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978-0-521-78367-5 - Wetland Ecology: Principles and Conservation

Paul A. Keddy

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Wetland Ecology
Principles and Conservation

Wetlands are among the most productive and biologically diverse ecosystems on Earth. Their very diversity has confounded ecologists and produced a fragmented area of study where each wetland type has tended to be considered in isolation. The discipline has been further compartmentalized by narrow focus on specific organisms and geographic regions. This book, in contrast, provides a synthesis of the existing field of wetland ecology, using a few central themes. These themes include basic characteristics of wetlands, key environmental factors that produce wetland community types and some unifying problems such as assembly rules, restoration and conservation. The volume draws upon a complete range of wetland habitats and geographic regions, including examples from Africa, Asia, Europe, Australia and New Zealand, as well as from North and South America. No other book provides up-to-date ecological syntheses over the entire geographical and habitat range of wetlands. As such, *Wetland Ecology* is essential reading for anyone planning research or management in wetland habitats.

PAUL KEDDY is the Edward G. Schlieder Professor for Environmental Studies at Southeastern Louisiana University. He is author of *Competition* (1989) which won both the Lawson Medal and the Gleason Prize, and co-editor of *Assembly Rules: Perspectives, Advances, Retreats* (1999).

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Preface

According to Bernard Shaw, writer of many a lengthy preface, the lesson intended by an author is hardly ever the lesson the world chooses to learn from his book. If Shaw is right (and who would risk disagreeing with him), why would anyone trouble to write a book? And why a book on wetlands?

In answer to the first question, the motivation of all writers includes a healthy dose of inspiration, frustration, and ego gratification. Events can conspire to feed these forces, with unfortunate consequences for both writers and the public. When Dr Birks first asked me to write this book, I therefore declined. In part, I was not convinced that a need existed. Bringing a new book into the world requires the shouldering of parental obligations. (While one can keep one's rowdy children at home, a book is always on public display.) The world certainly has too many children, and only the most devoted reader, deep-pocketed publisher, or hardened bibliophile could believe that every author who is inclined towards writing should do so. The self-restraint that is a virtue in biological procreation, may be equally so for aspiring authors.

Events can, however, over-ride caution. Illness, like the threat of a hanging, tends to concentrate and clarify one's mind. Moreover, during the days chained to the wall before the hanging, one is inclined to dwell on shortcomings, particularly those of one's associates. But I digress. This is, after all, a preface to a book on wetlands.

The principal objective of this book is to try to provide some unity and coherence in the study of wetland ecology. To do so, I have organized this book into three sections. The first section (Chapters 1–3) emphasizes the properties of wetlands, or, in statistical terms, the dependent variables in our inquiry. The next section (Chapters 4–9) addresses the environmental factors that control these properties: in statistical terms, the independent variables. In these chapters, I freely range across wetland types

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and geographic regions. My self-assigned task is to illustrate the relationships among properties and environmental factors, whether they occur in an Amazonian floodplain, prairie pothole, boreal peatland or tidal marsh. The book may still tend to emphasize the types of wetlands with which I am most familiar, but this should not distract a reader from principles and scientific generalities. The final section (Chapters 10–12) illustrates some larger frameworks for studying the relationships between ecological properties and conservation biology. Assembly rules, functional groups, and restoration ecology receive particular attention.

The book has been prepared with several audiences in mind. It is intended as a text book for senior undergraduates, an introduction to key factors controlling wetlands for busy managers, and as general reading for any scientist intending to work in wet habitats. Further, the first chapter, will I hope, introduce the essential features of wetlands to a general reader; while superficial in places, it is less so than many popular treatises, and it will simultaneously remind more experienced readers about the salient features that make wetlands of particular interest to humanity. The main body of the book presents a general framework for the study of wetland communities. For practising wetland scientists I had an expanded purpose. The discipline of wetland ecology is currently Balkanized by habitat types, geographic regions, and study organisms. Many of the studies of particular wet habitats that I have read over the past decade have seemed blissfully unaware of nearly identical work in other habitats, wet or dry. By combining all wetland types within one book, I have tried to restore some conceptual unity to the discipline by emphasizing the essential processes that all wetlands share, and then by illustrating the ways in which some of them differ. Hence the part of the title referring to principles. I hope that specialists will be stimulated by seeing the parallel advances in habitat types and geographic regions other than their own, and that this enriched context will assist them with further progress within their own areas of specialization. In exchange, I trust they will forgive the inevitable oversights that annoy a specialist.

