About the Authors

Norm Christensen is professor emeritus and founding dean of Duke University’s Nicholas School of the Environment. A central theme in Norm’s career has been ecosystem change from both natural and human causes. Norm has worked on numerous national advisory committees on environmental issues and on the boards of several environmental organizations including Environmental Defense Fund and The Wilderness Society. He is a fellow in the American Association for the Advancement of Science and a fellow and past president of the Ecological Society of America. Norm was the 2017 recipient of the Herbert Stoddard Lifetime Achievement Award from the American Association for Fire Ecology.

This book is very much a product of Norm’s passion for connecting students with their environment. Norm was honored twice by the Duke University with awards for distinguished undergraduate teaching. He was instrumental in the development of Duke’s undergraduate program in environmental science and policy, and he taught the introductory course for this program for over 15 years.

Lissa Leege is a professor of biology and the founding director of the Center for Sustainability at Georgia Southern University. She earned her undergraduate degree in biology from St. Olaf College and received her Ph.D. in plant ecology at Michigan State University. Her ecological research concerns threats to rare plants, including the effects of fire and invasive species on endangered plant populations and communities. She has also conducted 20 years of research on the impacts of invasive pines on the sand dunes of Lake Michigan and the subsequent recovery of this system following invasive species removal. Lissa was instrumental in the development of an Interdisciplinary Concentration in Environmental Sustainability for undergraduates at Georgia Southern. Under her direction, the Center for Sustainability engages the campus and community with annual sustainability celebrations, a sustainability grant program, and a robust speaker series. Lissa is also involved with the environment on a statewide level as a member of the 2013 Class of the Institute for Georgia Environmental Leadership and a founding member of the Georgia Campus Sustainability Network.

Lissa has taught nonmajors environmental biology for 19 years with an emphasis on how students can contribute to environmental solutions. In 2006, she established an Environmental Service Learning project, through which thousands of environmental biology students have engaged in tens of thousands of hours of environmental service in the local community. Lissa has been honored with both college and university service awards and has served as a faculty fellow in Service-Learning. Her contributions to this book have been inspired by her passion for engaging students in positive solutions to environmental problems.

Justin St. Juliana is a lecturer in the Ecology and Evolutionary Biology Department at Cornell University. He received his bachelor’s degree in animal ecology at Iowa State University, his master’s degree in evolutionary ecology from Ben Gurion University of the Negev (Israel), and his Ph.D. in biology from Indiana State University. Justin’s research lies at the interface of predator prey interactions, optimal foraging, and stress hormones. His study organisms include rodents, foxes, fleas, owls, snakes, and feral cats. Before taking his position at Cornell University, Justin was an associate professor at Ivy Tech Community College (Terre Haute Campus) in Indiana. While at Ivy Tech he taught at multiple biological levels from microbiology to environmental science. Justin also developed and still administers a statewide online nonmajors biology course taken by thousands of Ivy Tech students every year.

Justin teaches the large mixed majors/nonmajors Ecology and the Environment course at Cornell University. He is very interested in the latest teaching innovations and heavily incorporates active and community-based learning into his courses. Justin believes that scientific concepts can be taught as stories that relate to a student’s life. He also extensively utilizes technology to improve student learning outcomes. In addition to being a coauthor, Justin developed the Process of Science, Global Connects, and Focus on Figures activities associated with this book, in Mastering™ Environmental Science.

Dedication

To Nicholas, Natalie, Noelle, Nicole, Riley, and all other of Earth’s children. May we make decisions today that ensure the future beauty, diversity, and health of the environment on which they will depend.

To Micah and Emory, my constant joy and inspiration. I owe you the beautiful world I inherited, and it is my hope that education will motivate all kinds of students to take leadership and action in bringing about a bright and sustainable future.

To my father, Ronald, who, having spent his formative years as a hunting and fishing guide, enabled me to appreciate the natural world and taught me the value of a strong land ethic. I hope that, in this book, I can pass his valuable lessons along to the readers.
Preface

It has been said that change is the only constant. For billions of years, Earth’s environment and the organisms that inhabit it have been constantly changing. Over tens of millennia we, our species, have constantly changed; each generation’s technologies, values, and understanding of its environment have differed from those that preceded it. As a consequence of those technologies and our growing numbers, we have changed Earth’s environment more than any other species living now or in the past.

You and the world around you are the current manifestation of this process of inexorable change. The health and well-being of most of Earth’s people have markedly improved over the past century but our impacts on Earth’s environment have increased significantly. A century ago, our global population was fewer than 2 billion; today there are well over 7.5 billion of us. What’s more, each of us today uses several times more resources and generates several times more waste than our century-ago ancestors. The effects on our environment are alarming. Resources such as water and petroleum are dwindling. Air pollution and water pollution have become commonplace. Rates of extinction among Earth’s species are more than 100 times higher than in pre-industrial times, and Earth’s climate is warming because of human-caused changes in the chemistry of its atmosphere. Sea level rise, dwindling sea ice in the Arctic, and increased severity of droughts and hurricanes are just a few of the consequences of this global warming.

These changes threaten the health of Earth’s ecosystems and the well-being of many of its people; they directly affect you. These changes are unsustainable, but they are not inevitable. Sustainability and ecosystems are important themes throughout this book. Sustainable action and change require knowledge and understanding of the ecosystems upon which we depend. Yes, they are complex, but the key elements of ecosystem function and sustainability are beautifully simple. In an increasingly urban and technology-driven world, the connections between Earth’s ecosystems and our well-being may seem distant, even irrelevant. But they are at all times immediate and compelling.

We have not downplayed the significant challenges presented by the variety of environmental issues that affect our lives because a balanced view of the challenges is needed. Naïve optimism is not likely to motivate substantial change in our actions and impacts, but neither is pessimism. We can all change the world in directions that are truly sustainable. We are convinced you will be part of that process of change. That confidence and conviction were the motivation for writing this book; hope was the inspiration.

