BOOK REVIEW

Great Basin Riparian Ecosystems: Ecology, Management, and Restoration

Jeanne C. Chambers and Jerry R. Miller, editors. 2004. Island Press, Washington, D.C., 303 pages, $35.00, ISBN 1–55963–865–5 (paperback).

Applied ecosystem scientists tend to share several articles of faith: (1) that a clearer understanding of spatial and temporal patterns will better inform management decisions; (2) that patterns and relationships need to be examined at multiple scales; and (3) that effective study of ecosystems is fundamentally interdisciplinary. Occasionally a project such as the one described in this book affirms those principles. Chambers and Miller's edited compilation of chapters by a total of 18 investigators summarizes a decade of work by the U.S. Forest Service's Great Basin Ecosystem Management Project on Restoring and Maintaining Sustainable Riparian Ecosystems. The book is published as part of the Society for Ecological Restoration's series on The Science and Practice of Ecological Restoration.

At the most general level, this book provides a good model of interdisciplinary ecosystem science by describing the research of federal agency scientists and university researchers. The book demonstrates research collaborations between a diverse set of disciplines including plant and animal ecology, fluvial geomorphology, soil science, paleoecology, geology, and hydrology and strikes a good balance between individually credible studies and the synergistic combination of disciplines.

Ecosystem restoration, and riverine restoration in particular, is currently grappling with the articulation of general principles and the use of case studies to identify effective procedures and "lessons learned." This regional analysis of trajectories of ecosystem change, controlling variables, and impact sensitivities offers a real alternative for how ecosystem science might inform restoration actions.

Great Basin Riparian Ecosystems focuses on perennial, high-gradient, upland streams in narrow valleys of the Shoshone, Toiyabe, Toquima, and Monitor Mountain Ranges in central Nevada. There are strong elevational gradients in vegetation and precipitation, with riparian zones consistently representing the wet places in a dry landscape. These watersheds are of particular interest to the U.S. Forest Service. However, the book does not encompass lowland and ephemeral streams of the Great Basin and the associated impacts of flow depletion.

The topics in the well cross-referenced chapters include paleoecological reconstruction of Holocene climate and vegetation changes (Tausch, Nowak, and Mensing); reconstruction of late Holocene fluvial dynamics (Miller, House, Germanoski, Taush, and Chambers); basin sensitivity to channel incision (Germanoski and Miller); surface water–groundwater interactions at riparian meadow sites (Jewett, Lord, Miller, and Chambers); relations of vegetation pattern to hydrology (Chambers, Tausch, Korfmacher, Germanoski, Miller, and Jewett); water quality characteristics (Amacher, Kotuby-Amacher, and Grossl); patterns of native species richness (Flieshman, Dunham, Murphy, and Brussard); and a synthesis discussion emphasizing implications for management and restoration (Chambers, Miller, Germanoski, and Weixelman). Much of the book concentrates on vegetation as it is influenced by hydrology and the physical variables that determine hydrologic gradients. The chapter on water quality concludes that catchment lithology is the dominant influence on chemical composition, with overall high water quality in mountain streams, and little indication of water quality pattern in these streams due to human activities. Animal distributions, habitat usage, and population dynamics are not strongly considered. The chapter on species richness does provide a thoughtful discussion of alternative general approaches (historical changes, predictive models, surrogate species, and island biogeography) illustrated with data on butterfly distributions. Little attention is given to the currently challenging issues in western riparian management concerning protection and restoration for wide-ranging species, such as neotropical migratory birds and sage grouse, which depend on riparian areas as part of their usage of large landscapes.

The most compelling theme of the book is the hydrologic determination of vegetation pattern and dynamics as it is traced back through interactions of surface and subsurface hydrology in a fluvial geomorphic surface responding to local and immediate perturbations, but conditioned by geologic history and long-term climatic variation. For example, riparian wet meadows are the focal point of human impact and restoration actions in these riverine systems. The mesic vegetation of these meadows is linked to high groundwater levels, which often occur upstream of side-valley alluvial fans. Channel incision through these meadow systems produces lowered groundwater levels and shifts in the vegetation toward more xeric species. The incision process itself involves positive

feedback through mechanisms of groundwater sapping and vegetation shifts toward species providing less bank stability. Proximate causes of incision include both natural (fire, floods) and anthropogenic (overgrazing, roads, run-off enhancing clearing) disturbances. These relations are well documented by chapters analyzing current patterns of vegetation, hydrology, and channel change in study reaches.

Great Basin Riparian Ecosystems excels in effectively placing the changes that a current manager might see on a particular reach in longer and broader contexts of geologic variation and climate change. Holocene paleoclimatic and stratiographic reconstructions indicate that many of these streams are currently in nonequilibrium states and prone to incision following the erosion of hillslope sediments and aggradation of side-valley alluvial fans associated with a period of drought, which occurred roughly 1,900–2,500 years ago. Germanski and Miller's chapter identifies four classes of basin sensitivity to channel incision associated with geologic history: (1) flood-dominated, fundamentally unstable channels susceptible to significant channel change with almost all major runoff events; (2) deeply incised channels that responded first and most significantly to the current episode of instability; (3) fan-dominated channels that are currently only moderately incised but are actively downcutting; and (4) pseudo-stable channels that have experienced minimal incisions, but have the potential to incise rapidly and catastrophically. The summary chapter provides a rich foundation for management and restoration decisions in terms of spatial variation in sensitivity to disturbances triggering channel incision and an understanding of vegetation dynamics partially expressed in state transition models.

Great Basin Riparian Ecosystems is an interdisciplinary synthesis of the dynamics of a class of riparian systems. It is not a management prescription, or even a detailed handbook of management actions. In fact, it is possible for those agreeing with the analyses presented in the book to have sharp disagreement about what management actions should be taken. However, the science has done what it can to inform those decisions if the disagreements are primarily centered on value-laden differences about appropriate restoration goals. I recommend this book to anyone concerned with the ecology of western riparian systems and to a broader restoration audience as a model of what you should know about the systems you are trying to fix.

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