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 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 increased 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.

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**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.

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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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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!

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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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