New Innovations and Hallmark Features

A New Author

We welcome Justin St. Juliana to the author team of The Environment and You. Justin is a lecturer in the Ecology and Evolutionary Biology Department at Cornell University. Justin believes that scientific concepts can be taught as stories that relate to a student’s life. His ability to relate scientific concepts to a student’s experiences fits perfectly with our goal of bringing environmental science to life. His ability to use technology to improve student learning and engagement has been brought to bear on the various activities in Mastering™, both in this edition and previous ones. Justin’s energy, interests, and teaching philosophy are a welcome addition to the team.

New to this Edition

• Misconception  New to the third edition, this feature addresses common student misunderstandings related to matters of scientific fact and offers a new take on the Q&A feature from prior editions. Is Earth getting warmer because of the ozone hole? Is bottled water safer to drink than tap water? Do vaccines lead to autism in children?

• You Decide  New to the third edition, this feature presents you with a real environmental issue and challenges you to take a stand on that issue, using scientific evidence to support your position. Remember Cecil the lion? Are there some situations where it could be permissible to hunt endangered species? How would you react if fracking were to come to your town?
A Focus on You

A hallmark of each edition, now further reinforced in the third edition, is the importance of humans as agents of environmental change. The effects of those changes on human well-being continue to be a central theme in the third edition. *The Environment and You* emphasizes problem solving and solutions that will enable you to make more informed choices on actions to support the well-being of humans and the health of the planet.

- **Where You Live**  This feature invites you to use primary data sources to explore environmental principles, issues, and sustainable solutions within the context of your local community. By answering the questions posed, you’ll see how concepts and examples from your textbook can be applied to where you live and learn. This will not only satisfy your curiosity but also help you connect local discoveries to central themes of the chapters. Do you know, for example, what biome you live in (Chapter 7) or whether you share your local environment with an endangered species (Chapter 8)? Do you ever think about just how much water you use every day (Chapter 11)? How about the size of your waste footprint (Chapter 17)? These are just a few of the questions you will explore.

- **Seeing Solutions**  Problems need solutions and this feature highlights how individuals and groups around the world are using new approaches to solve environmental problems. Topics include a city that is investing in green space to solve problems associated with transportation, the local economy, and the health of its citizens (Chapter 16); a business that lessens its impact while improving profit and employee–community relations with a focus on the triple bottom line (Chapter 1); a group that supports increases educational opportunity for young women as a means to improve the health and well-being of their communities (Chapter 5); and efforts designed to support underdeveloped countries in dealing with the economic pressures of a changing world (Chapter 8).

- **Agents of Change**  This feature showcases the efforts of college students and recent graduates who have taken action to produce sustainable environments and improve human well-being. It is intended to provide guidance and encouragement for any student with a similar drive to make the world a better place. The third edition features six new inspiring Agents of Change: Will Amos and Aldrin Lupisan, inventors of a bike-powered plastic recycling system; Erica Davis, contributor to a reform bill that keeps money from natural resource extraction within local communities; Amira Odeh, leader of a campus-wide plastic bottle ban; Dejah Powell, creator of an environmental summer camp targeted at disadvantaged inner city youth; Swarnav Pujari, inventor and founder of TouchLight, a company that captures kinetic energy from human foot traffic; and Destiny Watford, champion of clean air and environmental justice in Baltimore.

Solid Coverage of Environmental Science

Our current understanding of environmental issues is built on a foundation of decades of careful research by generations of scientists. The third edition not only continues to provide many examples to help you understand the role science and scientific data can play in reducing uncertainty surrounding environmental issues but also engages you in the spirit of inquiry scientists use to ask questions and gather evidence to support predictions.

- **Currency**  New discoveries are constantly occurring, and our understanding is quickly evolving in all areas of environmental science. Among the many updates to the third edition are recently revised United Nations forecasts for the growth of human populations, the latest information on changes in Earth’s climate from the Intergovernmental Panel on Climate Change, and recent innovations in agriculture, energy conservation, and green building practices. This edition provides the most current synthesis of such changes in every environmental field. Graphs and charts use the latest available data, and recent events such as Hurricanes Harvey and Irma; the devastating wildfires in northern California; and the rise and spread of the Zika virus are included.

- **Motivation**  Each chapter opens with an essay about humans and their interaction with or understanding of the environment. From the historic collapse of the Newfoundland cod fishery (Chapter 1) to the restoration of breeding populations of the California Condor (Chapter 8) or the spread of the Zika virus into the Americas (Chapter 18), environmental science is full of interesting stories. These stories will help you connect to the scientific concepts introduced in each chapter.

- **Applications and Examples**  *The Environment and You* provides numerous explanations of how scientists have found innovative ways to gather the evidence that supports current conclusions and enables informed predictions.

- **Focus on Science**  This feature encourages you to think about the process of scientific inquiry and the different methods scientists use to gather evidence by highlighting the work of individual scientists and the contributions they have made. For example, how does a scientist measure the amount of plastic waste in the ocean (Chapter 11)? We emphasize the strategies scientists use to conduct scientific research and include critical thinking questions that will spark class discussion and encourage you to think like a scientist.

- **New Frontiers**  This feature highlights interesting areas of environmental research as well as unique approaches to problem solving. New Frontier features emphasize the complex interactions between new scientific discovery, ethics, and policy and ask you to consider the implications of the power science has to change the way we live and interact with the environment.
Acknowledgments

Organized for Learning

*The Environment and You* is organized to help students understand environmental science.

- Each lesson begins with a big idea so students always have a way to see the forest as well as the trees.
- Manageable amounts of information are organized by key concepts within modules, giving students complete lessons before moving on to the next topic.
- Important concepts are illustrated with clear, purposeful charts and graphs and supported with photographs that capture the essence of the concept being presented.

Supporting All Levels of Students

Students in introductory environmental science classes have vastly different levels of science background. *The Environment and You* is designed and written to serve that diversity.

