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0521780152 - Integrating Landscape Ecology into Natural Resource Management - Edited by Jianguo Liu and William W. Taylor

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Integrating Landscape Ecology into Natural Resource Management

The rapidly increasing global population has dramatically increased the demands for natural resources and has caused significant changes in quantity and quality of natural resources. To achieve sustainable resource management, it is essential to obtain insightful guidance from emerging disciplines such as landscape ecology. This text addresses the links between landscape ecology and natural resource management. These links are discussed in the context of various landscape types, a diverse set of resources, and a wide range of management issues. A large number of landscape ecology concepts, principles, and methods are introduced. Critical reviews of past management practices and a large number of case studies are presented. This text provides many guidelines for managing natural resources from a landscape perspective and offers useful suggestions for landscape ecologists to carry out research relevant to natural resource management. In addition, it will be an ideal supplementary text for graduate and undergraduate ecology courses.

JIANGUO LIU is an Associate Professor at Michigan State University where he teaches and researches in the areas of landscape ecology and biodiversity conservation. He has published extensively in scientific journals such as *Science* and has edited two other ecology books. In recognition of his contributions to research, outreach, and teaching, he has been given a number of awards including a CAREER award from the National Science Foundation, a Lilly Teaching Fellowship, and an Aldo Leopold Leadership Fellowship from the Ecological Society of America.

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Cambridge Studies in Landscape Ecology

Cambridge Studies in Landscape Ecology presents synthetic and comprehensive examinations of topics that reflect the breadth of the discipline of landscape ecology. Landscape ecology deals with the development and changes in the spatial structure of landscapes and their ecological consequences. Because humans are so tightly tied to landscapes, the science explicitly includes human actions as both causes and consequences of landscape patterns. The focus is on spatial relationships at a variety of scales, in both natural and highly modified landscapes, on the factors that create landscape patterns, and on the influences of landscape structure on the functioning of ecological systems and their management. Some books in the series develop theoretical or methodological approaches to studying landscapes, while others deal more directly with the effects of landscape spatial patterns on population dynamics, community structure, or ecosystem processes. Still others examine the interplay between landscapes and human societies and cultures.

The series is aimed at advanced undergraduates, graduate students, researchers and teachers, resource and land-use managers, and practitioners in other biophysical and social sciences that deal with landscapes.

The series is published in collaboration with the International Association for Landscape Ecology (IALE), which has Chapters in over 50 countries. IALE aims to develop landscape ecology as the scientific basis for the analysis, planning, and management of landscapes throughout the world. The organization advances international cooperation and interdisciplinary synthesis through scientific, scholarly, educational, and communication activities. Information on IALE is available at <http://www.crle.uoguelph.ca/iale/>

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Foreword

As the scale of environmental problems expands, ecology, the basic science of the environment, must then meet the challenge and expand the scale of research and management recommendations. Fortunately, during the past 50 years or so, ecology has emerged from its roots in biology to become a stand-alone discipline that integrates organisms, the abiotic environment, and human affairs. Thus, we see the emphasis moving from the species level to the ecosystem level on up to the landscape level that deals with complex systems such as large watersheds. Size does matter; big is different from little, because new properties emerge with an increase in scale.

An increase in problems with pests is a good example of the need to consider the bigger picture, rather than just continue trying to deal with pest species one at a time. A large agricultural landscape with conservation tillage, a diversity of crops, and lots of natural vegetation buffer strips separating crop fields has much less trouble with insect pests than a continuous monocultural landscape.

Most important of all, preservation of the life-support environment can only be accomplished on a large scale. For instance, protection of water quality and stream corridors cannot be achieved through local zoning but requires political and management action at the state, regional, national, and ultimately, the global levels.

Landscape ecology is a rapidly growing interdisciplinary field. Its concepts, theories, and methods are uniquely relevant in addressing large-scale issues in natural resource management (e.g., biodiversity conservation, land-use planning). The contributors of this book effectively show how natural resource management can benefit from landscape ecology, and how landscape ecology can be advanced by tackling challenging problems in natural resource management. The diversity of articles and topics in this book is impressive, as is the common theme of cross-disciplinary approaches. This book also provides valuable information that can be used for expanding the scope of environmental

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education beginning in grade school, increasing the general public's understanding of the need for better land-use planning, and thereby sending a clear message to policy-makers. Thus, this book lays a nice foundation for truly integrating theory and practice at the landscape level and beyond.

Eugene P. Odum

Preface

Traditionally, natural resources have been often managed using information collected from small scales, resulting in variable and limited success. To improve these results, many scientists and natural resource managers have recognized the need to adopt a large-scale approach to natural resource management, using the concepts, principles, and methods of landscape ecology. At the same time, many landscape ecologists have also realized that further development of landscape ecology will benefit from better connections with resource management issues. However, as is often the case between academic and non-academic worlds, landscape ecologists and natural resource managers historically have not communicated well. Landscape ecologists often do research without regard to the needs for natural resource management, and managers often do not know how to apply landscape ecology to managing natural resources.

