

## BOOK REVIEWS

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EFFLER, S. W. [ED.]. 1996. **Limnological and engineering analysis of a polluted urban lake: Prelude to environmental management of Onondaga Lake, New York.** Springer. 854 p. \$99.95. ISBN 0-387-94383-8.

This book chronicles the extreme ecological insults that Lake Onondaga has endured. It should be required reading by anyone concerned with how multiple stresses affect aquatic ecosystems. I have been actively involved in lake restoration for almost three decades. Until I read this book, I thought that I had seen lakes that traversed the entire continuum of polluted waters in North America. But I was humbled by what I read and am indeed one of those who Steven Effler, the editor of this volume, notes ". . . will be surprised, if not shocked, that there is a lake in the United States that remains as profoundly degraded as Onondaga Lake."

The introductory chapter by Steven Effler and Gena Harnett sets the stage for the book: It describes the lake's morphometry and watershed and summarizes pollutant loadings and the lake's responses. Onondaga Lake has a surface area of 12 km<sup>2</sup>, a mean depth of 10.9 m, and a maximum depth of 19.5 m. Syracuse, New York, is located within the watershed boundary. Some consequences of this unhappy juxtaposition are: By the late 1890s, the lake had lost its commercially valuable cold-water fisheries; ice harvesting was banned (for health reasons) in 1900; swimming was banned in 1940; and fishing was banned in 1970.

Chapters 2–8 deal with each of the major disciplines necessary to understand the ecological dynamics of Onondaga Lake. Chapters 2 and 3 detail the geology and hydrogeology of the watershed and surface water loadings to the lake. Chapter 4 describes physical processes that occur within the lake; this includes an interesting discussion of tributary inflow and chemical density gradients that cause the tributary waters and associated chemical loads to settle into the deeper waters of the lake. Chapter 5 deals with lake chemistry, including the usual variables (dissolved oxygen, phosphorus, and nitrogen), as well as more specialized information, e.g., mercury (albeit only total mercury). Chapter 6 is devoted to the lake's biology: from microbiology through phytoplankton up the food web to fish. Chapter 7 ("Optics") presents a variety of optic data: Secchi disk measurements taken since 1968 as well as measurements made with quantum sensors. Chapter 8 characterizes the sediments and fluxes of chemicals from them; the highlight here is that elevated mercury concentrations in the sediments result from inputs from the chloralkali operations in the watershed.

The final chapters ("Mechanistic Modeling of Water Quality in Onondaga Lake" and "Synthesis and Perspectives") summarize the salient points from the other chapters and exercise a user-friendly management model to investigate how the lake might respond to different watershed management alternatives. The authors also reflect on practical issues that must be considered in lake restoration, e.g., who will pay and is it worth it?

The book is an interdisciplinary effort to describe how extreme anthropogenic perturbations affect a particular aquatic ecosystem. As I read about the many industrial and municipal discharges and their effects on Onondaga Lake, I felt rage that this was allowed to happen. The book is highly recommended to anyone who must deal in either the hard science of lake restoration or the social science of how to respond to wholesale environmental pollution.

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PIELOU, E. C. 1998. **Fresh Water.** University of Chicago Press. x+275 p. \$24.00. ISBN 0-226-66815-0.

This book is about the natural history of fresh water, starting from the ground up, literally. Groundwater, soil moisture, rivers, lakes, wetlands, ice, and clouds are dealt with in 12 chapters, each summarizing the physical conditions and processes that occur in that particular environment or "life stage of fresh water," as ecologist Pielou would describe it.

It is not a textbook. The behavior of water is made far more appealing, with anecdotes about little known facts and answers to questions that are often asked in schoolrooms and public meetings. A few examples:

- The ages of groundwater vary enormously: "Water trapped in some Egyptian sandstone is up to 40,000 years old" but groundwater that infiltrated after 1952 may be detected by noting the presence of tritium from H-bomb testing.
- Most of the stored fresh water in Canada and the United States occurs in 8 ice-scoured lakes along the border of the Canadian Shield (Lake Ontario to Great Bear Lake): ". . . constituting the largest system of fresh surface water on earth."
- An ecologist's view of clouds: "A young newly formed cloud consists of a dense crowd of small droplets, and it looks pure white when the sun shines on it. As the cloud ages, however, many of the droplets coalesce, becoming bigger, fewer and more widely spaced . . . and by the time the cloud is old, it looks dark gray, even in bright sunshine, because it reflects the light less efficiently than it did when young."

Facts and exercises, e.g., how to measure stream discharge, are presented in anecdotal form but with thorough footnotes and references for those wishing to find the underlying physics and formulas (the book contains no equations). There are a few errors that specialists would find; for example, "hydraulic jumps" of noisy frothing water only occur below rapids and waterfalls as the fast flow decelerates and rises to the height of slower and deeper water downstream. In Figure 5.10 the jump leaps into the air above the stream for no apparent reason. But these would be easily discovered by anyone who pursued the carefully referenced sources.

Professor Pielou has done an outstanding job of integrating hydrology, geochemistry, geomorphology, meteorology, and ecology to explain the many properties of fresh water to the layman. The book is an excellent primer in these potentially complex subjects for students in secondary school and for college students specializing in peripheral fields (e.g., environmental law). This book will also answer many of the questions commonly asked by community stream and fish stewardship groups, and in a way that makes their involvement with fresh water far more interesting.

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