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Environmental Science

FOR
DUMMIES®

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- Apply concepts of environmental science to your life
- Supplement classroom learning with confidence
- Explore issues surrounding natural resources and sustainability
- Understand how the choices you make impact the environment

Alecia M. Spooner
Author of Geology For Dummies



*Environmental
Science*

FOR

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***Environmental
Science***
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DUMMIES®

by Alecia M. Spooner



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Dedication

To the many teachers who inspired me to look at the world more closely.

“We shall never achieve harmony with land, any more than we shall achieve absolute justice or liberty for people. In these higher aspirations, the important thing is not to achieve but to strive.”

—Aldo Leopold

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Contents at a Glance

<i>Introduction</i>	1
<i>Part I: Demystifying Science and the Environment</i>	7
Chapter 1: Investigating the Environment	9
Chapter 2: Lab Coats and Microscopes: Thinking Scientifically.....	19
Chapter 3: What’s the Matter? Living and Nonliving Material.....	31
Chapter 4: Making Things Happen: Energy	47
<i>Part II: Planting the Seed: Foundational Concepts in Environmental Science</i>	57
Chapter 5: Studying the Environment and Your Place in It.....	59
Chapter 6: Exploring Ecosystems	71
Chapter 7: Biogeography: How Earth’s Climate Shapes Global Ecosystem Patterns.....	89
Chapter 8: Playing Well with Others: Population Biology	107
<i>Part III: Getting Your Needs Met: Earth’s Natural Resources</i>	129
Chapter 9: Water, Water Everywhere: Freshwater Resources.....	131
Chapter 10: This Land Belongs to You and Me: Land as a Resource	143
Chapter 11: Dishing It Up: Food Resources	153
Chapter 12: Greater Than the Sum of Its Parts: Biodiversity	175
Chapter 13: Hitting the Hard Stuff: Geologic Resources and Energy	191
Chapter 14: Shifting Gears: Alternative Energy	207
<i>Part IV: Giving a Hoot: Pollution and Environmental Quality</i>	221
Chapter 15: Breathing Room: Addressing Manmade Air Pollution	223
Chapter 16: Drip Drop Splash: Water Pollution	237
Chapter 17: What’s Your Poison? Toxins and Infectious Disease	249
Chapter 18: A River of Garbage Runs through It: Solid and Hazardous Waste.....	263
Chapter 19: Is It Getting Warm in Here? Modern Climate Change	277

<i>Part V: Follow the Recycled Brick Road: A Sustainable Future</i>	295
Chapter 20: Building a Sustainable Future	297
Chapter 21: Cooperating to Sustain the Earth	311
<i>Part VI: The Part of Tens</i>	321
Chapter 22: Ten Ways to Live Sustainably	323
Chapter 23: Ten Real-Life Examples of the Tragedy of the Commons	331
Chapter 24: Ten Careers in Environmental Science	337
<i>Index</i>	343

Table of Contents

.....

Introduction **1**

About This Book	1
Conventions Used in This Book.....	2
What You're Not to Read.....	2
Foolish Assumptions.....	2
How This Book Is Organized	3
Part I: Demystifying Science and the Environment	3
Part II: Planting the Seed: Foundational	
Concepts in Environmental Science	3
Part III: Getting Your Needs Met: Earth's Natural Resources.....	4
Part IV: Giving a Hoot: Pollution and Environmental Quality	4
Part V: Follow the Recycled Brick Road: A Sustainable Future	4
Part VI: The Part of Tens.....	5
Icons Used in This Book	5
Where to Go from Here.....	6