- **Self-assessment:** Questions at the end of every module allow students to assess whether they have truly grasped a topic before they move on. Questions at the end of each chapter are designed to encourage synthesis of concepts and application to real situations.
- **Mastering™ Environmental Science:** Used by over a million science students, the Mastering platform is the most effective and widely used online tutorial, homework, and assessment system for the sciences. It motivates students to come to class prepared; provides students with personalized coaching and feedback; quickly monitors and displays student results; easily captures data to demonstrate assessment outcomes; and automatically grades assignments, including concept review activities, 3-D BioFlix® animation activities and quizzes, Graphit! activities, and chapter reading quizzes.

**Mastering™ Environmental Science** has a suite of activities designed to help your students practice concepts and develop scientific inquiry skills. Assignable activities include:

- **Focus on Figures videos,** new to the third edition, walk students through fifteen of the most critical environmental science figures from *The Environment and You*. Each video, created by Justin St. Juliana, helps students explore and interpret key figures such as the carbon cycle, the Keeling curve, and logistic population growth. The videos are assignable in **Mastering™ Environmental Science** as part of an interactive activity that further reinforces student understanding.
- **Process of Science activities** encourage your students to put scientific inquiry skills into action. These interactive activities guide them through current environmental research and help them understand concepts such as developing a hypothesis, making a prediction, understanding variables and independent variables, and more.
- **Global Connection activities** demonstrate the global relevance of local environmental issues and chapter themes. Your students will be able to draw comparisons between environmental issues in the United States and other countries such as water usage, air pollution, or species habitat loss.
- **Interpreting Graphs and Data** activities allow students to practice quantitative skills related to graph interpretation and analysis.
- **Video Field Trips** bring real environmental issues to life. These fourteen videos are embedded in the eText and assignable in **Mastering™ Environmental Science**. Take a tour of a water desalination plant, explore the sustainability features of a college campus, or visit a coal-fired power plant. These are just a few examples of the issues each video explores.

**Acknowledgments**

We accept all of the responsibilities of authorship for the third edition of *The Environment and You*, most particularly for any mistakes or flaws. But others deserve much of the credit for its development, organization, presentation, and production. As this project evolved over the course of several years, the Pearson Education publishing team and numerous environmental science colleagues have provided much needed guidance and encouragement.

We are especially grateful to Alison Rodal, our courseware portfolio manager for the second and third editions of *The Environment and You*. She was the catalyst for many of this edition’s new features, and her contagious enthusiasm for this project motivated us at every stage.

Our development editor, Mary Hill, expertly and cheerfully guided us on this third edition journey, from start to finish, as she did for the second edition. Mary has an exceptional eye for detail on matters ranging from grammar to module organization and layout to connections among chapters. Even more, we are awed by her nuanced understanding of so many facets of environmental science that informed her suggestions on substance and presentation. Her wonderful sense of humor sustained us throughout this process.

We thank Courseware Portfolio Management, Director Beth Wilbur and Courseware Director, Content Development Ginnie Simione Jutson who encouraged and facilitated this project throughout its second and third editions. In addition, we would not have been able to publish this project without the support from SVP Portfolio Management-Science Adam Jaworski and Managing Director, Higher Education Courseware Paul.
Corey. Thank you for taking a risk on this project and for your ongoing collective leadership in science education. Sophie Mitchell and her wonderful team at Dorling Kindersley Education helped craft and execute the original vision for the first edition of this project.

Producing a book where text and art are created, designed, and arranged in tandem requires a highly collaborative approach to publishing. We are grateful to our production colleagues for overseeing and orchestrating this effort. Mike Early and the content production team oversaw the project’s many details and milestones. Mark Ong and Lisa Buckley were responsible for the page and cover design of this third edition, Jason Hammond and Kelly Murphy of Spi-Global oversaw the composition of our text files to actual page layouts, along with Becca Groves who managed to keep all members of the team on point. We thank Kevin Lear of International Mapping for his leadership in the production of illustrations, graphs, and maps and Hilair Chism for her graphic talents utilized in creating this edition’s cycle diagrams and other complex figures.

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We would also like to thank each contributing supplement author for the edition. Jacquelyn Jordan, Clayton State University, did a wonderful job carefully updating the Instructor’s Guide. The Text Bank was written and assembled by David Serrano, Broward State College. David is also the author of the third edition PowerPoint presentations, carefully updating each chapter presentation to help give instructors a head start in planning each lecture. Reading Questions were crafted by Nilo Marin, Broward State College. We also thank Erica Kipp, Pace University, for her contribution to the updates in Mastering™ Environmental Science resources for this edition.

After many years spent creating and crafting this book, there comes a time to pass the torch to marketing and sales. We are grateful to Allison Rona Director of Product Marketing, for her support of this text. Christa Pelaez and Mary Salzman brought endless enthusiasm in promoting The Environment and You, communicating our vision to instructors all over the country. We are fortunate to have the support of the many sales representatives who work tirelessly to communicate our vision to faculty and ensure instructors’ needs are satisfied. We thank them for their dedication and commitment!

Terrence Bensel, Brian Bovard, Robert Kingsolver, and Lester Rowntree made important contributions in the first edition to chapters on climate change, biodiversity, agriculture, energy, and waste management. Their detailed outlines provided road maps through sometimes unfamiliar territory, and many elements from their drafts of several of these chapters are part of the final product.

We owe much to our students at Duke, Georgia Southern, and Cornell Universities. In many ways, they helped shape the spirit and content of this text. They have been guinea pigs for each of its chapters and volunteered many editorial comments. The book is much the better for their input.

Over the years, each of us has had the benefit of working with wonderful mentors and colleagues, all the while being supported by our families. For each of us, individually, we want to thank those people who are so special to us.

Norm: My undergraduate and master's advisor Bert Tribbey passed along much knowledge and wisdom that appears in these pages, and he has long served as my primary role model for teaching excellence. My Duke colleagues William Chameides, Deborah Gallagher, Prasad Kasibhatla, Emily Klein, Randy Kramer, Susan Lozier, Marie Lynn Miranda, Joel Meyer, Lincoln Pratson, William Schlesinger, and Dean Urban were key sources of information and constructive criticism.

