

# Essentials of Physical Geography

Sixth Edition

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### Preface

Earth, the life-support system for humankind, is a wondrous and complex place, yet it is also enigmatic. Our planet is in many ways robust and adaptable to environmental change, but in other ways it is fragile and threatened. In our modern day-to-day life, our use of technology has a tendency to insulate us from fully experiencing our environment, and we have become lulled into forgetting about our direct reliance on Earth's natural resources. Sometimes it is hard to imagine that as you read this you are also moving through space on a life-giving planetary oasis surrounded by the vastness of space—empty and, as far as we know, devoid of life. Yet a knowledge of our planet, its environments, and how they operate is as critical as it has ever been for human society.

For as long as humans have existed on Earth, the resources provided by their physical environment have been the key to their survival. Primitive, preindustrial societies, such as those dependent on hunting and gathering or smallscale agriculture, tended to have small populations and exerted relatively little impact on their natural surroundings. In contrast, today's industrialized societies have large populations, demand huge quantities of natural resources, and can influence or cause environmental change, not only locally, but also globally. As the human population has increased, so have the scale, degree, and cumulative effects of its impacts on the environment. Unfortunately, many of these impacts are detrimental. We have polluted the air and water. We have used up tremendous amounts of nonrenewable resources and have altered the natural landscape without fully assessing the consequences. Too often, we have failed to respect the power of Earth's natural forces when constructing our homes and cities or while pursuing our economic activities. As we enter the twenty-first century, it is evident that if we fail to comprehend Earth's potential and respect its limitations as a human habitat, we may be putting ourselves and future generations at risk. Despite the many differences between our current lifestyles and those of early humans, one aspect has remained the same: Our use of our physical environment in all its diversity is still the key to our survival.

Today, this important message is getting through. We understand that Earth has limits and does not offer boundless natural resources. Broadcast and print media have expanded their coverage of the environment and human/environment relationships. Politicians are drafting legislation designed to address environmental problems. Scientists and statesmen from around the world meet to discuss environmental issues that increasingly cross international boundaries. Humanitarian organizations, funded by governments as well as private citizens, struggle to alleviate the suffering that results when human beings cannot cope with the limitations of their physical surroundings or when they wittingly or unwittingly degrade the environments in which they live.

The study of geography is essential to developing a thorough knowledge, understanding, and appreciation of Earth as well as the people who occupy, alter, and rely upon our planet for their continued existence. Long a highly regarded subject in most nations of the world, geography in the last two decades of the twentieth century has undergone a renaissance in the United States. More and more people are realizing the importance of knowing and respecting the people,

cultural contributions, and resources of other nations as well as those of the United States. National standards have been written to ensure that a high quality geographic curriculum is offered to students in American elementary, secondary, and postsecondary schools. Employers across the nation are recognizing the value and importance of geographic knowledge, skills, and techniques in the workplace. Geography as an applied field makes use of computer-assisted and space-age technologies, such as interpretation of satellite images, geographic information systems (GIS), computer cartography, and the global positioning system. At the collegiate level, physical geography offers an introduction to the concerns, ideas, knowledge, and tools that are necessary for further study of our planet. More than ever before, physical geography is being recognized as an ideal science course for general-education students-students who will make decisions that weigh human needs and desires against environmental limits and possibilities. It is for these students that Essentials of Physical Geography has been written.

#### **Features**

Comprehensive View of the Earth System. Essentials of Physical Geography introduces all major aspects of the Earth system, identifying physical phenomena and stressing their distribution and relationships. It covers a wide range of topics, including the atmosphere, oceans and other water bodies, the solid Earth, and the patterns of life on our planet.

Clear Explanation. The text uses an understandable and often narrative style to explain the origins, development, significance, and distribution of processes, physical features, and events that occur within, on, or above the surface of the Earth. The authors' writing style is targeted toward rapid reader comprehension and toward making the study of physical geography an enjoyable undertaking.

Introduction to the Geographer's Tools. The space age and the computer have revolutionized the ways that we can study the environments of our planet. The text provides a full chapter devoted to the tools used by geographers, and illustrations throughout the book include many examples of images gathered from space, accompanied by interpretations of those aspects of the environment that the scenes illustrate. There are also introductory discussions of tech-

niques used by geographers in analyzing or displaying locational and environmental aspects of Earth, including remote sensing, geographic information systems, computer-assisted cartography, and the global positioning system.