Part I: Demystifying Science and the Environment..... **7**

Chapter 1: Investigating the Environment **9**

Putting the "Science" in Environmental Science	9
Using the scientific method.....	10
Understanding the connection between atoms, energy, and life ...	10
Analyzing the Earth's Physical Systems and Ecosystems.....	11
Sorting the world into climate categories	12
Dividing the Earth into ecosystems.....	12
Observing the interactions between	
organisms within an ecosystem.....	13
Supplies Limited! Natural Resources and Resource Management.....	13
Factoring in food, shelter, and more	13
Thinking about energy alternatives.....	14
Keeping Things Habitable	14
Clearing the air (and water)	15
Tracking toxins and garbage	15
Influencing climate.....	16
Imagining the Future	16
Realizing a sustainable economy.....	16
Putting it on the books: Environmental policy	16

Chapter 2: Lab Coats and Microscopes: Thinking Scientifically . . . 19

Asking and Answering Questions with the Scientific Method	19
Reasoning one way or another: Inductive versus deductive	20
Working through the scientific method	20
Presenting Data Graphically.....	25
Quantifying Uncertainty	27
Recognizing Good Science When You See It.....	28

Chapter 3: What's the Matter? Living and Nonliving Material 31

Changing States of Matter	31
Examining Atomic Structure	32
Making and Breaking Chemical Bonds.....	33
Ionic bonding.....	34
Covalent bonding.....	35
Hydrogen bonding	36
Oxidizing and reducing compounds.....	37
Surveying the Properties of Water	37
Taking a closer look at the water molecule.....	37
The unbearable lightness of ice.....	39
What's pH Got to Do with It? Acids and Bases	40
Defining acids and bases.....	40
Measuring reactivity with the pH scale	40
It's Alive! Organic Matter and Compounds	41
Proteins	42
Nucleic acids	43
Carbohydrates.....	43
Lipids	43
Building Organisms One Cell at a Time	44
Working together: Cell specialization	44
Separating plant cells from animal cells	44

Chapter 4: Making Things Happen: Energy 47

Identifying the Different Types of Energy.....	47
Transferring heat: Thermal energy	48
Setting things in motion: Work and kinetic energy	50
Storing potential energy.....	50
Moving in waves.....	51
Defining the Thermodynamic Laws.....	52
Counting Calories (And Joules)	52
Converting the Sun's Energy to a Useable Form	53
Spinning sugar from sunlight: Photosynthesis	54
Waiting to exhale: Respiration	55

***Part II: Planting the Seed: Foundational Concepts
in Environmental Science* 57**

Chapter 5: Studying the Environment and Your Place in It 59

Integrating Multiple Disciplines	60
Applying Common Tools of Environmental Science.....	61
Reviewing case studies	61
Assessing environmental indicators	61
Measuring human impacts: The ecofootprint.....	62
Tracing the Development of Modern Environmental Ethics	64
Managing for use: Utilitarian conservation	64
A life of its own: Preservation of wilderness	65
Reducing pollution: Battling pesticides and other toxins	66
It's a small world after all: Global environmentalism.....	66
The Overall Goal: Seeking Sustainability	67
To Be or Not to Be a Tree-Hugger: Looking Past Political Debates.....	68

Chapter 6: Exploring Ecosystems 71

Understanding Systems	71
Defining open and closed systems	72
Mapping out system dynamics	73
Systematically Understanding the Earth's Environment.....	74
Flowing through the hydrologic cycle	75
Recognizing important nutrient cycles.....	76
Transferring Energy and Matter through an Ecosystem.....	81
Defining ecosystem boundaries.....	82
Getting caught in the food web.....	82
Measuring productivity.....	85
Building ecological pyramids: Illustrating energy and biomass flow.....	86

**Chapter 7: Biogeography: How Earth's Climate Shapes
Global Ecosystem Patterns 89**

Positioning Ecosystems: Latitude and Altitude.....	89
Recognizing Major Climate Drivers	90
Bringing on the heat: Differential absorption of the sun's energy.....	91
The wide blue yonder: Atmospheric circulation	93
Making waves around the globe: Patterns of ocean circulation....	96
Separating the Globe into Biomes	98
Tundra to tropics: Terrestrial biomes	99
Depending on depth: Aquatic biomes.....	103
Swimming out to sea: Ocean ecosystems.....	104