The final part of the title mentions conservation. Sound science is the essential foundation of good ecosystem management. Ecosystem management emphasizes ecological processes and their interconnections. This book takes exactly such a perspective: it begins with patterns present in wetlands, and then proceeds to the processes and interconnections that produce the patterns. The focus is upon communities and ecosystems themselves; implications for global biogeochemical cycles are mentioned from time to time, but they are not a primary focus. Rather, it is assumed

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that, in most cases, maintaining the normal processes within wetlands will ensure that their valued functions continue to occur. When, and if, it is necessary to manipulate wetlands in order to change some aspect of their global function, say, to increase wildlife production or to decrease methane production, this will always require knowledge of processes at the local community scale.

I first thought that such a book might be too personal a perspective on wetlands. Fields of enquiry are now so large that perhaps only multi-authored works are appropriate. However, my editor and advisor, Alan Crowden, has convinced me that many readers actually prefer a systematic and personal account of a field to a series of edited papers. Moreover, I have slowly convinced myself, too, that the existing literature is far too fragmented and diffuse and therefore confused. I have already written bluntly, perhaps too much so, of my views on symposium reports and festschrifts (Keddy 1991a, b, c). A number of recent symposium volumes on wetlands appear to be little more than expensive books with a haphazard collection of people giving a haphazard collection of papers with no unifying theme whatsoever except for the fact that all work in wet areas. Surely we can aspire to do better than this. While my own community-oriented perspective undoubtedly has its limitations, it at least compensates with continuity and consistency.

I have tried to emphasize several research strategies. These include (i) greater emphasis upon measurable properties of ecosystems and (ii) the relative importance of different environmental factors that produce pattern. Far too many studies in wetlands consist, it seems, of little more than drawings of transects through wetlands or autecological studies of small groups of species living in wet places. Neither of these latter styles will inspire bright young scientists to enter the field. In fact, wetland community ecology is exciting, challenging, socially significant, and worthy of our best minds.

At first I was going to include a chapter on applications. But then my continued resistance to the forced distinction between theoretical and applied ecology intervened. Throughout this book there is an interplay between theory and application. In combining them we can achieve maximum impact upon knowledge with a minimal expenditure of effort. An appeal to efficiency itself ought to be sufficient, but we are now faced, in addition, with the rapid loss of the very ecosystems we study. We must hasten if we are to solve some of the growing problems with management of wetlands. Throughout the book there are practical examples that show that wetland ecologists have a great many useful things to say

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to environmental managers. Altered hydrology, eutrophication, loss of species – these are fundamental environmental issues and conceptual axes in the study of wetlands. There is therefore no single chapter on conservation alone because the entire book is about conservation.

Were it not for the inseparability of theory and application, this book might be considered schizophrenic. It is written with both the basic researcher and the resource manager in mind. I hope that both bright, young graduate students and cynical, overworked managers can benefit from consulting it. I have made abundant use of subheadings and figures so that parts that, at least on first reading, appear of secondary importance can easily be skipped. Each chapter will, I hope, be able to stand alone. Those needing an immediate short course, or feeling too harried to deal with an entire book, can obtain an overview of essentials with Chapters 1, 4, 5, and 12. Chapters 10 and 11 are the most speculative, and can be safely omitted from a first reading since they deal more with future possibilities than established phenomena.

Some of the limitations of the book are deliberate. I have placed an emphasis upon communities and on the factors than influence them. Although nutrient cycling is an important topic, I have not dealt with it extensively except under the heading of eutrophication. Similarly, systems models are already well covered in works such as Good *et al.* (1978), Mitsch and Gosselink (1986), and Patten (1990). Apart from eutrophication, I have left the topic of toxic contaminants to other better-qualified authors. There are also two fine compendia which already describe wetland types by region (Gore 1983; Whigham *et al.* 1992). I have not tried to duplicate their efforts. The logical structure of this book is built upon similarities in process rather than geography.

Finally (restrictions on travel are inclined to make one long-winded) this is not *just* a book on wetlands. I have tried to present not only an overview of wetland ecology, but to illustrate the general procedures with which one can dissect an ecological community to search for patterns and the mechanisms that may cause them. In this way, I hope to not only contribute to our understanding of wetlands, but to illustrate practices that will be of use in other vegetation types and ecological communities.

Since we began with Shaw, let us also close with him too. A successful book, according to Shaw, will impress the strong, intimidate the weak and tickle the connoisseur.

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The final product is a team effort. The staff at Cambridge University Press, in particular, Mary Sanders, Maria Murphy and Sue Tuck, deserve special mention for their care and patience during production. The cover draws upon an original 1976 line drawing of a snapping turtle by Howard Coneybear (courtesy of Friends of Algonquin Park) in a design by Chris McLeod. Other line drawings were prepared by Rochelle Lawson. Michaelyn Broussard helped track down the last errant figures, and Kim

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