Focus on Student Interaction. The text provides numerous ways to promote continuous interaction between students and the subject matter of physical geography. The Consider and Respond activities at the end of each chapter are designed to encourage students to apply their newly acquired knowledge in different and, when possible, problem-solving situations. Answering the queries at the end of the environmental essays requires critical thinking skills, and the legend questions challenge students to react to the illustrations they are examining.

"The Environment" Essays. A series of essays on the environment is included in the text as supplementary reading. The essays deal with current issues such as alternative energy sources, desertification, global warming, rainforest destruction, protection of wetlands, and environmental hazards, including earthquakes, mudflows, and tsunamis.

Map Interpretation Series. The authors consider the learning of map-interpretation skills a major priority in a physical geography course. To meet the needs of students who do not have the opportunity to interact with physical geography in a laboratory setting, the text includes 11 map exercises with accompanying explanations, illustrations, and interpretation questions. This dynamic feature gives all students the opportunity to learn and practice valuable map skills.

#### **Objectives**

Since the first edition, the authors of this book have sought to accomplish several major objectives:

To Address the Academic Needs of the Student. Those instructors who are familiar with the style and content of Essentials of Physical Geography know that this is one textbook written specifically for the student. It has been designed to help meet the major purposes of a liberal education by providing students with sufficient knowledge and understanding to make informed decisions involving the physical environments with which they will interact throughout their lives. The text assumes little or no background in

physical geography or other Earth sciences on the part of introductory-level students. The authors include numerous examples from throughout the world to illustrate difficult concepts and help students bridge the gap between scientific theory and its practical application.

To Integrate the Illustration Program with the Text. Numerous photographs, block diagrams, and other line drawings have been carefully chosen to illustrate each of the complex concepts in physical geography the text addresses. Text discussions of these concepts often contain repeated references to the illustrations. and the student is able to examine in model form. as well as mentally reconstruct, the physical processes and phenomena involved. Particularly good examples of the integration of text and illustration include the sections on seasons (Chapter 3), heat energy budget (Chapter 4), surface wind systems (Chapter 6), atmospheric disturbances (Chapter 8), plate tectonics (Chapter 14), and ice sheets (Chapter 19).

To Communicate the Nature of Geography. The nature of geography as a physical science is discussed at length in Chapter 1, and several underlying themes are identified to illustrate the spatial focus of the discipline. In subsequent chapters, these themes are used as the organizational bases for the presentation of chapter content. For example, location is the major theme of Chapter 2 and remains an important ingredient throughout the text; spatial distributions are emphasized as each of the climatic elements are discussed in Chapters 4 to 7; a changing Earth system is the central consideration in Chapter 9; characteristics of places constitute the content of Chapters 10 and 11; spatial interactions are frequently demonstrated in discussions of weather systems (Chapter 8) and tectonic activity (Chapters 14 and 15); and human-environment interaction is given serious consideration whenever justified. As a part of the course summary, all of the themes are revisited in Chapter 23.

To Fulfill the Major Requirements of Introductory Physical Science College Courses. Essentials of Physical Geography offers a full chapter on the important tools and methodologies of physical geography. Throughout the book, the physical processes that are responsible for the location, distribution, and spatial relationships of physical phenomena beneath, at, and above Earth's surface are examined in detail. Scientific method, hypothesis, theory, and explanation are

continually stressed. Models and systems are frequently cited in the discussion of important concepts, and scientific classification is presented in several chapters—specifically, air masses (Chapter 8), climates (Chapter 9 and the Appendix), biomes (Chapter 12), soils (Chapter 13), and coasts (Chapter 22).

#### **Sixth Edition Revision**

The challenge of revising Essentials of Physical Geography for a sixth edition turned out to be the most difficult the authors have faced in over 20 years. Several reviewers recommended increased numbers of chapters of varying lengths to be focused more directly on specific topics. Others urged expanded coverage in critical areas of physical geography that have recently sparked increased interest on the part of students. The authors had already agreed that the time had come to clearly demonstrate that physical geography could open the door to an interesting, exciting, and highly rewarding future for those individuals who decide to take advantage of its career opportunities. The challenge was to accomplish all of this in addition to thoroughly revising the text; preparing new graphs, maps, and diagrams; selecting dozens of new photographs; and updating the numerous examples of worldwide environmental events that keep physical geography current and topical. What follows is a brief review of major changes incorporated in the sixth edition in an attempt to meet the challenge.

