



PREFACE

THE ROLE OF ENVIRONMENTAL SCIENCE IN SOCIETY

We live in a time of great change and challenge. A quick read of the headlines of any newspaper provides images of disease, hunger, poverty, natural disasters, and pollution. Challenges, however, are also opportunities. Opportunities exist because of the changes the global society must make. Simply put, we cannot continue with business as usual. Such a path is not sustainable. What does that mean? In short, we must do things differently. For example, different farming practices will allow crops to be raised with fewer chemicals and less water. Buildings can be constructed with new, more sustainable methods. Transportation can be provided while using less energy. In other words, we must think differently. Environmental science is a discipline that fosters new ways of thinking. Environmental science is an applied science designed to help address and solve the challenges the world faces. It is also by its very nature a global science. This text, for example, has been translated and published in Spanish, Chinese, and Korean. Therefore, students in Santiago, Shanghai, Seoul, or Seattle are learning the “how’s and why’s” involved in thinking and acting sustainably. At the end of the day we all share the same air, water, and one not-so-big planet. It’s important for all of us to make it last.

WHY “A STUDY OF INTERRELATIONSHIPS”?

Environmental science is an interdisciplinary field. Because environmental problems occur as a result of the interaction between humans and the natural world, we must include both scientific and social aspects when we seek solutions to environmental problems. Therefore, the central theme of this book is interrelatedness. It is important to have a historical perspective, to appreciate economic and political realities, to recognize the role of different social experiences and ethical backgrounds, and to integrate these with the science that describes the natural world and how we affect it. *Environmental Science: A Study of Interrelationships* incorporates all of these sources of information when discussing any environmental issue.

WHAT MAKES THIS TEXT UNIQUE?

We present a balanced view of issues, diligently avoiding personal biases and fashionable philosophies.

It is not the purpose of this textbook to tell readers what to think. Rather, our goal is to provide access to information and the conceptual framework needed to understand complex issues so that readers can comprehend the nature of environmental problems and formulate their own views. Two features of the text encourage readers to think about issues and formulate their own thoughts.

- The **Issues & Analysis** box near the end of each chapter presents real-world examples of environmental problems and prompts students to think about the issues involved and respond to a series of questions.
- The **What’s Your Take?** feature found at the end of each chapter asks students to take a stand on a particular issue and develop arguments to support their position.

We recognize that environmental problems are global in nature.

Three features of the text support this concern:

- Throughout the text, the authors have made a point to use **examples** from around the world as well as those from North America.
- **Case Studies** provide examples of specific situations that allow students to see how the concepts discussed in the chapter can be applied to everyday situations.
- The presence of easily accessible **Foldout World Maps** at the back of the text allows students to quickly locate a country or region geographically.

NEW TO THIS EDITION

The twelfth edition of *Environmental Science: A Study of Interrelationships* is the result of extensive analysis of the text and the evaluation of input from environmental science instructors who conscientiously reviewed chapters during the revision. We have used the constructive comments provided by these professionals in our continuing efforts to enhance the strengths of the text. The following is a list of global changes we have made, along with a description of significantly revised chapters. To see a more

detailed list of chapter-by-chapter changes, please contact your McGraw-Hill sales representative.

Focus on the Positive Environmental science often seems to focus on the negative, since one of the outcomes of any analysis of an environmental situation is to highlight problems and point out where change is needed. We often overlook the many positive actions of individuals and organizations. Therefore, in this edition three new features call attention to the positive:

- **Going Green** boxes describe actions that are having a positive environmental impact. Some of these actions are taken by governments, some are by corporations, and some are individual efforts.
- **Campus Sustainability Initiatives** highlight some of the many actions of students and the colleges and universities they attend that are making a positive environmental impact.
- **Thinking Green** is an end-of-chapter feature that asks students to consider making changes that will have a positive environmental impact.

Focus on Water Interrelatedness is a core concept in environmental science. Although this concept can be illustrated in many ways, in this edition we have chosen to use water as a theme. A **Water Connections** box appears in every chapter. Sometimes the topic of water is also addressed as a heading in the text.

Revised Art Program About 100 new photos have been added or substituted throughout the text to depict real-life situations. Over 50 illustrations, graphs, and charts are new or revised to present detailed information in a form that is easier to comprehend than if that same material were presented in text form.

Several Significantly Revised Chapters Every chapter has a new Going Green, Water Connections, and Campus Sustainability Initiative box. In addition, many chapters have other significant changes, including:

Chapter 1, Environmental Interrelationships There is a new section entitled *Interrelatedness Is a Core Concept*. It uses John Muir's statement "*Tug on anything at all and you'll find it connected to everything else in the universe,*" as a theme. It then highlights the changes brought about by the reintroduction of wolves into Yellowstone National Park to show how one simple change has far ranging impacts. A new illustration accompanies this addition.

