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Review of: Monitoring stream and watershed restoration

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Book Reviews

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Ecology and Management of Riparian Ecosystems

Naiman, Robert J., Henri Décamps, and Michael E. McClain. 2005. **Riparia: ecology, conservation, and management of streamside communities.** Elsevier, Burlington, Massachusetts. xv + 430 p. $79.95, ISBN: 0-12-663315-0 (alk. paper).

Key words: floodplain; riparian; river; stream.

The challenging task of managing riparian ecosystems is illustrated by the unfortunate fact that, despite considerable research and conservation effort, these systems are among the most threatened on the planet and their ecological integrity continues to decline. This scenario is particularly regrettable given the high levels of biodiversity that riparian areas maintain and the valuable ecosystem services they provide. *Riparia* is a synthesis of the eclectic and very large body of literature dealing with riparian ecology and management, with a focus on how humans interact with riparian ecosystems.

Perhaps more than most other ecosystems, understanding riparian systems requires the integration of diverse disciplines. *Riparia* accomplishes this integration nicely by using landscape ecology to overarch potentially separate themes. The book is logically organized. The authors, all prominent researchers of river and riparian ecosystems, devote early chapters to the physical template of riparian areas, with appropriate focus given to the ecological implications of hydrology and fluvial geomorphology. Attention is also paid to different methods of geomorphic and biotic classification. Building upon this physically oriented foundation, subsequent chapters become more biological, with the structure (species diversity, distributions) and function (energy flow, decomposition, nutrient retention) of riparian vegetation receiving considerable attention. A chapter on anthropogenic disturbance (flow regulation, habitat fragmentation, climate change) links the remaining chapters. These latter chapters address social aspects of riparian ecosystems (restoration, conservation legislation), offer some of the most original perspectives on riparian management contained in the book, and are an important distinction between *Riparia* and other riparian ecology texts. Final chapters emphasize that riparian areas influence, and are influenced by, societies. Here they also stress the idea that the way societies manage riparian ecosystems depends on how they are perceived, and vice versa. Among the most useful sections of the book for researchers is the bibliography, which contains nearly 1000 references, most of which are from articles published during the last 15 years.

The authors regularly draw from their areas of research expertise, and focus on riverine systems in Central Europe and the Pacific Northwest, somewhat at the neglect of other regions and topics. One gets the feeling, however, that an effort was made to provide a global synthesis of riparian literature and the authors' inattention to some regions and topics mirrors the lesser amount of research conducted in these areas. An exception is exotic plant invasions, a vital issue to riparian management, particularly in the new world (e.g., *Tamarix*, *Fallopia*, *Elaeagnus*, *Arundo*), but one given only cursory attention in *Riparia*. While it is not reasonable to expect a single text to include an exhaustive treatment of all aspects of riparian ecology and management, invasive plants influence riparian zones in diverse ways (geomorphology, water use, decomposition rates) that have far reaching ecological implications (species extinctions, reduced ecosystem services). Moreover, a body of research has emerged around the subject and it is unfortunate that riparian plant invasions were not given more prominence.

Riparia will be most useful as a text for graduate students, or as reference volume for researchers and resource managers. The value of *Riparia* as a textbook is occasionally limited by the use of jargon, but in most instances the writing is for a non-specialist and technical terms are used sparingly or are defined. As a reference, *Riparia* is factually accurate, and in general the most important literature is thoroughly reviewed. Professional ecologists who are familiar with some of the more fundamental principles addressed in the book may still find them worthwhile in that these ideas are usually complemented with information from specific case studies. Another feature of the book is the frequent use of ''sidebars,'' short blocks of text, usually invited contributions from prominent researchers that highlight particular case studies or specific examples that are relevant to the chapter in which they are found. The sidebars serve as brief diversions from the style and perspectives of the primary authors. The book is exceptionally illustrated with instructive, high-quality photographs and colorful figures. Many figures that were borrowed from the literature are re-designed in a consistent style that gives the book uniformity and makes it more usable.