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I thank my parents for believing in my passion for sustainability and supporting my path. I owe much to my children Micah and Emory for the time they allowed me to dedicate to this book. Finally, I extend my deepest gratitude to my remarkably patient and supportive husband Frank D’Arcangelo, who encouraged me to follow this dream, even though it meant that he would take on a greater share of parenting responsibilities.

Justin: I would like to thank my undergraduate advisors Fred Janzen and Brent Danielson, my master’s advisor Burt Kotler as well as Berry Pinshow, my Ph.D. advisor William Mitchell as well as Steve Lima, and my former department head Janice Webster. Each of these people taught me valuable lessons about science and education.

I am grateful to my family, Paloma, Tanner, Vincent, and Lourdes. When I was a young child I wanted to be an environmental author. Although, I never thought this would take the form of a textbook, or textbook associated activities. my family afforded me the time to pursue this dream.
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University of Maryland  
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Hartwick College  
Mark W. Anderson  
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Collin County Community College  
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University of Colorado, Denver  
Morgan Barrows  
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Tom Jurik  
Iowa State University  
Richard Jurin  
University of Northern Colorado  
Susan W. Karr  
Carson-Newman College  
David K Kern  
Whatcom Community College  
Kevin King  
Clinton Community College  
Jack Kinworth  
Concordia University  
Rob Kingsolver  
Bellarmine University  
Cindy Klevickis  
James Madison University  
Steven A. Kolmes  
University of Portland  
Ned Knight  
Linfield College  
Erica Kosal  
North Carolina Wesleyan College  
Janet Kotash  
Moraine Valley Community College  
Robert Kremer  
University of Missouri  
Diana Kropl-Gomez  
Richland College  
James David Kubicki  
The Pennsylvania State University  
Kody Kuehn  
Frank Kusser  
Moravian College  
Troy A. Ladine  
East Texas Baptist University  
Elizabeth Larson-Reagy  
Arizona State University  
Jiejung Lee  
University of Missouri  
Lissa M. Lege  
Georgia Southern University  
Kurt Leuschner  
College of the Desert  
Honqi Li  
Frostburg State University  
Satish Mahajan  
Lane College  
Kenneth Mantai  
State University of New York, Fredonia  
Anthony Marcattilio  
St. Cloud State University  
Heidi Marcum  
Baylor University  
Allan Matthias  
University of Arizona  
Kamau Mbuthia  
Bowing Green State University  
John McClain  
Temple College  
Joseph McCulloch  
Normandale Community College  
Robert McKay  
Bowing Green State University  
Bram Middeldorp  
Minneapolis Community and Technical College  
Chris Migliaccio  
Miami Dade College  
Kiran Misra  
Edinboro University of Pennsylvania  
James Morris  
University of South Carolina, Columbia  
Sherri Morris  
Bradley University  
Eric Myers  
South Suburban College  
Jason Neff  
University of Colorado, Boulder  
Emily Nekl  
High Point University  
John Olson  
Villanova University  
Bruce Olczewski  
San Jose State University  
Gregory O’Mullan  
Queens College
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Class Test and Interview Participants

Ginny Adams, University of Central Arkansas; John All, Western Kentucky University; Jeff Anglen, California State University, Fresno; Dave Armstrong, University of Colorado; Berk Ayaranci, Temple University; Roy Barnes, Scottsdale Community College; Christy Bazan, Illinois State University; Sandy Bejarano, Pima College East Campus; Leonard Bernstein, Temple University; William Berry, University of California, Berkeley; Neil Blackstone, Northern Illinois University; Christopher Bloch, Texas Tech University; Gary M. Booth, Brigham Young University; James Brandle, University of Nebraska, Lincoln; Robert Bruck, North Carolina State College; George Byrns, Illinois State University; John Calloway, University of San Francisco; Frank Carver, Forsyth College; Ken Charters, Coos Community College; Dave Charlet, Community College of Southern Nevada; LuAnn Clark, Lansing Community College; Jaimee Corbet, Paradise Valley Community College; Robert Cromer, Augusta State University; Wynn Dudmore, Chemeketa Community College; Jane Cundiff, Radford University; Lynnette Danzl-Tauer, Rock Valley College; James Diana, University of Michigan, Ann Arbor; Darren Divine, Community College of Southern Nevada; Rebecca Dodge, Midwestern State University; David Dolan, University of Wisconsin, Green Bay; Michael Draney, University of Wisconsin, Green Bay; Renee Duteaux-Hai, California State University, Los Angeles; Johannes Feddema, University of Kansas; Richard S. Feldman, Marist College; Kevin Fermanich, University of Wisconsin, Green Bay; Linda Fitzhugh, Gulf Coast College; Laurie Fladd, Trident Technical College; Chris Fox, Catonsville Community College; Katie Gerber, Santa Rosa Junior College; Thaddeus Godish, Ball State University; James Goetz, Kingborough Community College; Robert Goodman, Citrus College; Larry Gray, Utah Valley University; Peggy Green, Broward Community College; North; Joshua Grover, Ball State University; Kurt Haberny, Northwest Missouri State; George Hagen, Palo Alto College; Nigel Hancock, Long Beach City College; Wendy Hartman, Palm Beach Community College; Kim Hatch, Long Beach City College; James Haynes, State University of New York, Brockport; Kathi Hopkins, McClenann Community College; James J Horwitz, Palm Beach Community College; Joseph Hull, Seattle Central Community College; Carolyn Jensen, Pennsylvania State University; University Park; David Jones, North Eastern Illinois University; Susan Karr, Carson-Newman College; Leslie Kanat, Johnson State College; Julie Klejeksi, Mesabi Range Community College; Janet Kotash, Moraine Valley Community College; Katherine LaCommare, Lansing Community College; John Lendvay, University of San Francisco; Paul Lorah, University of St. Thomas; Deborah Marr, Indiana University; South Bend; Allan Matthias, University of Arizona; Shelly Maxfield, Pima Community College; John McClain, Temple Junior College; Joseph McCulloch, Normandale Community College; Rachel McShane, St. Charles Community College; Steven J. Meyer, University of Wisconsin, Green Bay; Alex Mintzer, Cypress College; Jane Moore, Tarrant County Community College; James Morris, University of South Carolina, Columbia; William Muller, Temple University; Hari Pant, City University of New York, Lehman; Robert Patterson, North Carolina State University; Dan Pavuk, Bowling Green State University; Christopher Pennuto, Buffalo State University; Barry Perlmuter, Community College of Southern Nevada; Julie Phillips, De Anza College; Mai Phillips, University of Wisconsin, Milwaukee; John Pleasants, Iowa State University; Ron Pohala, Luzerne County Community College; Juan Carlos Ramirez-Darromoro, Ball State University; Marco Restani, St. Cloud University; Brad Reynolds, University of Tennessee, Chattanooga; Howard Riesens, Buffalo State University; Shamili A. Sandiford, College of Dupage; Jodi Shann, University of Cincinnati; Loris Sherman, Somerset Community College; Brent Sipes, University of Hawaii, Manoa; Shobha Sirharan, Virginia State University; Edward Standora, Buffalo State University; Philip Stevens, Indiana University; Fort Wayne; John Suem, California State University, Fresno; Jamey Thompson, Hudson Valley Community College; Claire Todd, Pacific Lutheran University; William Trayler, California State University, Fresno; Carl N. Vondenhoff, Northern Illinois University; Zhi Wang, California State University, Fresno; Sharon Ward, Montgomery College; Jeff Watanabe, Ohlone College; Paul W. Webb, University of Michigan, Ann Arbor; James W.C. White, University of Colorado; Deb Williams, Johnson County Community College; Christopher J Winslow, Bowling Green State University; Don Wijk, Oakland Community College, Auburn Hills; Lori Zalkowski, Dowling College; Carol Zellmer, California State University, Fresno; Joseph Zurovchak, Statue University of New York, Orange Community College.
# Contents