**New Coauthor** The sixth edition of *Essentials of Physical Geography* is privileged to have James F. Petersen of Southwest Texas State University as a new coauthor. Jim's expertise in geographic education, geomorphology, and applied physical geography has been an invaluable asset to this project. His work throughout the book has allowed us to expand in a number of areas, which is sure to benefit students and teachers alike.

Chapter Reorganization. The number of chapters has been increased from 17 to 23. The fundamentals of Earth–sun relationships are covered in a separate new chapter preceding the discussion of solar energy and temperature. Wind systems and ocean currents have been combined in a chapter on global circulation. Climate classification and climate change are treated together in a new chapter. Groundwater is now covered in a separate chapter, and the erosional processes associated with streams in both humid and arid regions are now discussed together in a chapter

entirely devoted to fluvial geomorphology. Wind as an erosional agent receives individual treatment, and content dealing with the world ocean has been subdivided into separate chapters—one dealing with general characteristics and another with processes that produce coastal landforms. In addition, a summary chapter has been added to the textbook to help students reflect on their experiences with a course in physical geography. The authors believe that these changes will provide increased course flexibility and that they have been accomplished without altering significantly the original sequence of topics or forcing instructors to make major changes in syllabi.

New and Revised Text. In addition to the text revision that was essential to chapter reorganization, major new textual material has been added on a variety of topics. These include models and systems (Chapter 1), modern technology and remote sensing (Chapter 2), the solar system (Chapter 3), El Niño (Chapter 6), climate classification and climate change (Chapter 9), paleogeography (Chapter 14), fluvial geomorphology (Chapter 18), and physical geography in the future (Chapter 23). Space was provided for these additions through the condensation of previous text, the removal of redundancy, and the elimination of some supplementary reading.

Enhanced Illustrations. The illustration program has undergone thorough revision for the sixth edition. The new text required new figures, which resulted in the drafting of many graphs and line drawings, the addition of numerous impressive photographs and satellite images, and the development of new maps treating subjects such as climate, soils, and landforms. In addition, over fifty previous figures have been replaced by new photographs and new or revised line drawings. Perhaps most challenging of all, the world distribution maps of population, precipitation, climate, and natural vegetation were redrafted to show new boundaries.

Increased Focus on the Discipline. Several changes in the text have been introduced in the sixth edition to provide students with a better understanding and appreciation of geography as a discipline worthy of continued study and meriting serious consideration as a career choice when choosing a career. The definition of geography, the discipline's tools and methodologies, selected themes in physical geography, and the practical applications of the discipline are all introduced in Chapter 1. In addition, the authors

believe there are few better ways to understand an academic discipline than to learn firsthand from its practitioners. To that end, the Career Vision series has been included in the sixth edition to provide a close look at geographers in the workplace, how they earn their living, and what educational programs prepared them for their occupations. These brief interviews serve to inform students of the essential knowledge and skills associated with the exciting new career opportunities offered those who choose physical geography as their preferred field of study.

A Look at the Future. The addition of Chapter 23 to the sixth edition has provided authors with more than just a chance to summarize the important knowledge and valuable perspectives regarding our planet gained from a course in physical geography. It also provides students with an opportunity to imagine the future role of the subject in their lives as they make their way through the twenty-first century. No student should put Essentials of Physical Geography aside without reading the last chapter.

#### **Ancillaries**

Instructors and students alike will greatly benefit from the invaluable ancillary package that accompanies this text.

**Study Mate.** This student study guide includes specific recommendations focusing its contents as aids to learning. The body of Study Mate is organized to complement the textbook, and for each chapter it gives a chapter outline, a chapter summary, the Define and Recall terminology, Discuss and Review study questions keyed to textbook pages, supplementary reading lists, and a comprehensive pretest that students can use for self-evaluation.

**Earth Systems CD-ROM.** This interactive CD-ROM's video clips, photos, and animations introduce the study of plate tectonics and surface processes in a way the reader will never forget. By presenting the basics of Earth science in the context of today's technology, it serves as an invaluable aid to instructors and students alike.

**Rand-McNally Atlas.** This excellent addition to the textbook is available at minimal cost to student purchasers of the sixth edition of *Essentials of Physical Geography*. Its clear, comprehensive maps make it an invaluable tool for students and a practical complement to the text.