Synthesizing the diverse literature about riparian ecosystems and presenting it in a comprehensive and attractive manner is no small task, but it is one the authors accomplish nicely.

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MONITORING STREAM AND WATERSHED RESTORATION

Roni, Philip, editor. 2005. **Monitoring stream and watershed restoration.** American Fisheries Society, Bethesda, Maryland. x + 350 p. $65.00, ISBN 1-888569-63-8 (acid-free paper).

Key words: restoration; riparian; river; salmonids; watershed.

As aquatic ecosystems are increasingly degraded by land use changes and other human activities, efforts to restore them have increased apace. This is particularly true in the Pacific Northwest where extensive and costly restoration projects have been implemented to restore habitat and improve conditions for native species, particularly salmonid fishes. This volume was designed to meet the growing need for guidance on restoration techniques, with an emphasis on approaches to monitor the success (or lack thereof) of stream and river restoration efforts. It sprang from the recognition that rigorous monitoring to evaluate the effectiveness of restoration and recovery techniques is frequently lacking, leading to missed opportunities to learn from existing projects and improve the success of future ones. A comprehensive, detailed approach to monitoring is presented to quantify physical and biological responses to restoration at multiple spatial scales, including the site (habitat), reach, and watershed levels. Specific examples of studies and techniques abound, and although the emphasis is decidedly on salmon population restoration in the Pacific Northwest, the techniques and principles presented will prove useful in restoration projects anywhere.

This well-edited volume is organized into 12 very long and detailed chapters that are astonishingly well referenced (averaging about 175 references per chapter). Topics center either on restoration approaches (e.g., minimizing road impacts, culvert replacements to increase connectivity, and grazing management), or landscape position (floodplains, temperate North American estuaries). Two introductory chapters provide background on restoration ecology generally and include a primer on how to design a restoration monitoring program, then integrate it with other monitoring programs in the watershed of interest. Topics range from basic definitions of terms used by restoration practitioners to a comparison of common study designs (e.g., before-after control-impact) and appropriate statistical analysis. An extensive and useful discussion is presented on methods to establish what sample sizes are needed to detect change in population numbers.

Several chapters feature restoration or enhancement techniques and the indicators or metrics that can be used to quantify subsequent ecosystem responses. In a chapter on monitoring the effects of road treatments, scant detail is provided on the actual restoration measures; the focus instead is on designing a follow-up monitoring scheme, either to gauge the effectiveness of the project (for example, is sediment yield altered as predicted due to road improvements?) or for validation monitoring (has the physical habitat such as channel form responded as predicted, and have the biota responded to the changing physical template as anticipated?).

Many riparian areas, particularly in the western U.S., have been heavily impacted by cattle grazing, making grazing management a key tool in the efforts to restore river corridors. The emphasis of a chapter devoted to this topic is expressly on the effects of grazing on fishes, and how restoration programs undertaken on the watershed scale might improve population numbers. Several case studies are included, and the authors present several that were inherently flawed in order to illustrate common pitfalls in study design. They provide a clear and cogent analysis of common designs that confound the interpretation of data by not taking into account such key variables as the placement of control and treatment reaches, inadequate replication, or by the complex interactions of instream variables (such as fish, sediment loads), and the effects of upstream activities (e.g., fish stocking).

Several chapters that deal with restoration of riparian forests and floodplains more broadly are at the heart of the book. Intact riparian forests are essential to watershed processes such as water temperature regulation and stream health (through, for example, the inputs of organic matter). Evaluating riparian restoration necessitates an understanding of successional processes and the impacts, whether positive or negative, of common silvicultural techniques. Monitoring programs are defined in terms of the project goals, objectives, and hypotheses, and the authors provide an impressive overview of hypotheses and the potential monitoring parameters needed to evaluate them, as well as the use of recent forestry models to predict changes in habitat complexity, for example due to the accumulation of large woody debris. Surprisingly, for all the discussion of setting project goals and monitoring progress, there is little talk of using least-impacted reference sites as a means to set appropriate end targets, a common approach used in the development of biological indicators.