## 1 Environment, Sustainability, and Science

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>It Takes a Community</td>
<td>2</td>
</tr>
<tr>
<td>1.1 Environment and Sustainability</td>
<td>4</td>
</tr>
<tr>
<td>The Environment and You</td>
<td>6</td>
</tr>
<tr>
<td>Defining Sustainable Actions</td>
<td>7</td>
</tr>
<tr>
<td>Planet, People, and Profit: The Triple Bottom Line</td>
<td>9</td>
</tr>
<tr>
<td>Seeing Solutions</td>
<td>10</td>
</tr>
<tr>
<td>1.2 Ecosystems</td>
<td>11</td>
</tr>
<tr>
<td>Ecosystem Function and Integrity</td>
<td>11</td>
</tr>
<tr>
<td>Ecosystem Services</td>
<td>12</td>
</tr>
<tr>
<td>1.3 Principles of Ecosystem Function</td>
<td>13</td>
</tr>
<tr>
<td>Conservation of Matter and Energy</td>
<td>13</td>
</tr>
<tr>
<td>Ecosystems Are Open</td>
<td>14</td>
</tr>
<tr>
<td>Ecosystem Stability</td>
<td>15</td>
</tr>
<tr>
<td>Ecosystem Change</td>
<td>16</td>
</tr>
<tr>
<td>1.4 Acting Sustainably</td>
<td>17</td>
</tr>
<tr>
<td>Managing Resources</td>
<td>17</td>
</tr>
<tr>
<td>Understanding Boundaries</td>
<td>18</td>
</tr>
<tr>
<td>Maintaining Balance and Integration</td>
<td>18</td>
</tr>
<tr>
<td>Embracing Change</td>
<td>19</td>
</tr>
<tr>
<td>1.5 Uncertainty, Science, and Systems Thinking</td>
<td>20</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>20</td>
</tr>
<tr>
<td>Reducing Uncertainty with Science</td>
<td>21</td>
</tr>
<tr>
<td>Systems Thinking</td>
<td>22</td>
</tr>
<tr>
<td>Focus on Science</td>
<td>23</td>
</tr>
<tr>
<td>Ways of Knowing</td>
<td>23</td>
</tr>
<tr>
<td>1.6 Sustainable Development, The Environment, and You</td>
<td>24</td>
</tr>
<tr>
<td>Sustainable Development Goals</td>
<td>24</td>
</tr>
<tr>
<td>Challenges to Sustainable Development</td>
<td>27</td>
</tr>
<tr>
<td>Agents of Change</td>
<td>28</td>
</tr>
<tr>
<td>Earth Rebirth</td>
<td>28</td>
</tr>
<tr>
<td>SYNTHESIS AND KEY CONCEPTS</td>
<td>30</td>
</tr>
</tbody>
</table>

