

# Preface

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The summer of 2023 brought the global water crisis into the media spotlight once again, with headlines reflecting the range of devastating water problems being experienced around the world: Flooding in California. Drought and famine in the Horn of Africa. Massive fish kills in Texas and Australia. “Forever chemicals” in US drinking water. Escalating tensions between Egypt and Ethiopia over the latter’s new dam.

Similar headlines are sure to dominate the news in the years ahead.

What is sometimes missing from the headlines, though, is an understanding that these diverse water problems are related, that these water “hotspots” are manifestations of serious underlying stresses on our interconnected social–physical water systems. These stresses require sustained attention from water managers, scientists, policymakers, and the public, even after the headlines have faded. That attention, in turn, requires a shared understanding of how water systems function, the stresses they are experiencing, and the tools available to increase their resilience.

This book aims to fill that need by providing the necessary knowledge base for understanding and managing water problems. It is geared primarily toward students in water management courses at the undergraduate and graduate levels but will also be a helpful resource for practicing water professionals who want to get new ideas or a broader view of water management. In addition, I hope that this book will prove useful for laypeople who want to understand this vital resource and their own role in protecting it. After all, water touches every aspect of our society, so every one of us is affected by water issues—and we each make decisions every day that affect our collective water future. The book is written primarily for a US audience, although case studies from around the world will make it useful for students from other countries as well.

Rather than focusing on one type of water problem (as many water books do), this book provides reasonably comprehensive coverage of the entire gamut of water issues, from dams to desalination, from flooding to famine, from prior appropriation to pumped storage, from sanitation to stormwater. And rather than teaching from one disciplinary perspective (as many water books do), this book looks at water problems

through a variety of lenses: hydrology, climate science, ecology, and engineering, but also law, economics, history, and environmental justice.

Anyone writing a water management textbook (or teaching a water management course) faces two interconnected dilemmas. First, given the largely local nature of water problems—and the diversity of place-based solutions—how do I balance general principles with local applications? Second, given the rapidly changing nature of the water space, how do I provide an accurate, textured description of where we stand today, while also recognizing that things will look different tomorrow? I don't have a perfect solution to these dilemmas, of course, but I have tried to ensure that readers—whether they are in New Haven or New Delhi, whether they are reading in 2024 or 2034—will find in this book both principles and examples that they can apply to their own settings. In addition, the companion website (<https://watermanagement.yale.edu>) is regularly updated with the latest global data, along with the latest developments in the various case studies.

This book is designed to be accessible and engaging to readers from a broad range of backgrounds. Several features help make the book readable and student centered without losing rigor and comprehensiveness:

- **Modularity:** For readers who are interested in particular issues and don't have time to read the whole book, the book is designed to be modular. Once you have read the Introduction (Chapter 1) and Part I, each of the remaining parts—Part II (river and ecosystem management), Part III (water governance), and Part IV (urban, industrial, and agricultural uses)—can be read independently, depending on your interests. Similarly, within Part IV, readers who are interested in industrial or agricultural issues can turn directly to Chapters 17 or 18, respectively, while readers interested in drinking water issues in the United States can turn to Chapter 14. Fuller descriptions of reading suggestions for different interests, and syllabi for different types of courses, are available online at the companion website.
- **Glossary:** A detailed glossary is included, and every phrase in the glossary is presented in *bold italics* the first time it appears in each chapter. Thus, readers who haven't read (or have forgotten!) previous chapters have ready access to definitions of key concepts.
- **Chapter highlights:** Each chapter ends with bullet points that summarize the ideas introduced in the chapter, with critical concepts highlighted in *bold italics* (and appearing in the glossary).
- **Case studies:** Since water issues are largely local in nature, I use case studies (in both the text and the companion website) to illustrate, concretize, and enliven the concepts covered in the book.
- **Water science primer:** The book is focused on water *management* rather than water science and thus assumes some familiarity with the hydrologic cycle, water quality, and related scientific concepts. For those who lack this background, the companion website offers an “introduction to water science,” which will quickly get you up to speed.

After an introductory chapter, the book is divided into four parts. Part I provides an overview of water as a resource for human use, addressing basic questions about

*supply* (how much water is available, including how availability is affected by climate change), *demand* (how much water we are using), and *scarcity* (the gap between supply and demand). Part II looks at how rivers are managed for *instream uses* (navigation, hydropower, fishing, recreation, flood management, waste disposal, dams), the ecological and social consequences of those uses, and how these consequences could be mitigated. Part III examines water governance, including issues of water allocation, environmental flows, tribal water rights, planning and coordination, and transboundary conflict and cooperation. Part IV delves into offstream water uses—municipal, industrial, and agricultural—with the goal of describing how those uses could better serve the people who are reliant on them while minimizing impacts on other communities and ecosystems.