The chapter on floodplain restoration illustrates the disproportionately high levels of regional biodiversity these areas contain, and centers on the effectiveness of projects designed to reconnect isolated habitats within the floodplain corridor. This chapter provides an excellent overview of floodplain ecology as the basis upon which restoration should be attempted. It is notable that the hydrological processes that drive floodplain dynamics are emphasized as both restoration technique and monitoring variables. Techniques to quantify the cumulative effects of floodplain restoration efforts at the watershed level are given their due as well, although the science of working at this scale is relatively undeveloped.

Throughout the text, there are tables outlining metrics that can be used to monitor different classes of restoration activities. These alone are valuable syntheses of what is known to work in practice, and offer a useful starting point for those undertaking such a project. A lengthy chapter on monitoring restoration in estuaries includes detailed examples of some physical, chemical, and biological indicators of restoration success, the ecological factors that control them, and their structural and functional attributes, demonstrating how man-

agement decisions can be made on their use as metrics for evaluation of restoration success. The authors of this chapter make a strong case to switch our emphasis from short-term evaluation of habitat to longer-term studies of what they call the ''fundamental ecosystem processes that maintain post-restoration conditions.''

A chapter on the practice of deliberate nutrient additions to enhance ecosystem productivity is perhaps the most counterintuitive topic in the book given our general awareness of the problems of water quality degradation from, for example, nutrients in agricultural runoff. The authors document fascinating recent work showing that many western watersheds suffer nutrient deprivation due to the ''carcass famine,'' a result of declining anadromous fish populations, which leads to a concomitant decline in stream community productivity. Many techniques are being tested to counter the loss of this seasonal nutrient influx, illustrating an increasing sophistication in our understanding of nutrient and trophic dynamics, and the ecosystem consequences of fish population declines.

Concluding chapters cover the role of land acquisition and conservation easements in watershed protection, and economic approaches based on cost-benefit analysis. Both are welcome additions that expand the scope of the book into the social and political realm. The chapter on monitoring acquisitions and conservation easements takes a holistic view of watershed restoration by recognizing the importance of acquired lands for (1) providing buffers from human activities, and (2) placing sensitive habitats, such as nursery and spawning grounds, under protection. Several informative case studies are provided with strategies for identifying sites with high biological value, and the potential goals and hypotheses that could make up a monitoring plan.

Given the book's title, I was expecting more focus on strategic planning to maximize restoration effectiveness at the washed scale. Insights on topics such as identifying sites that are suitable for restoration and prioritizing available sites to maximize downstream benefits or provide the most benefit given the available resources are lacking.

Overall, this volume is a collection of technically strong chapters with a unified voice, detailing work to improve the effectiveness of restoration of freshwater systems. At over 300 pages it is chock full of information, although the large size of the pages (28 × 21.5 cm) with a single text block across the whole page, makes it unwieldy to handle. At a time when resources for environmental protection are increasingly scarce, maximizing effectiveness of restoration efforts is more important than ever. This book has a place in showing us the way.

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THE LITTLE THINGS THAT RUN THE WORLD

Samways, Michael J. 2005. **Insect diversity conservation.** Cambridge University Press, New York. xi + 342 p. $110.00 (cloth), ISBN: 0-521-78338-0 (alk. paper); $55.00 (paper), ISBN: 0-521-78947-8 (alk. paper).

Key words: community; fragmentation; insects; restoration.

Insects are the Rodney Dangerfields of conservation. They get no respect. While a bone or two is tossed at conserving pollinators and there are some examples of butterfly conservation—the charismatic micro-megafauna of the entomological world—very little conservation planning pays attention to insects. It is ironic that butterflies are the only taxa of insects that appear in the index of two common texts on conservation planning (Bennett, Andrew F. 2003. Linkages in the landscape: the role of corridors and connectivity in wildlife conservation. IUCN, Cambridge, Massachusetts; Groves, Craig R. 2003. Drafting a conservation blueprint: a practitioner's guide to planning for biodiversity. Island Press. Washington, D.C.) when insects are one of the most speciose classes of animals. Michael J. Samways book, *Insect diversity conservation,* should improve the status of insects. This book is an elegant summary of why insects need to be conserved, what the key threats to insects are and what steps are available for conserving insects.