Chapter 8: Playing Well with Others: Population Biology 107

Characterizing a Population.....	107
Predicting Population Change	109
Regulating populations with different growth factors	109
Modeling population growth.....	109
Reproducing strategies	112
Watching Species Interact.....	114
Survival of the fittest: Competition.....	114
Eat or be eaten: Predation	115
Mutually surviving: Symbiosis	117
From Indicator Species to Ecosystem Engineers: Filling Every Niche ...	117
Working Together: Biological Communities	119
Succeeding through different stages.....	119
Responding to disturbances.....	120
The People Principle: Human Population Biology	122
Tracking exponential growth	122
Calculating population size	123
Diagramming age structure	124
Experiencing a demographic transition.....	126
Getting caught in a demographic trap	127
Understanding human impacts.....	128

**Part III: Getting Your Needs Met:
Earth's Natural Resources 129****Chapter 9: Water, Water Everywhere: Freshwater Resources 131**

Thirsty for More: The Never-Ending Need for Fresh Water.....	131
Withdrawal versus consumption.....	132
Scarcity and stress	132
Meeting human water needs	133
Finding Fresh Water	136
Diverting surface flow	136
Tapping what flows below: Groundwater	137
Conserving Fresh Water	139
Creating Fresh Water	140

**Chapter 10: This Land Belongs to You and Me:
Land as a Resource 143**

Sharing Land	143
Watching a tragedy unfold: Land resource depletion.....	144
Classifying shared land	144
Managing Land Resources.....	145
Timber! Harvesting the forest	146
Grazing the grasslands.....	147
Questioning Smokey the Bear: Fire management.....	148

Considering the Connection between Urbanization and Land Use 148
 Sprawling across the horizon..... 149
 Growing smarter 150

Chapter 11: Dishing It Up: Food Resources153

Seeking Food Security 153
 Identifying the factors that lead to famine 154
 Eating for health..... 155
 Feeding the world: The green revolution 156
 Digging in the Dirt: Components of Healthy Soil 157
 Learning the ABC’s of soil..... 158
 Considering erosion: The removal of topsoil..... 160
 The Pitfalls of Pesticides 161
 Concocting a formula for every pest..... 161
 Running in circles: The pesticide treadmill..... 161
 Spreading poisons far and wide..... 162
 “Frankenfood”: Genetically Modifying Food 164
 Splicing and dicing chromosomes..... 164
 Debating GMOs 165
 Considering the ethical issues related to GMOs..... 166
 Farming Fish and Other Animals 167
 Eating less efficiently..... 167
 Confining animals for mass production..... 168
 Farming fish 169
 Establishing Sustainable Agriculture 169
 Conserving soil..... 169
 Integrating pest management..... 170
 Defining Organic 172

Chapter 12: Greater Than the Sum of Its Parts: Biodiversity175

Variety Is the Spice of Life: Defining Biodiversity 175
 Examining species richness and evenness..... 176
 Benefitting from biodiversity 177
 Becoming Biodiverse: Evolution by Natural Selection 178
 Combining genetic material..... 178
 Selecting for survival..... 179
 The HIPPO in the Room: Major Threats to Biodiversity 180
 Habitat destruction..... 181
 Invasive species 182
 Pollution..... 183
 Population growth (of the human variety)..... 183
 Overharvesting..... 184
 Creating Effective Conservation Plans..... 184
 Of singular importance: The species approach
 to conservation 185
 Size does matter: Preserving entire ecosystems 186