Instructor's Resource Manual and Test Bank. The manual is divided into three sections: The first section provides suggestions for using the many other ancillaries that accompany the text; the second section contains sources for additional instructional aids; and the third section includes recommendations for using the text as a major tool in reaching an instructor's individual course goals and objectives. This final section focuses on course flexibility, textbook features, and chapter-by-chapter responses to the critical-thought questions that appear in several places throughout the textbook. A test bank with a number of questions for each chapter is also included in this volume.

**Computerized Test Bank.** Test banks contain hundreds of multiple-choice, short-answer, and true-and-false test items that may be used for chapter or unit evaluation. The computerized test bank is available in IBM or Macintosh formats.

Lab-Pack. Lab-Pack offers a complete and fully integrated laboratory experience. It includes one or more exercises related to each textbook chapter and over 30 additional learning activities that can help students better understand the important concepts in physical geography. Some of the exercises and learning activities have been modified and included in the text to increase student involvement in the content of physical geography.

**Overhead Transparencies and Slides.** Over 100 carefully chosen color illustrations and photographs are available for use with overhead projectors or slide projectors for classroom presentation.

**Saunders Geography Web Site.** This exciting, up-to-date resource provides students and instructors with a number of intriguing opportunities. Web surfers can get the latest news in the field, go on virtual field trips, work on end-of-chapter quizzes, or find out about other geography textbooks published by Saunders College Publishing.

**Instructor's Resource CD-ROM.** This is a presentation CD-ROM that contains numerous images from this and other texts, as well as animations of earth processes.

**Mapmaking Video.** A unique 30-minute video, "Mapmaking Today and Tomorrow," focuses on mapmaking history, the work of today's

cartographers, and the role maps will play in the future.

**Videodisks.** Also included in the ancillary package are two Saunders videodisks on Earth sciences and geography. These disks contain hundreds of still images as well as live-action and animated footage on such topics as storms, the origins of oceans, and the Big Bang Theory.

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Despite the painstaking efforts of all reviewers, there will always be questions of content, approach, and opinion associated with the text. The authors wish to make it clear that they accept full responsibility for all that is included in the sixth edition of *Essentials*.

Robert E. Gabler
Robert J. Sager
Daniel L. Wise
James F. Petersen
October 1998

# Foreword to the Student

#### Why Study Geography?

In this global age, the study of geography is absolutely essential to an educated citizenry of a nation whose influence extends throughout the world. Geography deals with location, and a good sense of where things are, especially in relation to other things in the world, is an invaluable asset whether you are traveling, conducting international business, or sitting at home reading the newspaper.

Geography examines the characteristics of all the various places on Earth and their relationships. Most important in this regard, geography provides special insights into the relationships between humans and their environments. If all the world's people had one goal in common, it should be to better understand the physical environment and protect it for the generations to come.

Geography provides essential information about the distribution of things and the interconnections of places. The distribution pattern of Earth's volcanoes, for example, provides an excellent indication of where Earth's great crustal plates come in contact with one another; and the violent thunderstorms that plague Illinois on a given day may be directly associated with the low-pressure system spawned in Texas two days before. Geography, through a study of regions, provides a focus and a level of generalization that allows people to examine and understand the immensely varied characteristics of Earth.

As you will note when reading Chapter 1, there are many approaches to the study of geography. Some courses are regional in nature; they may include an examination of one or all of the world's political, cultural, economic, or physical

regions. Some courses are topical or systematic in nature, dealing with human geography, physical geography, or one of the major subfields of the two.

The great advantage to the study of a general course in physical geography is the permanence of the knowledge learned. Although change is constant and is often sudden and dramatic in the human aspects of geography, alterations of the physical environment on a global scale are exceedingly slow when not influenced by human intervention. Theories and explanations may differ, but the broad patterns of atmospheric and oceanic circulation and of world climates, landforms, soils, natural vegetation, and physical landscapes will be the same tomorrow as they are today.

#### **Keys to Successful Study**

Good study habits are essential if you are to master science courses such as physical geography, where the topics, explanations, and terminology are often complex and unfamiliar. To help you succeed in the course in which you are currently enrolled, we offer the following suggestions.

#### **Reading Assignments**

- Read the assignments before the material contained therein is covered in class by the instructor.
- Compare what you have read with the instructor's presentation in class. Pay particular attention if the instructor introduces new examples or course content not included in the reading assignments.