Samways' book is a deft synopsis of terrestrial insect conservation. There are 12 chapters covering topics as diverse as the patterns of diversity to methods for restoration. In many ways, one could consider this a conservation biology text using insects for every example.

The book is pitched at the same level as an introductory conservation biology text. Because of this choice of level, much of the conceptual material will be familiar to most ecologists. What is new is the burst of research in insect conservation biology since the publication of Samways' last book on insect conservation in 1994. Since Samways' first book on insect conservation, the *Journal of Insect Conservation* has been established.

The chapters are broken into three major themes: (1) the need for insect diversity conservation; (2) insects and the changing world; and (3) conserving and managing insect diversity. The chapters are brief, succinct, and fairly comprehensive. The first section answers the question why preserve insects. Samways makes the interesting choice to open the book with a chapter on the ethical foundation for insect conservation. The chapter reviews the philosophical and religious

arguments for preserving insects. It is not every author that is willing to review how the conservation ethic of each of the world's major religions applies to insects. The subsequent chapters review the ways insects are diverse and the various roles that insects play in ecosystems. Conservation efforts historically have been focused on preserving patterns of diversity. More recently, conservation has moved towards the preservation of ecological and evolutionary processes and species interactions. By highlighting the amount of genetic, ecological, and morphological diversity found in insects and the variety of roles insects play in ecosystems, Samways makes a compelling, though not novel, argument for insect conservation.

The second section focuses on the key threats changing insect populations and communities. This is a diverse section discussing everything from invasive species to pesticides to global climate change. Samways draws the surprising conclusion that there is a lack of evidence for an effect of insecticides on overall insect diversity. Because there are few references cited in this section, I searched the AGRICOLA database to see if this conclusion is justified. There are fewer studies than expected documenting a decline of diversity in terrestrial insects, but they do exist. However, there are many papers on the effects of pesticides on aquatic insects. Overall, the coverage of the literature on aquatic insects is light. This brings up a strength and weakness of the book. Samways has limited, in many cases, the references cited to key papers. While this makes the text very readable, the chapters cannot serve as comprehensive starting points for delving into the literature on a particular topic.

This second section also illuminates some of the gaps in our knowledge. There are surprisingly few studies included from tropical regions. Once again, it is easy to point out that given the vast diversity of tropical species and the rapid rates of human-induced change in those regions, it is critical that we understand and manage the effects of these changes. There are also remarkably few references from North American systems; the majority of references are European or African. This pattern may reflect the state of the research and literature on insect conservation. While there are several non-profit groups involved in insect conservation in North America (e.g., Xerces Society, North American Pollinator Protection Campaign), there is no comprehensive effort focused on insect conservation. In contrast, the European Union has funded a large project focused on assessing and forecasting changes in the biodiversity and the structure function and dynamics of ecosystems across 26 countries that includes an explicit focus on pollinators (Project ALARM).

The final section outlines the methods for conserving, managing, and restoring insects. These chapters cover the usual list of conservation measures and issues such as umbrella and flagship species, monitoring, reserve design, corridors, and urbanization. It is clear from these chapters that the issues for insects are not very different than the issues for species more commonly used in conservation. For example, preservation of high quality, connected, diverse landscapes will help maintain insect diversity. What is not clear is whether traditional conservation measures are sufficient to conserve insect diversity.

By gathering all this information into a single volume, Samways provides the necessary background for planning the future of insect conservation. Given the plant and vertebrate biases of most conservation plans, we would recommend this text to land managers and conservation practitioners. It would also serve as a wonderful text for a course on insect conservation. The book is well written, easy to read, and efficient. Hopefully, it will garner insects a new level of respect.

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