Chapter 13: Hitting the Hard Stuff: Geologic Resources and Energy	191
Getting to Know the Earth	191
Finding Value in Rocks	193
Rocks and minerals	193
Metals and ores	194
Extracting Geologic Resources	195
Scraping the surface: Surface mining	196
Digging deep: Subsurface mining	198
Forming and Depleting Fossil Fuels	199
Creating rocks from life	199
Down and dirty: Mining and burning coal	199
Perusing petroleum and natural gas resources	201
Reacting to Nuclear Energy	203
Splitting atoms: Nuclear fission	203
Fusing atoms: Nuclear fusion	204
The once and future fuel: Debating nuclear energy	204
 Chapter 14: Shifting Gears: Alternative Energy	 207
Looking for Alternative Energy	207
Farming Fuel: Biofuel Energy Sources	208
Biomass	209
Biodiesel, ethanol, and other liquid biofuels	209
Methane gas	210
Harnessing Energy from Water	211
Damming rivers: Hydropower	211
Feeling the pull: Tidal and wave energy	213
Getting Steamed: Geothermal Energy	213
Soaking Up the Sun: Solar Energy	214
Chasing Windmills: Wind Energy	216
Energy on Demand: Creating Fuel Cells	216
Making the Most of the Energy You Already Have:	
Energy Conservation	217
Cogenerating: A two-for-one deal	218
Building smarter power grids	218
Getting around town more efficiently	219
Capturing energy at home	220

***Part IV: Giving a Hoot: Pollution
and Environmental Quality..... 221***

Chapter 15: Breathing Room: Addressing Manmade Air Pollution . . . 223

Sorting Out Common Pollutants	223
Observing the Effects of Air Pollution	226
Losing vegetation.....	227
Tinting the sky a hazy shade of brown	227
Trapping pollutants: Temperature inversion and smog.....	227
Melting monuments: Acid rain.....	228
Holy Ozone! Remembering the Hole in the Ozone Layer	229
Creating ozone naturally.....	230
Depleting the ozone layer	232
Halting ozone depletion: The Montreal Protocol	233
The Air in There: Watching Out for Indoor Air Pollution.....	234
Clearing the Air	235

Chapter 16: Drip Drop Splash: Water Pollution 237

Polluting Water in Many Ways.....	237
Getting to the Point(And Nonpoint) Source.....	238
Endangering Human Health.....	239
Bacteria, viruses, and parasites, oh my!.....	239
Pesticides, drugs, and metals.....	240
Disrupting Ecosystems	241
Measuring dissolved oxygen	241
Creating zones in aquatic ecosystems.....	242
Growing to extremes: Nutrient pollution.....	243
Breaking with Tradition: Wastewater Treatment and Constructed Wetlands	245

Chapter 17: What's Your Poison? Toxins and Infectious Disease. . . 249

Identifying Common Toxins	249
Sticking Around: Persistent Organic Pollutants	251
Understanding the Ins and Outs of Toxic Exposure	252
Accumulating in fatty tissue: Bioaccumulation	252
Magnifying up the food chain: Biomagnification	253
Risky Business: Assessing the Dangers of Chemicals.....	255
Measuring risk.....	255
Perceiving risk.....	256
Choosing a risk management strategy.....	258
Tracking Infectious Disease	258
Emerging on the scene: Modern infectious disease.....	258
Evolving resistance.....	260

Chapter 18: A River of Garbage Runs through It: Solid and Hazardous Waste	263
Wading into the Waste Stream.....	264
Disposing of Waste.....	265
Tossing it aside and covering it up: Dumps and landfills.....	265
Burning trash: Incineration.....	266
Exporting electronics: E-waste disposal	267
Swimming in Waste: The Ocean Garbage Patches	267
Swirling and whirling: Concentrating trash in ocean gyres.....	268
Fighting photodegradable flotsam.....	269
Stopping trash at the source	270
Reduce, Reuse, Recycle (and Compost):	
Shrinking the Waste Stream	271
Handling Hazardous Waste	272
Cleaning up the mess: The Superfund.....	273
Danger lying dormant: Bringing up brownfields.....	275
 Chapter 19: Is It Getting Warm in Here? Modern Climate Change	 277
Hothouse Humans: The Greenhouse Effect	278
Filling the air: The top six greenhouse gases	279
Recognizing human influences.....	280
The proof is in the isotopes.....	281
Considering Past, Present, and Future Climates	283
The ghost of climates past.....	283
Measuring carbon dioxide levels in the atmosphere.....	284
Tracking patterns of variability	285
Predicting the future: Climate models	286
Feeling the Heat: Environmental Effects of Modern Climate Change ...	287
Facing a Warmer Future.....	290
Feeling the effects on human society.....	290
Turning down the heat: Mitigating human influences	291
Adapting along the way.....	293
 Part V: Follow the Recycled Brick Road: A Sustainable Future	 295
 Chapter 20: Building a Sustainable Future	 297
Overlapping Spheres of Sustainability.....	298
Looking at Ecosystem Lessons	299
Counting Coins: Mainstream Economics.....	300
Measuring Earth's capital	300
Going to the market.....	300
Calculating a nation's wealth	301