To facilitate the communication between landscape ecologists and natural resource managers, we hosted the 13th annual conference of the US Regional Association of the International Association for Landscape Ecology (US-IALE) on the campus of Michigan State University in 1998. The conference's theme was "Applications of landscape ecology in natural resource management." Clearly, this theme of linking landscape ecology with natural resource management reflected the desire of many others, as more than 500 landscape ecologists and natural resource managers from around the world participated in the conference (the largest number ever to attend a US-IALE annual meeting). The conference was a huge success, but we were urged by many attendees to produce a book expanding upon the ideas presented at the conference, reaching a larger audience, and promoting further communication and collaboration between the landscape ecology and natural resource management communities.

Such impetus and urging from the conference attendees motivated us to edit this book that addresses the gaps and linkages between landscape ecology and natural resource management.

The specific objectives of this book are to: (1) introduce fundamental concepts, principles, and methods of landscape ecology; (2) provide practical information for natural resource managers to use; and (3) offer suggestions for landscape ecologists to carry out research relevant to natural resource management. To accomplish these objectives, this book offers a critical review of past management practices, synthesizes existing information, introduces innovative ideas, presents a large number of case studies, and provides many insightful guidelines and “rules of thumb” for managing natural resources from a landscape perspective. Furthermore, we have designed this book to closely link each major component of landscape ecology to a natural resource management paradigm (i.e., “Landscape structure and multi-scale management,” “Landscape function and cross-boundary management,” “Landscape change and adaptive management,” and “Landscape integrity and integrated management”). To highlight these links, we have chosen a wide range of landscape types (e.g., forested, agricultural, urban, grassland, and aquatic), a diverse set of resources (e.g., land, forests, wildlife, fish, plants, insects, and water), and various management issues (e.g., biodiversity conservation, land use, timber harvesting, fishing, and wildlife management).

This book has been written for a very diverse audience, including landscape ecologists, natural resource managers, conservation biologists, social scientists, non-government organizations, policy-makers, graduate students, and advanced undergraduate students. It will also be helpful as a supplemental text for many graduate and undergraduate courses, such as Landscape Ecology, Natural Resource Management, and Conservation Biology.

We were fortunate that more than 100 landscape ecologists and natural resource managers had enthusiastically participated in this book endeavor, either as contributors (59) or as reviewers (53). To ensure the highest quality possible and the appropriate coverage of perspectives from both landscape ecologists and natural resource managers, two to four experts from both academic institutions and management agencies reviewed each chapter. Thus, it is fair to say that the completion of this book is an excellent example of close collaboration between landscape ecologists and natural resource managers. We hope that this teamwork will continue, and that this book will help to cement the bond between landscape ecology and natural resource management. Ultimately, by doing so, we can better manage the world’s natural resources in a sustainable manner.

Jianguo Liu
William W. Taylor

Acknowledgments

First, we would like to express our sincere appreciation to the 59 contributors of this book. This was an unprecedented endeavor for us. Usually, academics write books for their peers. Writing this book was much more challenging because the audience includes both academic and non-academic readers. It took exceptional efforts to meet the needs from both groups. The contributors' cooperation and enthusiasm are greatly appreciated.

The manuscripts for this book were reviewed by 53 experts from academic institutions, natural resource management agencies, and private organizations. The reviewers' insightful comments and constructive suggestions have made this book better, clearer, and more readable. We gratefully acknowledge the precious time and tremendous help of the following reviewers: Jack Ahern (University of Massachusetts), James T. Anderson (West Virginia University), Mack Barrington (Oregon Department of Agriculture), David P. Bernard (ESSA Technologies Ltd., Canada), Dean Beyer (Michigan Department of Natural Resources), Rene Borgella Jr. (Cornell University), Dennis Boychuk (Integra Research, Inc., Canada), Han Chen (Ontario Ministry of Natural Resources, Canada), Christopher P. Dunn (The Morton Arboretum), Michael Francis (Colorado River Indian Tribes), Grant Gerrish (University of Hawaii–Hilo), Frank Golley (University of Georgia), Deborah Green (College of William & Mary), Timothy G. Gregoire (Yale University), Jerry Griffith (University of Kansas), Michael Jones (Michigan State University), Christina Hargis (USDA Forest Service), William Hargrove (Oak Ridge National Laboratory), Jim Harrison (US Environmental Protection Agency), Gilberto Hernández Cárdenas (Universidad Metropolitana – Iztapalapa, Mexico), Barry L. Johnson (US Geological Survey), Eric Jorgensen (US Environmental Protection Agency), Richard T. Kingsford (National Park

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We are pleased that this book is the first in the *Cambridge Studies in Landscape Ecology* series of the International Association for Landscape Ecology (IALE). Thanks to John Wiens (former President of IALE) for initiating this series and for encouraging us to be part of this exciting initiative. It has been our great pleasure to work with the outstanding staff at Cambridge University Press, especially Shana Coates, Alan Crowden, Anna Hodson, Carol Miller, Maria Murphy, and Claire Nugent.

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