- Do not be afraid to ask questions in class and seek a full understanding of material that may have been a problem during your first reading of the assignment.
- Reread the assignment as soon after class as possible, concentrating on those areas that were emphasized in class. Highlight only those items or phrases that you now consider to be important, and pass over lightly those sections that are already mastered.
- Add to your class notes important terms, your own comments, and summarized information from each reading assignment.

#### **Understanding Vocabulary**

Mastery of the basic vocabulary often becomes the critical issue in the success or failure of the student in the beginning science course.

- Focus on the terms that appear in boldface type in your reading assignments. Do not overlook any additional terms that the instructor may introduce in class.
- Develop your own definition of each term or phrase and associate it with other terms in physical geography.
- Identify any physical processes associated with the term. Knowing the process helps to define the term.
- Whenever possible, associate terms with location.
- Consider the significance to humans of terms you are defining. Recognizing the significance of terms and phrases can make them relevant and easier to recall.

#### **Learning Earth Locations**

A good knowledge of place names and of the relative locations of physical and cultural phenomena on Earth is fundamental to the study of geography.

- Take personal responsibility for learning locations on Earth. Your instructor may identify important physical features and place names, but you must learn their locations for yourself.
- Thoroughly understand latitude, longitude, and the Earth grid. They are fundamental to location on maps as well as on a globe. Practice locating features by their latitude and longitude until you are entirely comfortable using the system.

- Develop a general knowledge of the world political map. The most common way of expressing the location of physical features is by identifying the political unit (state, country, or region) in which it can be found.
- Make liberal use of outline maps. They are the key to learning the names of states and countries and they can be used to learn the locations of specific physical features. Personally placing features correctly on an outline map is still the best way to learn location.
- Cultivate the atlas habit. The atlas does for the individual who encounters place names or the features they represent what the dictionary does for the individual who encounters a new vocabulary word.

#### **Utilizing Textbook Illustrations**

The secret to making good use of maps, diagrams, and photographs lies in understanding why the illustration has been included in the text or incorporated as part of your instructor's presentation.

- Concentrate on the instructor's discussion of slides, overhead transparencies, and illustrations and take notes that will allow you to follow the same line of thought at a later date.
- Study all textbook illustrations on your own and be sure to note which were the focus of considerable classroom attention. Do not quit your examination of an illustration until it makes sense to you, until you can read the map or graph, or until you can recognize what a diagram or photograph has been selected to explain.
- Hand-copy important diagrams and graphs.
   Few of us are graphic artists, but you might be surprised at how much better you understand a graph or line drawing after you reproduce it yourself.
- Read the captions of photos and illustrations thoroughly and thoughtfully. If the information is included, be certain to note where a photograph was taken and in what way it is representative. What does it tell you about the region or site being illustrated?
- Attempt to place the principle being illustrated in new situations. Seek other opportunities to test your skills at interpreting similar maps, graphs, and photographs and think of other examples that support the text being illustrated.
- Remember that all illustrations are reference tools, particularly tables, graphs, and diagrams.
   Refer to them as often as you need to.

#### **Taking Class Notes**

The password to a good set of class notes is selectivity. You simply cannot and, indeed, you should not try to write down every word uttered by your classroom instructor.

- Learn to paraphrase. With the exception of specific quotations or definitions, put the instructor's ideas, explanations, and comments into your own words. You will understand them better when you read them over at a later time.
- Be succinct. Never use a sentence when a phrase will do, and never use a phrase when a word will do. Start your recall process with your notetaking by forcing yourself to rebuild an image, an explanation, or a concept from a few words.
- Outline where possible to discern the logical organization of information. As you take notes, organize them under main headings and subheadings.
- Take the instructor at his or her word. If the instructor takes the time to make a list, then you should do so too. If he or she writes something on the board, it should be in your notes. If the instructor's voice indicates special concern, take special notes.
- · Come to class and take your own notes. Notes trigger the memory, but only if they are your notes.