Tripling the Bottom Line 301
 Taxing harmful practices 302
 Instituting incentive-based regulations..... 302
 Exercising the Precautionary Principle 303
 Looking at the World in New Ways 304
 Evolving economics..... 304
 Reevaluating production and consumption 305
 It Takes a Global Village: Poverty and Sustainability..... 307
 Seeking justice..... 308
 Microlending a hand..... 309

Chapter 21: Cooperating to Sustain the Earth 311

Understanding What’s at Stake..... 311
 Uniting Nations: International Agreements
 on Planetary Stewardship 312
 The Ramsar Convention on Wetlands..... 312
 The Convention on International
 Trade in Endangered Species 313
 The Convention on Biological Diversity 313
 United Nations agreements 314
 Other international agreements..... 315
 From Sea to Shining Sea: Environmental Protection in the U.S..... 316
 Overseeing environmental regulations..... 316
 Legislating for the environment..... 317

Part VI: The Part of Tens..... 321

Chapter 22: Ten Ways to Live Sustainably. 323

Reducing Household Energy Use..... 323
 Eating Locally 324
 Disposing with Disposables 325
 Planting Seeds 326
 Recycling 326
 Reselling and Donating Items..... 327
 Drinking from the Tap..... 327
 Saving Water 327
 Relying Less on Your Car 328
 Purchasing Fair-Trade Products..... 329

**Chapter 23: Ten Real-Life Examples of the Tragedy
 of the Commons 331**

Grand Banks Fisheries 331
 Bluefin Tuna 332
 Passenger Pigeons 332

Ocean Garbage Gyres.....	333
Earth’s Atmosphere	333
Gulf of Mexico Dead Zone.....	334
Traffic Congestion	334
Groundwater in Los Angeles	335
Unregulated Logging	335
Population Growth	335
Chapter 24: Ten Careers in Environmental Science	337
Marketing Sustainability	337
Restoring Natural Landscapes.....	338
Spreading the Word and Educating Others	338
Continuing Study and Research	339
Defending the Environment	339
Assessing Risk.....	339
Analyzing Policy.....	340
Engineering Solutions	340
Conserving Farm and Ranch Land	340
Advising Investment.....	341
<i>Index</i>	343

Introduction

Environmental science is the study of Earth's environment. To study the environment, scientists draw from many other disciplines, including chemistry, geography, economics, and everything in between. No wonder students new to environmental science often find themselves dizzy at the breadth of information needed to study and solve environmental problems.

Fortunately, you've found *Environmental Science For Dummies*! Regardless of whether you picked up this book to help you through a science class or to begin an independent exploration of environmental science, I hope it's a useful reference for you, providing an introduction to the most important concepts and issues in modern environmental science.

I've written this book to cover as many environmental science concepts as possible, while at the same time helping you understand how these concepts apply to your life. If you're already familiar with some of the topics explained in the book, perhaps this book will help renew your interest in environmental studies and sustainable living. If these topics are completely new to you, I hope it helps you realize that you can take action daily and make choices that affect your environment in a positive way.