Chapter 5, Interactions: Environments and Organisms The section on limiting factors and range of tolerance was rewritten and supported with a new illustration. A new food web illustration was substituted. A new case study discusses the changes in food chains in the Great Lakes.

Chapter 6, Kinds of Ecosystems and Communities A new section on the *temperate rainforest* was added and supported with photographs and a graph. Many new photographs were added or substituted to help better describe the nature of specific biomes.

Chapter 9, Energy Sources The chapter was updated with the most recent energy data on energy supply and consumption. The section on renewable energy was reorganized and greatly revised. A new "Issues and Analysis" feature discusses the pros and cons of corn ethanol production. There are many new and substituted photos.

Chapter 11, Biodiversity Issues The sections *Biological and Ecosystem Services Values* and *Threats to Biodiversity* were rewritten. A new section on the importance of climate change to biodiversity was added. New figures illustrate the concepts of genetic diversity, species diversity, and ecosystem diversity. Many new figures have been added and tables and graphs have been updated. The table of *Estimated Values of Ecosystem Services* was significantly modified.

Chapter 15, Water Management This chapter features a new figure on the global distribution of the world's water and a new map showing areas of the world experiencing water stress. New content has been added on the role of the oceans as the primary regulator of global climate and an important sink for greenhouse gases. There is also new content on pricing of water in countries and expanded coverage on the restoration of the Everglades. Also featured is expanded coverage on groundwater usage.

Chapter 19, Environmental Policy and Decision Making This chapter has gone through a major reorganization, including new material on the challenge for U.S. environmental policy. New material on the complexity of ecological problem solving and China's rising energy consumption has been added.

ACKNOWLEDGMENTS

The creation of a textbook requires a dedicated team of professionals who provide guidance, criticism, and encouragement. It is also important to have open communication and dialogue to deal with the many issues that arise during the development and production of a text. Therefore, we would like to thank Sponsoring Editor Marge Kemp; Developmental Editor Robin Reed of S4Carlisle Publishing Services; Project Manager Joyce Watters; Production Supervisor Sandy Ludovissy; Photo Research Coordinator Lori Hancock; Designer Brenda Rolwes; and Media Project Manager Sandy Schnee for their suggestions and kindnesses. Finally, we'd like to thank our many colleagues who have reviewed all, or part, of *Environmental Science: A Study of Interrelationships*. Their valuable input has continued to shape this text and help it meet the needs of instructors around the world.

Twelfth Edition Reviewers

Kenneth Banks, *University of North Texas*
Tamatha R. Barbeau, *Francis Marion University*
Judy Bluemer, *Morton College*
Kelly S. Cartwright, *College of Lake County*
Michelle Cawthorn, *Georgia Southern University*
Lynda Davis, *Dalton State College*
Alicia Kramer Durham, *Park University*
Dr. Steven P. Frysinger, *James Madison University*
Jayant Lal, *Philadelphia University*
Timothy F. Lyon, *Ball State University*
Julie Stoughton, *University of Nevada, Reno*

Eleventh Edition Reviewers

Joseph A. Angelo, *Rollins College*
Donna H. Bivans, *Pitt Community College*
Iver W. Duedall, *Florida Institute of Technology*
Sara Garrington, *Parks College*
Terry Hilleman, *University of Northern Iowa and William Penn
University College for Working Adults*
Barbara A. Hollar, *University of Detroit–Mercy*

Megan E. Hughes, *Bowling Green State University*
Walter A. Illman, *University of Iowa*
Lureta J. Kahler, *William Penn University College for Working Adults*
Robert G. Kremer, *The Metropolitan State College of Denver*
Ernesto Lasso de la Vega, *Edison College*
Anthony J. M. Marcattilio, *St. Cloud State University*
Allan L. Markezich, *Black Hawk College*
Lauren J. Preske, *University of Southern Indiana*
Greg Pryor, *Francis Marion University*
John Rybczyk, *Western Washington University*
Arthur N. Samel, *Bowling Green State University*
Jana H. Svec, *Moraine Valley Community College*
Jamey Thompson, *Hudson Valley Community College*
Anne Todd Bockarie, *Philadelphia University*
Jonah Triebwasser, *Marist College*
Richard Waldren, *University of Nebraska*
Jeff White, *Lake Land College*
Nicole Wilson, *Pennsylvania College of Technology*
J. Michael Wright, *Truckee Meadows Community College*
Joni Young-Torres, *Pitt Community College*

Eldon D. Enger
Bradley F. Smith