## 2 Environmental Ethics, Economics, and Policy

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dam-nation!</td>
<td>32</td>
</tr>
<tr>
<td>2.1 Changing Views of Humans and Nature</td>
<td>34</td>
</tr>
<tr>
<td>Pre-Industrial Views</td>
<td>36</td>
</tr>
<tr>
<td>The Enlightenment and Industrial Revolution</td>
<td>38</td>
</tr>
<tr>
<td>Living in the Modern World: Conservation vs. Preservation</td>
<td>39</td>
</tr>
<tr>
<td>2.2 Environmental Ethics</td>
<td>40</td>
</tr>
<tr>
<td>Doing the Right Thing</td>
<td>40</td>
</tr>
<tr>
<td>Who or What Matters?</td>
<td>41</td>
</tr>
<tr>
<td>Ecofeminism and Environmental Justice</td>
<td>42</td>
</tr>
<tr>
<td>2.3 The Environment and the Marketplace</td>
<td>43</td>
</tr>
<tr>
<td>Economic Systems</td>
<td>47</td>
</tr>
<tr>
<td>Supply and Demand</td>
<td>45</td>
</tr>
<tr>
<td>Economic Value</td>
<td>46</td>
</tr>
<tr>
<td>Market Complications</td>
<td>46</td>
</tr>
<tr>
<td>2.4 Valuing Ecosystems</td>
<td>47</td>
</tr>
<tr>
<td>Economic Valuation of Ecosystem Services</td>
<td>47</td>
</tr>
<tr>
<td>Ecological Valuation</td>
<td>48</td>
</tr>
<tr>
<td>Focus on Science</td>
<td>49</td>
</tr>
<tr>
<td>Calculating Ecological Value</td>
<td>49</td>
</tr>
<tr>
<td>Measuring the Wealth of Nations</td>
<td>50</td>
</tr>
<tr>
<td>2.5 Environmental Policy: Deciding and Acting</td>
<td>51</td>
</tr>
<tr>
<td>The Policy Cycle</td>
<td>51</td>
</tr>
<tr>
<td>Policy Decision Framework</td>
<td>52</td>
</tr>
<tr>
<td>2.6 U.S. Environmental Law and Policy</td>
<td>55</td>
</tr>
<tr>
<td>Governmental Functions</td>
<td>55</td>
</tr>
<tr>
<td>The Constitution and Environmental Policy</td>
<td>56</td>
</tr>
<tr>
<td>2.7 International Environmental Law and Policy</td>
<td>57</td>
</tr>
<tr>
<td>Environmental Laws</td>
<td>57</td>
</tr>
<tr>
<td>International Institutions</td>
<td>58</td>
</tr>
<tr>
<td>Seeing Solutions</td>
<td>59</td>
</tr>
<tr>
<td>The Global Environmental Facility and the Mesoamerican Biological Corridor</td>
<td>59</td>
</tr>
<tr>
<td>Agents of Change</td>
<td>60</td>
</tr>
<tr>
<td>Reducing Plastic Waste at the University of Puerto Rico</td>
<td>60</td>
</tr>
<tr>
<td>SYNTHESIS AND KEY CONCEPTS</td>
<td>62</td>
</tr>
</tbody>
</table>
5 Human Population Growth

Human Population Growth—By the Numbers 126
5.1 The History of Human Population Growth 128
   Three Periods of Growth 129
   Seeing Solutions Demography Is Not Destiny 130
      Demographic Transition Model 131
      A Tale of Two Countries 132
5.2 Global Variation in Human Population Growth 134
   Birth Rate 134
   Death Rate 136
   Age Structure 138
   Migration 139
5.3 Predicting Human Population Growth 140
   Population Growth Forecasts 140
   Focus on Science Forecasting Future Population Trends and Their Uncertainties 141
5.4 Managing Population Growth 142
   Family Planning 142
   Development and Population 143
   Aging Populations 143
   Two Approaches to Population Growth 144
   Seeing Solutions Women Deliver 145
5.5 Resource Use and Population Sustainability 146
   Sustainability vs. Carrying Capacity 146
   Human Resource Use 146
   Affluence and Technology 148
   SYNTHESIS AND KEY CONCEPTS 150

6 Communities and Ecosystems

The Straight Poop on Dung Beetles 152
6.1 Competition for Shared Resources 154
   Interspecific Competition 156
   How Competitors Coexist 157
   Exploitation and Interference 159
6.2 Herbivory, Predation, and Parasitism 160
   Herbivores 160
   Predators 161
   Parasites 162
6.3 Mutualism and Commensalism 164
   Mutualisms and Commensalisms 164
6.4 The Flow of Energy in Ecological Communities 166
   Food Chains 166
   Energy and Biomass Pyramids 167
   Food Web and Species Diversity 168
   Keystone Species 169
   Focus on Science The Little Things Do Matter 171
6.5 The Carbon Cycle and Ecosystem Productivity 172
   The Carbon Cycle 172
   Terrestrial Carbon 173
   Aquatic and Marine Carbon 174
   Human Impacts 175
6.6 Disturbance and Community Change 176
   Primary Succession 176
   Secondary Succession 178
   Cyclic Succession 180
   The Importance of Place and Time 181
   Agents of Change Vermicomposting at Michigan State University 182
   SYNTHESIS AND KEY CONCEPTS 184
10 Air Quality

The Killer Smog

10.1 Air Quality and Air Pollution
- Gases and Particles
- Sources of Air Pollution
- Dispersion and Deposition of Air Pollution

10.2 Pollution in the Stratosphere
- Aerosols and Climate
- Stratospheric Ozone Destruction

Focus on Science  Laboratory Science Predicts Global Effects

10.3 Pollution in the Troposphere
- Acid Deposition
- Heavy Metals
- Smog
- Air Quality Index

10.4 Indoor Air Pollution
- Combustion By-Products

Seeing Solutions  Taking the Fire out of Cooking
- Building Materials
- Radon
- Pesticides
- Biological Contaminants

10.5 Air Pollution Policy and Law
- U.S. Air Pollution Policy
- International Air Pollution Policy
- Co-Benefits

Agents of Change  Resisting a Waste Incinerator in Baltimore

SYNTHESIS AND KEY CONCEPTS
11 Water

A Disappearing Resource

11.1 Water World
- The Hydrologic Cycle and Earth’s Water Budget
- The Geography of the Hydrologic Cycle
- Watersheds
- Providing Essential Ecosystem Services
- Where Is Earth’s Fresh Water?

