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Book review

Integrating landscape ecology into natural resource management

J. Liu and W.W. Taylor (eds.), *Integrating landscape ecology into natural resource management*. Cambridge University Press, Cambridge, UK. 2002, 480 pp. illus., maps; 25 cm. Hardcover, ISBN 0521780152, US$150.00. Paperback, ISBN 0-52178433-6, US$55.00.

One of the most well-attended conferences of the US Regional Association of the International Association for Landscape Ecology was the meeting with the theme, 'Applications of Landscape Ecology in Natural Resource Management,' from which this book emerged. The objectives of this synthetic and practical book are to introduce the basic concepts, principles and methods of landscape ecology, to offer useful information and 'rules of thumb' to help guide natural resource managers, and to provide suggestions for how landscape ecologists may conduct research relevant to management.

The primary theme throughout the book is to identify gaps and highlight linkages between landscape ecology and resource management. Both the structure and content of the book reflect this theme. Structurally, each of the four main sections of the book link fundamental components of landscape ecology to emerging practices in natural resource management. This was a successful and innovative organizational tool, which effectively emphasized the thematic and practical linkages between landscape ecology and resource management.

The first section links landscape structure to multiscale management. Because landscapes are heterogeneous and often hierarchically structured, effective management must address not only the patch, population, or reach, but also the mosaic, metapopulation, and watershed. Each of the chapters in this section addresses the complexities of managing across multiple scales and offers guidelines for dealing with these challenges in diverse systems.

The second section links landscape function to cross-boundary management. Management of large landscapes must address the flows of energy, matter, and organisms across natural, ownership, political, and management boundaries. As a consequence, this section addresses management issues across ownerships, among edges and patches, and between aquatic and terrestrial landscapes. Examples and guidelines for effective cross-boundary management were clearly and creatively articulated. However, I was surprised that the opportunity to explore landscape function – the pattern of ecosystem processes across heterogeneous landscapes – was overlooked in this section. Admittedly, this emerging frontier in landscape ecology was in its incipient stages when the book was initially conceived in the late 1990s; however, this absence reflects an omission of ecosystem studies throughout the book.

The third section links landscape change to adaptive management. Landscape ecology emphasizes not only broad spatial scales but also the importance of understanding long-term temporal dynamics. Landscape ecology has a long tradition of examining the spatial consequences of disturbance and other ecological processes over time through monitoring and modeling, therefore this link to adaptive management is key. Adaptive management treats management decisions as working hypotheses, which are modified through time as knowledge and experience accumulates. This section reveals how tools and methods for tracking and predicting landscape change can effectively inform adaptive management of large, dynamic landscapes.

The fourth section attempts to link landscape integrity to integrated management. Unlike the previous three sections which address separate aspects of landscape ecology (landscape structure, function, and change), this section (and the introduction) introduce a new concept of landscape integrity as an integrated measure of landscape health, which builds upon the three separate aspects of landscape ecology. Landscape integrity is a bold, new, comprehensive idea, where concepts like ecological or ecosystem integrity would be expressed at the landscape level. The authors recognize that this concept is 'relatively un-

explored' but do not plumb the depths of this idea or offer further exploration. One of the strengths of the book is its emphasis on the need to incorporate ecological and social components of landscape change into resource management decisions, which is stressed in each of the sections and echoed eloquently in the last chapter by the late Eugene Odum. Surprisingly, however, introduction of the concept of landscape integrity does not emphasize this interdisciplinary perspective, which is a hallmark of landscape ecology. Citing possible indicators of landscape integrity, productivity or native diversity, I was yearning for broader conceptions of this term (not just ecological measures writ large). The idea of landscape ecologists tracking the integrity or health of landscapes comprehensively, by including assessments of social and ecological sustainability, represents an exciting new frontier on which the discipline is poised to embark and undoubtedly effective management of complex landscapes demands. So I applaud the authors for introducing this intriguing potential new frontier in landscape ecology, although, I think the concept experienced a somewhat halting debut. In defense, however, Chapter 15 by Taylor et al. and Chapter 17 by Hobbs et al., present excellent case studies which outline approaches to managing the integrity of landscapes by considering spatial heterogeneity and change within regional socioeconomic contexts. These chapters exemplify how we may begin to develop integrated management plans that consider the integrity of coupled natural-human landscapes, and highlight the challenges of this broad task.

Throughout the book, study systems are diverse and generally reflect the broad application of landscape ecology. This is very refreshing. Numerous chapters investigate the application of landscape principles to aquatic and riparian systems. For example, Chapter 5 applies the concept of patch dynamics to lotic systems, which may be novel for *land*scape ecologists, and highlights the logical extension of landscape ecology to riverine management. Human-dominated and multi-ownership landscapes are also considered. There are also a number of methods discussed, which optimize sampling effort across scales, investigate approaches to field sampling of large heterogeneous landscapes, and describe remote sensing applications. The use of models in testing hypotheses of landscape change and carrying out broad-scale 'experiments' to evaluate management scenarios is also discussed.

Each chapter offers important 'rules of thumb', and practical guidelines or questions for managers to consider in conducting multi-scaled, cross-boundary, adaptive, integrated management. Many of these guidelines are general, although managers may wish for more specific rules. As the authors point out, this is not possible given the specificity of different management systems and objectives. Nonetheless, the guidelines explicitly offered in each chapter draw from specific case studies, which provide valuable advice pertinent to the organizational theme of the each section.

Although numerous guidelines are offered to resource managers, the book provides few guidelines for landscape ecologists to better link research to management questions. This lack of reciprocity is evident throughout the book. Although the authors represent an even mix of academics and practitioners, and the objective of the book is to link landscape ecology and natural resource management, the overall emphasis is providing guidelines to managers rather than to landscape ecologists in filling the gaps between these two fields. This is understandable; given that the application of landscape ecology appears to have lagged behind the development of the science. Nonetheless, Chapter 13 by Dunning describes how managers and researchers can collaborate in highly managed regions to plan large-scale experimental field studies that may further the development of landscape ecology and its application to adaptive management.

Natural resource management has shifted to consider multiple spatial scales, adaptive approaches to dynamic systems, and integration of multiple objectives. Although landscape ecology addresses broad spatial scales, emphasizes the role of disturbance dynamics, and provides modeling tools to facilitate complex management decisions, the application of landscape ecology to management of natural resources has lagged. This book provides useful guidelines and practical, diverse case studies within a well-organized framework that hopefully will minimize the gaps between the science and management of large, heterogeneous landscapes. In addition, perhaps this book may spur the field of landscape ecology to consider novel, comprehensive approaches to help better monitor and maintain the integrity of complex social-environmental landscapes.

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