhabitats, such as decaying wood, are absent.

I very much enjoyed this book. In some ways it is peculiar in its organization, format, and writing style, although it must be noted that some of this distinctiveness is imposed by the editors of the series. Chapters are written according to a strict basic format, each concluding with a section titled "Summary of Five Items to Remember," and each beginning with a "prelude," which is a personal narrative intended to help set the context for the material to follow. For example, the prelude to the first chapter begins, "Mosquitos kept biting us fiercely as we leaned over the fallen log of a large Norway spruce." I suppose one could say there is more quaintness than substance in these preludes, but I enjoyed reading them nevertheless.

Partly because of the distinctive prescribed format, and partly because the author was trying to meet the institute's goal that the EE books speak to a diverse audience, I found that the accessibility and depth of presentation varied. There are sections that should be easily accessible to the general reader but that

the expert may find unnecessary, interspersed among sections that will be of more interest to the expert but probably not very accessible to the general reader. Ultimately, if one is going to try to reach such a diverse audience, I think the approach Hanski took is the right one, as opposed to one that tries to present all the material at some mid level of difficulty, which both groups would perceive as unsuitable. Readers are likely to find themselves skipping over certain parts of the text because the material is either too basic or too difficult for them, and then settling down in other parts for more intense consideration of the material.

Although most readers may find some material unsuitable or unnecessary, I do recommend this book to all the members of its intended diverse audience. In particular, I think it would be an excellent book for classes and seminars exploring population ecology, because of its content and its reasonable price. In fact, I have decided to use it in my advanced undergraduate seminar in conservation biology next semester.

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NEW TITLES

Aquaculture in the 21st Century. Anita M. Kelly and Jeffrey Silverstein, eds. American Fisheries Society, Bethesda, MD, 2006. 643 pp., illus. $69.00 (ISBN 1888569719 paper).

Enhancing Participation and Governance in Water Resources Management: Conventional Approaches and Information Technology. Libor Jansky and Juha I. Uitto, eds. United Nations University Press, New York, 2006. 236 pp., illus. $32.00 (ISBN 9280811207 paper).

Environmental Leadership Equals Essential Leadership: Redefining Who Leads and How. John C. Gordon and Joyce K. Berry. Yale University Press, New Haven, CT, 2006. 192 pp., illus. $22.00 (ISBN 0300108915 cloth).

Evolution and Ecology of the Organism. Michael R. Rose and Laurence D. Mueller. Prentice Hall, Upper Saddle River, NJ, 2006. 720 pp., illus. $115.33 (ISBN 0130104043 cloth).

The Evolving World: Evolution in Everyday Life. David P. Mindell. Harvard University Press, Cambridge, MA, 2006. 352 pp., illus. $24.95 (ISBN 0674021916 cloth).

Freshwater Fishes of Mexico. Robert Rush Miller. University of Chicago Press, Chicago, 2006. 652 pp., illus. $75.00 (ISBN 0226526046 cloth).

Handbook of Avian Hybrids of the World. Eugene M. McCarthy. Oxford University Press, New York, 2006. 598 pp., illus. $89.50 (ISBN 0195183231 cloth).

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Statistics Explained: An Introductory Guide for Life Scientists. Steve McKillup. Cambridge University Press, New York, 2006. 280 pp., illus. $29.99 (ISBN 0521543169 paper).

Variation: A Central Concept in Biology. Benedikt Hallgrímsson and Brian K. Hall, eds. Elsevier, Burlington, MA, 2005. 592 pp., illus. $74.95 (ISBN 0120887770 cloth).