About This Book

Environmental Science For Dummies presents an introduction to the core concepts in environmental science and the most important issues studied by environmental scientists today.

The topics in environmental science are so intricately linked that there's simply no way to explain one without explaining a little bit of another as well. In each chapter, I use cross-references to other chapters to help you link together the related concepts and to provide a more complete understanding of the complex topics in environmental science.

Throughout the book, you also find multiple illustrations. These drawings expand on what I've written in places where a visual representation may be helpful. But don't forget to look up from reading once in a while! You have plenty of first-hand experience with the environment. As you read about certain topics or issues, you may find it useful to look at them in the context of your own life.

Conventions Used in This Book

Here are some of the conventions I use in the book to keep things easy to find and follow:

- ✓ Anytime I use a word that I think you may not have seen before, I put it in *italics* and define it.
- ✓ **Boldface** words highlight a bulleted list or sequence of steps.
- ✓ Internet and web addresses appear in monospace to help them stand out.

What You're Not to Read

Throughout this book, you find sidebars highlighted in gray. The sidebars include extra information or particularly interesting tidbits that I thought you might enjoy. I find them interesting — and I hope you do, too — but they aren't required reading to understand the concepts in the book. Feel free to skip these sidebars, as they're not integral to the information presented in each chapter.

Similarly, any portion of text with the Technical Stuff icon beside it indicates that it explains or describes a concept in extra detail, beyond what you need to have a basic grasp of the idea. Feel free to skip these portions or to breeze through them.

Foolish Assumptions

As the author of this book, I've made some assumptions about you, my reader. For instance, I assume that you live on Earth, drink water, breathe air, and use energy for various things such as heating and transportation. I assume that you're familiar with basic geography, such as the location of continents and some countries around the world.

However, I don't assume that you have any background in chemistry, biology, geology, ecology, economics, or any of the other disciplines that are part of environmental science. And you don't need a background in any of these to benefit from the explanations in this book. Wherever the details of another science are important, I provide those details in my explanations.

Each topic in environmental science could fill an entire book of its own, so if you find that something in particular catches your interest, I encourage you to look for books that offer more detail into that topic specifically.

How This Book Is Organized

I've broken this book into chapters and organized those chapters into parts that group topics together. Here's a brief overview of each part.

Part I: Demystifying Science and the Environment

In Part I, I introduce you to environmental science, the study of Earth's environment and the living and nonliving things within it. I describe the scientific method and explain how scientists design effective experiments and portray information by using graphs.

This part includes a discussion of matter, the “stuff” that makes up all things, and a quick look at how atoms bond to form molecules. It describes inorganic matter and the important organic molecules that are the building blocks for life. And it includes a chapter on what scientists understand about energy: what it is, how it works, and how it flows. This is where you find details on photosynthesis and cellular respiration.

Part II: Planting the Seed: Foundational Concepts in Environmental Science

Like any science, environmental science has a few key concepts or principles that provide the foundation for greater understanding. In Part II, I introduce you to these concepts, including how to measure human impact with the ecological footprint and how to use the ecosystem as a unit of study.

The plants and animals that inhabit an ecosystem are determined largely by the climate (temperature and moisture) conditions of the region. Scientists link living communities to climate by classifying ecosystems into defined categories called *biomes*, which I describe in this part.

This part also scratches the surface of *population biology*, which is the study of how organisms interact with one another. I explain competition, cooperation, and predation within an ecosystem, as well as some of the complex ways that scientists measure and track changes in populations (including human populations) over time.

Part III: Getting Your Needs Met: Earth's Natural Resources

A major focus of environmental science is how to use and care for Earth's natural resources so that they can continue to meet the needs of human beings for as long as possible. Part III describes Earth's natural resources and the issues humans face in trying to *conserve* them, or make them last.

