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RESTORATION ECOLOGY

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PREFACE

The new field of restoration ecology is quickly gaining momentum. At the time of my first professional restoration ecology meeting in 1985, a few mine reclamation journals were in print, but not a single scientific journal existed to unify the multidisciplinary facets of restoration ecology. The Society of Ecological Restoration International was founded in 1988 to promote a sustainable and healthy relationship between nature and culture. Now, the organization has grown to over 2,300 members operating in 37 countries. It hosts several conferences every year to exchange information and ideas among members, and publishes two journals of peer-reviewed scientific articles. Over the past 25 years, the field of restoration ecology has expanded to address problems in a greater variety of degraded ecosystems worldwide as well as to incorporate new strategies that reflect our growing understanding of complex ecology—and the need could not be greater.

Today, the Earth's biodiversity is at risk, as delicate ecosystems struggle to overcome global warming, rain forest destruction, acid rain, overfishing, eutrophication, erosion, and a whole host of other interconnected—and largely anthropogenic—environmental problems. Fortunately, as the severity of these problems has escalated globally, so has the prominence of restoration ecology, which offers practical and economical solutions. Ambitious projects are underway worldwide; large-scale examples within the United States include the Longleaf Pine Initiative, which is working to restore native forests across nine southern states, and the Comprehensive Everglades Restoration Plan, which provides a long-term framework for protecting the depleted freshwater resources and damaged ecosystem of southern Florida. In 2010, of course, the *Deepwater Horizon* oil leak in the Gulf of Mexico turned public attention to the major ecological risks of offshore drilling; the cleanup effort for the disaster requires a thorough understanding of marine, wetland, and coastal restoration ecology.

Many challenges lie ahead for scientists in our field. Effective resource management is key to the long-term success of restoration projects, but this relies on cooperation from legislators, property owners, and businesses, whose interests do not always coincide with the ecological good. New tools that can assign an accurate economic value to healthy ecosystems will be essential. Further complicating the situation, among scientists, opinions differ as to the most effective strategies. Although the theory of community succession has played an important role in restoration ecology, other approaches that emphasize niche assembly or put more emphasis on neutral and/or random processes need to be tested vigorously under various ecological conditions in different biomes. Strategies that facilitate restoration of high biodiversity need to be designed and tested as well. All of this requires careful planning, access to economic, political, and natural resources, and—above all—time.

Teaching a course on such a young and fluid subject is not an easy task. Restoration ecology is multidisciplinary, using techniques derived from molecular biology, geography, oceanography, soil sciences, environmental chemistry, botany, resource management, and—of course—ecology. The first time I taught a course on restoration ecology, it was impossible to find a textbook that covered appropriate topics for the discipline. As a result of that challenge, I started gathering information and writing the textbook that is in your hands.

Restoration Ecology is written to engage the upper-level undergraduate or graduate student in this increasingly relevant topic. A vast majority of the material in the book was tested in the classroom with great success, and the textbook covers both the theoretical background and restoration approaches of various ecosystems. Divided into five logical parts, the text opens with a look at ecological perspectives of restoration (Chapter 1), including nutrient cycling and factors that regulate ecosystem function (Chapters 2 and 3). Chapters 4 and 5 discuss the ecological theories that have shaped restoration ecology. Chapters 6 through 13 are devoted to restoration in practice, providing accounts of restoration efforts in actual ecosystems. The text includes vivid examples of recent restoration projects, many of which are still ongoing and hopefully will stimulate students to consider restoration ecology as a professional career. Chapter 14 delves into the planning, implementation, monitoring, and appraisal of restoration work.

Special Features

End-of-Chapter Tools

This text is intended to be more than just a reader or a reference book, and accordingly it incorporates several pedagogical elements that will help students understand and retain the material. **Key Terms** highlight the most important ideas and information introduced in each chapter, and a comprehensive list of terms is found at the end of the reading. **Key Questions** are designed to help

students review and assess their comprehension of the material. For students with the motivation and capacity for independent research, a **Further Reading** section provides relevant texts and articles for deeper exploration of the topics covered in the text.

Case Study Boxes

The text provides a global perspective on restoration ecology with examples of restoration problems worldwide. These examples are highlighted in **Case Study** boxes, written by experts in the field, which can be found throughout the text. The Case Study boxes, in chapter order, are:

- Carbon Sequestration of Soil
- Importance of Fire and Grazing in Grassland Biomes
- Ecological Genetics and Restoring the Tallgrass Prairie
- Restoration of Primary Sites
- Resilience and Ecosystem Restoration
- Phylogenetic Structure of Floridian Plant Communities Provides Guidelines for Restoration
- A Metapopulation Approach to Restoration of Pitcher's Thistle in Southern Lake Michigan Dunes
- Kudzu—The Notorious Invader of the Southern United States
- Pale Swallow-Wort: An Emerging Threat to Natural and Seminatural Habitats in the Lower Great Lakes Basin of North America
- Importance of Soil Microbial Communities
- Role of Arbuscular Mycorrhizal Fungi in Restoration of Mine Tailings
- Coastal Erosion at Dauphin Island, Alabama
- Ecological Effects of Sandy Beach Restoration in Northeast Norfolk, United Kingdom
- Restoration of Gold Mines in Ghana, West Africa
- Phytoremediation as a Reclamation Strategy of Lead-Contaminated Soil
- Bioremediation of a Pesticide: Hydroxylation of Bensulide
- Recovery of Forested Ecosystems After Management in Nova Scotia, Canada
- Hybridization Between Introduced Walleye and Native Sauger in Montana: Implications for Restoration of Montana Sauger
- Restoration of Coastal Salt Marshes in Brazil Using Native Salt Marsh Plants
- Biomanipulation as a Tool for Shallow Lake Restoration in the Norfolk Broads, United Kingdom
- Restoration of the Kissimmee River, Florida
- Integrated Restoration Efforts of Severely Degraded Subarctic Heathland Ecosystem
- Decision Making in Ecological Restoration

Ancillaries

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I welcome any comments and suggestions on the book, and I hope it will be used in classrooms worldwide to promote the field of restoration ecology.

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