11.2 Groundwater
- Characteristics of Groundwater
- Human Uses and Impacts

11.3 Water Distribution
- Too Much Water
- Too Little Water
- Subsidence and Intrusion

11.4 Water Quality
- Water Pollution
- Effects of Water Pollution on Ecosystems

Focus on Science Measuring an Ocean of Plastic

11.5 Water Management and Conservation
- Regulating the Flow

Seeing Solutions The Chesapeake Bay Foundation—50 Years of a Private-Public Partnership
- Managing and Conserving Water Used in Agriculture
- Water Reuse
- Desalination
- Getting the Price Right

11.6 Wastewater Treatment
- Municipal Wastewater Treatment
- On-Site Wastewater Treatment
- Water and You
- Municipal Water Use
- Water Efficiency and Conservation

11.8 Water Conservation Policy and Law
- Water Use in the United States
- Water Quality in the United States
- International Water Law

Agents of Change Water Conservation Competition

12 Agriculture and the Ecology of Food

Farming for the Future: Contrasting Approaches

12.1 Origins and History of Agriculture
- Why Did Agriculture Begin?
- How Did Agriculture Begin?
- And Then What? Agricultural History

12.2 Agroecosystems
- Energetics of Agroecosystems
- Cycling of Nitrogen and Phosphorus
- Dynamic Homeostasis

12.3 The Growth of Crop Plants
- Plant Growth and Reproduction
- What Grows Where and Why?
- The Role of Other Organisms

12.4 Managing Soil Resources
- Soil Origins and Structure
- Soil Fertility
- Soil Conservation

12.5 Water and Agriculture
- Water in Soil
- Irrigation
- Conserving Water in Agroecosystems

12.6 Livestock in Agroecosystems
- Trophic Level Efficiency
- Environmental Impacts

12.7 Managing Genetic Resources
- Genetic Diversity and the Stability of Agroecosystems
- Genetically Modified Organisms

12.8 Managing Competitors and Pests
- Chemical Pest Control
- Biological Pest Control
- Agroecosystem Management of Pests

12.9 The Ecology of Eating
- The Food Footprint
- Ecological Eating

Seeing Solutions Urban Farming

12.10 Food for the Future
- Sustainable Agriculture
- Feeding a Hungry World

Agents of Change STOGROW: A Student-Run Campus Farm at St. Olaf College

SYNTHESIS AND KEY CONCEPTS
<table>
<thead>
<tr>
<th>13 Forest Resources</th>
<th>Nonrenewable Energy and Electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Tragedy of Forest Loss in Haiti</td>
<td>420</td>
</tr>
<tr>
<td>13.1 The Values of Forests</td>
<td>422</td>
</tr>
<tr>
<td>Ecosystem Services</td>
<td>424</td>
</tr>
<tr>
<td>Wood Products</td>
<td>425</td>
</tr>
<tr>
<td>Non-Wood Forest Products</td>
<td>428</td>
</tr>
<tr>
<td>13.2 Forest Growth</td>
<td>429</td>
</tr>
<tr>
<td>The Life History of a Tree</td>
<td>429</td>
</tr>
<tr>
<td>The Life History of a Forest Stand</td>
<td>430</td>
</tr>
<tr>
<td>The Life History of a Forested Landscape</td>
<td>431</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>13.3 Deforestation</td>
<td>432</td>
</tr>
<tr>
<td>Historical Change</td>
<td>433</td>
</tr>
<tr>
<td>Causes of Deforestation</td>
<td>434</td>
</tr>
<tr>
<td>How Can Deforestation Be Halted?</td>
<td>436</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>13.4 Forest Degradation</td>
<td>437</td>
</tr>
<tr>
<td>Forest Health in Peril</td>
<td>438</td>
</tr>
<tr>
<td>13.5 Defining Sustainable Forest Management</td>
<td>438</td>
</tr>
<tr>
<td>Allocation</td>
<td>440</td>
</tr>
<tr>
<td>Harvest</td>
<td>441</td>
</tr>
<tr>
<td>Rationing</td>
<td>442</td>
</tr>
<tr>
<td>Investment</td>
<td>442</td>
</tr>
<tr>
<td>Criteria for Sustainable Forest Management</td>
<td>443</td>
</tr>
<tr>
<td>SYNTHESES AND KEY CONCEPTS</td>
<td>444</td>
</tr>
</tbody>
</table>

**Focus on Science** CO₂ and the Growth of Forest Stands | **Focus on Science** Let It Snow
---

**Seeing Solutions** Restoring Forests and Community Well-Being in Haiti | **Seeing Solutions** A Smart Grid
---

**Agents of Change** An Advocate for Appalachia | **Agents of Change** An Advocate for Appalachia

---

**SYNTHESIS AND KEY CONCEPTS** | 444
### 15 Renewable Energy and Energy Conservation

#### Human Energy Consumption Through the Ages

15.1 Renewable Energy Overview
- The Transition to Renewable Energy Challenges

15.2 Solar Energy
- Sources and Production
- Advantages and Disadvantages

15.3 Biomass Energy
- Sources and Production
- Advantages and Disadvantages

15.4 Wind Power
- Sources and Production
- Advantages and Disadvantages

15.5 Hydropower
- Sources and Production
- Advantages and Disadvantages

15.6 Ocean Energy
- Sources and Production
- Advantages and Disadvantages

15.7 Geothermal Energy
- Sources and Supplies
- Advantages and Disadvantages

15.8 Energy Conservation and Efficiency
- Defining Energy Conservation
- More Efficient Lighting and Appliances

**Focus on Science** Are Electric Vehicles Really Better?

15.9 Sustainable Energy Policy
- Renewable vs. Nonrenewable Energy Policy Options

**Seeing Solutions** Leapfrogging to Renewables

**Agents of Change** Biodiesel Project at Loyola University Chicago

**SYNTHESIS AND KEY CONCEPTS**

### 16 Urban Ecosystems

#### Portland, Oregon: Sustainable by Choice

16.1 Urbanization
- Ancient Cities
- Development of Modern Cities
- Current Trends

16.2 Urban Ecosystems
- Defining Urban Ecosystems
- Urban Climate
- Urban Hydrology

16.3 Urban Land Use
- Urban Population Distribution
- Causes of Urban Sprawl
- Consequences of Sprawl
- Urban Slums: Informal Settlements