You're familiar with some of these resources — water, land, and energy. But you may not realize that the diversity of biological organisms, or *biodiversity*, is also a natural resource. I describe all these resources in this part and explain why biodiversity is so important and why it's in danger in many parts of the world. I also explain the pros and cons of alternative energy sources.

Part IV: Giving a Hoot: Pollution and Environmental Quality

Along with managing natural resources, environmental scientists are often asked to help solve problems created by pollution. Part IV covers topics of environmental quality, including air and water pollution. It's also the place to look for information about what dangerous substances or toxins are present in the environment and how garbage and hazardous waste can be managed to reduce further environmental damage.

This part also addresses what scientists currently understand about Earth's climate and how human actions continue to affect the global climate system.

Part V: Follow the Recycled Brick Road: A Sustainable Future

The goal of most environmental scientists is *sustainability*. This means using the environment and its resources in such a way that it can continue to provide for human needs long into the future, possibly forever. In this part, I describe some basic economic principles and explain how shifting your

perspective from human-centered to ecosystem-centered may lead you to make more sustainable choices as a consumer.

Millions of people with different desires and priorities share Earth. In this part, you uncover some of the most successful policies across the U.S. and across the world that have come about to help protect the environment and conserve Earth's resources for future generations.

Part VI: The Part of Tens

In the final part of *Environmental Science For Dummies*, you find three lists. The first is a list of ten simple ways to live life more sustainably. The second describes ten examples of how unsustainable practices have ruined shared resources, or *commons*. And the last chapter of the book lists ten careers that center on environmental science. You may be surprised at the variety of options you have for working in an environmental science field!

Icons Used in This Book

Throughout this book I use icons to catch your eye and highlight certain kinds of information. Here's what these little pictures mean:



Anytime you see the Remember icon take notice! I use this icon to highlight important information, often fundamental to the concepts being explained around it or in the same chapter. Other times I use it to highlight a statement meant to help you pull multiple concepts together.



The Tip icon marks information that may be particularly useful to help you study or prepare for an exam. It often marks a helpful way to remember a certain concept.



The Case Study icon brings your attention to real-world examples of particular environmental issues. Case studies are a great way to provide context for the concepts I present in the book.



Anywhere I describe a potential solution for an environmental problem I mark it with a Solution icon.



A few places in this book I offer a little extra detail about a particular topic or concept and mark it with the Technical Stuff icon.

Where to Go from Here

I've written this book to function as a reference that you can open to any page and dive into. If you choose to start from the beginning, you'll find the information organized in what I hope is a logical way that answers your questions as soon as you think to ask them! But you can also browse the table of contents to find topics you're interested in knowing more about and then turn to the chapters on those topics.

If you've never thought much about how you're connected to everything around you, you may want to start with Chapter 6, which explains what an ecosystem is and does. This chapter may dramatically change your perspective!

If you're intrigued by the idea of alternative energy sources, flip to Chapter 14, where I cover many different ways to fuel daily living without using fossil fuels (coal, gas, and oil) or nuclear power. Environmental scientists have found ways to capture or produce energy in cleaner, more efficient ways than have ever been possible before.

For a real wake-up call, turn to Chapter 18 to see how the packaging and convenience of modern life (think bottles of water, to-go containers, and plastic utensils) have resulted in oceans full of trash. In particular, plastic bits that don't decompose are interfering with ocean ecosystems, which is just one of the consequences of waste I describe in that chapter.

Part I

Demystifying Science and the Environment

The 5th Wave

By Rich Tennant



"You've almost got the Earth's layers right,
but I don't think there's a creamy nougat
between the mantle and the core."

In this part . . .

At its core, environmental science is like any science — based on a methodical way of asking and answering questions to expand the human understanding of the natural world.

In this part, I describe how the scientific method shapes the process of learning about the environment. I also cover foundational scientific ideas about what makes up everything around you (atoms, molecules, and compounds) and how energy moves things through the environment. This is also where you find out how green plants capture energy from the sun and transform it into sugar through the process of photosynthesis.