#### **Doing Well on Tests**

Follow these important study techniques to make the most of your time and effort preparing for

- Practice distillation. Do not try to reread but skim the assignments carefully, taking notes in your own words that record as economically as possible the important definitions, descriptions, and explanations. Do the same with any supplementary readings, handouts, and laboratory exercises. It takes practice to use this technique, but it is a lot easier to remember a few key phrases that lead to ever increasing amounts of organized information than it is to memorize all of your notes. And the act of distillation in itself is a splendid memory device.
- Combine and reorganize. Merge all your notes into a coherent study outline.
- Become familiar with the type of questions that will be asked. Knowing whether the questions will be objective, short-answer, essay, or related to diagrams and other illustrations can help in your preparation. Some instructors place old

- tests on file where you can examine them or will forewarn you of their evaluation styles if you inquire. If not, then turn to former students; there are usually some around the department or residence halls who have already experienced the instructor's tests.
- Anticipate the actual questions that will likely be on the test. The really successful students almost seem to be able to predict the test items before they appear. Take your educated guesses and turn them into real questions.
- Try cooperative study. This can best be described as role playing and consists very simply of serving temporarily as the instructor. So go ahead and teach. If you can demonstrate a technique, illustrate an idea, or explain a process or theory to another student so that he or she can understand it, there is little doubt that you can answer test questions over the same material.
- Avoid the "all-nighter." Use the early evening hours the night before the test for a final unhurried review of your study outline. Then get a good night's sleep.

#### The Importance of Maps

Like graphs, tables, and diagrams, maps are an excellent reference tool. Familiarize yourself with the maps in your textbook in order to better judge when it is appropriate to seek information from these important sources.

Maps are especially useful for comparison purposes and to illustrate relationships or possible associations of things. But the map reader must beware. Only a small portion of the apparent associations of phenomena in space (areal associations) are actually cause-and-effect relationships. In some instances the similarities in distribution are a result of a third factor that has not been mapped. For instance, a map of worldwide volcano distribution is almost exactly congruent with one of incidence of earthquakes, yet volcanoes are not the cause of earthquakes, nor is the obverse true. A third factor, the location of tectonic plate boundaries, explains the first two phenomena.

Finally, remember that the map is the most important statement of the professional geographer. It is useful to all natural and social scientists, engineers, politicians, military planners, road builders, farmers, and countless others, but it is the essential expression of the geographer's primary concern with location, distribution, and spatial interaction.

#### About Your Textbook

This textbook has been written for you, the student. It has been written so that the text can be read and understood easily. Explanations are as clear, concise, and uncomplicated as possible. Illustrations have been designed to complement the text and to help you visualize the processes. places, and phenomena being discussed. In addition, the authors do not believe it is sufficient to offer you a textbook that simply provides information to pass a course. We urge you to think critically about what you read in the textbook and hear in class.

As you learn about the physical aspects of Earth environments, ask yourself what they mean to you and to your fellow human beings throughout the world. Make an honest attempt to consider how what you are learning in your course relates to the problems and issues of today and tomorrow. Practice using your geographic skills and knowledge in new situations so that you will continue to use them in the years ahead. Your textbook includes several special features that will encourage you to go beyond memorization and reason geographically.

- · Consider and Respond. At the end of each chapter, Consider and Respond questions require you to go well beyond routine chapter review. The questions are designed specifically so that you may apply your knowledge of physical geography and on occasion personally respond to critical issues in society today. Check with your instructor for answers to the problems.
- Legend Questions. With almost every illustration and photo in your textbook a legend (caption)

- links the image with the chapter text it supports. Read each caption carefully because it explains the illustration and may also contain new information. Wherever appropriate, questions at the ends of captions have been designed to help you seize the opportunity to consider your own personal reaction to the subject under consideration.
- Map Interpretation Series. It is a major goal of your textbook to help you become an adept map reader, and the Map Interpretation Series in your text has been designed to help you reach that goal.
- Environmental Systems Diagrams. Viewing Earth as a system comprising many subsystems is a fundamental concept in physical geography for researchers and instructors alike. The concept is introduced in Chapter 1 and reappears frequently throughout your textbook. The interrelationships and dependencies among the variables or components of Earth systems are so important that a series of special diagrams (see, for example, Figure 1.4) have been included with the text to help you visualize how the systems work. Each diagram depicts the system and its variables and also demonstrates their interdependence and the movement or exchanges that occur within each system. The diagrams are designed to help you understand how human activity can affect the delicate balance that exists within many Earth systems.

As authors of your textbook, we wish you well in your studies. It is our fond hope that you will become better informed about Earth and its varied environments and that you will enjoy the study of physical geography.

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