16.4 Urban Planning
- Urban Plans and Planning
- Bounding Growth
- Sustainable Urban Growth

**Seeing Solutions** Atlanta’s Beltline: Abandoned Railway to Transformative Park Network

16.5 The Built Environment: Sustainable Building
- Green Building
- Rating Systems for Sustainable Building

**Seeing Solutions** Greening the Empire State Building

16.6 Urban Transportation
- The Challenges of Urban Transportation
- Balancing Transportation Options
- Urban Transportation Economics

16.7 Urban Biodiversity
- Urban Wildlife
- Green Infrastructure

**Focus on Science** Green Walls and Bird Abundance

16.8 The City as a Sustainability Strategy
- Efficient Capture and Use of Energy and Matter
- Ecosystem Characteristics

**Agents of Change** Get them to the Green

**SYNTHESIS AND KEY CONCEPTS**
### 18. The Environment and Human Health

#### 18.1 Out of Africa
- Introduction to Public Health
- Measuring Public Health
- Hazards and Risk
- Risk Perception and Reality

#### 18.2 Physical Hazards in the Environment
- Geologic Hazards
- Weather Hazards
- Fire in the Environment

#### 18.3 Chemical Hazards in the Environment
- What Is a Toxin?
- Human Vulnerability to Toxins
- Toxin Transport and Fate
- Kinds of Toxins
- Toxin Testing and Regulation

#### 18.4 Biological Hazards in the Environment
- Infectious Disease and the Environment
- Respiratory Disease
- Diarrheal Diseases
- Blood-Borne Diseases
- Evolutionary Change and the War against Pathogens

#### 18.5 Environmental Change and Human Health
- Human Population Size
- Air and Water Pollution
- Landscape Change
- Climate Change

---

### 17. Waste Management

#### The Cost of a Can
- Solid Waste
- Municipal Solid Waste
- Sanitary Landfills
- Waste to Energy
- Industrial Solid Waste

#### Hazardous, Biomedical, Electronic, and Radioactive Waste
- Hazardous Waste
- Biomedical Waste
- Electronic Waste
- Radioactive Waste

#### Sustainable Waste Management
- Diminishing the Waste Stream
- Challenges to Municipal Recycling

**Focus on Science** To Recycle or Not to Recycle

#### Managing Product Life Cycles
- Life-Cycle Assessment
- Reimagining Product Life Cycles

#### Waste Management Policy and Law
- Municipal Solid Waste
- Hazardous, Biomedical, Electronic, and Radioactive Waste

**Seeing Solutions** Managing E-Waste

**Agents of Change** Trash 2 Treasure: Post-Landfill Action Network

**SYNTHESIS AND KEY CONCEPTS**
Contents

19 The Environment and You

19.1 Hope for the Environment
Warmer Climates
Scarcer Resources
Less Biodiversity
More People and Bigger Footprints
614

19.2 And You?
Continue to Learn and Improve Your Understanding
Reduce Your Shoe Size
Give What You Can
Think and Act for the Future
622

19.3 Be an Agent of Change
Articulate a Vision Based on Your Values and Be Willing to Act on It
Cultivate Diversity
Focus on Outcomes
Be Humble and Adaptable
626

Be Confident, Committed, and Hopeful
628
Agents of Change  Closing the Loop with Plastics
630

SYNTHESIS AND KEY CONCEPTS
632

New Frontiers
Resurrecting Species
Counting Species
Revving Up Severe Weather?
The Highs and Lows of Sharing Water
Patenting Life
Spying on Forests
Cleaning Up Coal
A Future for Fusion?
Glowing Green
Running on Sunshine
Building a Truly Sustainable Landfill
Proving a Chemical Disrupts Endocrine Function
162
239
283
351
402
436
456
465
482
503
559

Where You Live
What resources does your national forest provide? 7
What important environmental issues are facing you? 52
What do the numbers tell you? 137
How does the U.S. ecological footprint compare with that of other nations? 146
How do different bird species coexist where you live? 158
What is your climate like? 192
What endangered species live near you? 249
Is your climate changing? 277
Where is the coal plant located nearest to you? 318
What is your AQI? 321
Where does your water come from? 352
How much water do you use? 367
What’s growing in your neighborhood? 388
How can you reduce the food footprint of your campus? 409
What can you eat for $4 a day? 414
What is your national forest worth? 428
Where does your electricity come from? 470
What are your state’s renewable portfolio standards? 506
How do you get around on campus? 539
How does your campus compare to an urban ecosystem? 547
Is there a landfill near you? 558
Are you living with hazardous waste? 560
What can you do to reduce your waste footprint? 566
Is there a superfund site located near you? 572
How healthy is your state’s population? 582

You Decide
Should “big game” hunting be banned in African wildlife preserves? 41
Should Nigeria enforce a one-child policy to curtail its population growth? 144
Should trade in elephant ivory be banned within countries? 261
Should we attempt to slow global warming by using engineering techniques? 293
Should e-cigarettes be regulated like smoking tobacco? 323
When do water issues transcend homeowners’ rights? 349
Should you have to consider the global consequences of your food-buying decisions? 399

Do you believe that converting natural forest to plantations could actually be a conservation strategy? 441
Would you protest the use of hydraulic fracturing in your community? 462
Would you support the installation of new hydropower projects on rivers in the southern Andes of Chile? 496
How would you respond if confronted with the gentrification paradox? 530

Should you bury or burn your garbage? 558
Zika vs. Pesticides: Would you support the use of pesticides to fight mosquitoes carrying the Zika virus? 599

Appendices
Appendix A: Graph Appendix A1
Appendix B: Metric System A4
Bibliography B1
Glossary G1
Credits C1
Index I1

You Decide

Appendices
Appendix A: Graph Appendix A1
Appendix B: Metric System A4
Bibliography B1
Glossary G1
Credits C1
Index I1

You Decide

Appendices
Appendix A: Graph Appendix A1
Appendix B: Metric System A4
Bibliography B1
Glossary G1
Credits C1
Index I1

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