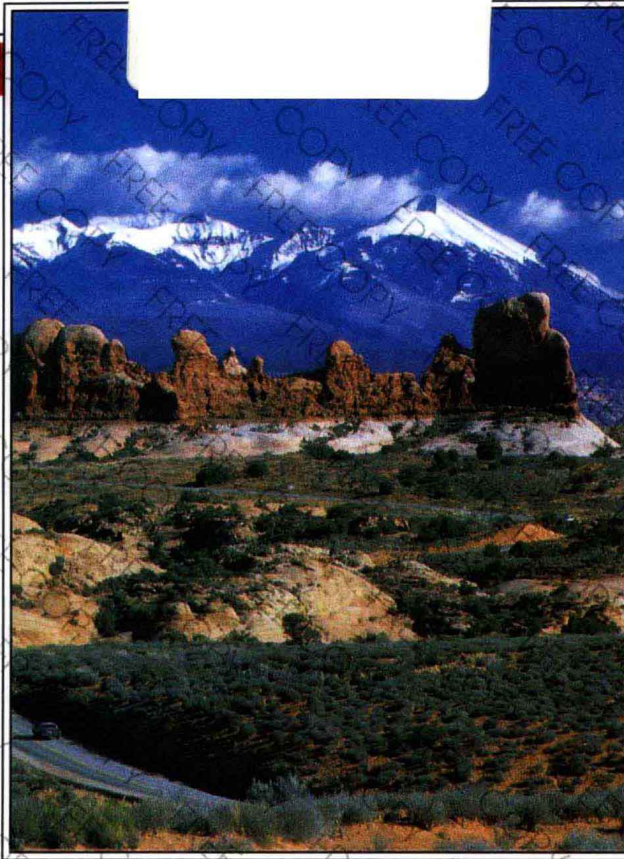


Essentials of Physical Geography

Ralph C. Scott





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Preface

As we enter the 1990s, geographic education in North America seems to be experiencing a long-overdue revival. Students, educators, and the general public are once again coming to realize that other places, and the events that occur in them, have an important bearing on our own lives. Especially crucial to our future well-being is the recent growth in public environmental consciousness. Our planet is a finely balanced and fragile one, and humanity now has a greater potential than ever before to alter permanently its physical characteristics. It is essential that the next generation of leaders gain an understanding and appreciation of the environment greater than that of the leaders of the past.

My primary goal in writing this book is to provide its readers with some understanding and appreciation of the world around them. The book is intended chiefly for college undergraduate students with limited physical science and geography backgrounds. Most of these students will likely be taking a geography course to help meet general university requirements; others, I hope will be taking it as an early course within a geography major program. This book is approximately 20 percent shorter than my previous textbook, *Physical Geography*, also published by West Publishing Company. Its somewhat reduced scope should make it easier to cover within the time constraints of a one-semester or one-quarter course.

The optional sequence of topics in a physical geography course has long been a popular subject of debate among those who teach in this field. Before I began writing this book, we surveyed a large group of physical geography instructors to assess their feelings on this important matter. A clear-cut majority believed that the

first of the “big four” subjects to be covered should be weather and climate, followed, in turn, by treatment of natural vegetation, soils, and landforms. I have followed this suggested order in this book. For those who prefer other sequences, the material in each of these sections is, I believe, sufficiently self-contained that there should not be any major problems of comprehension or continuity if the chapters are covered out of numerical order.

The approach I have used for each topic was called by one reviewer the “process/distribution approach.” By this he meant that a certain amount of general science background material appears first to explain the origin and characteristics of the topic. This is followed by a discussion of the topic’s geographical distribution and, finally, by the reasons for its distribution. Throughout the book, I have tried to stress the causative and distributional linkages among the various earth phenomena.

I have treated the subject of human interaction with the natural environment lightly in the main body of the text itself. This is not because this factor is unimportant; rather, it is because there is simply not enough space to systematically cover this crucial subject in an introductory physical geography textbook. Important environmental concerns are, however, discussed in the Case Studies found at the end of most chapters and in many of the Focus boxes scattered throughout the text. I hope that these studies will promote student interest, will illustrate the relevance of the material to contemporary issues, and will foster an increased environmental consciousness.

A number of additional learning aids have been provided in the text. At the beginning of each chapter is a subject outline and several Focus Questions that pose

broad questions addressing the core subjects of the chapter material. Within the body of the chapters, key terms appear in boldface type for easy recognition, while other important terms are italicized. At the end of each chapter is a summary, a number of review questions, and a listing of the key terms. An index and extensive glossary appear at the end of the text, and appendix sections deal with the topics of scale conversions, maps and remote sensing, and weather map interpretation. In addition, you have probably already noted that the book is extensively illustrated with full-color photographs, maps, and diagrams.

West has also provided a comprehensive package of ancillaries that I believe will greatly aid adopters of this book. These include an instructor's manual, a laboratory manual, a student study guide, a computerized study guide available for IBM and Macintosh, and a computerized test bank for IBM, Macintosh, and Apple computers. A set of nearly 60 color slides or overhead transparencies of the more important maps and diagrams in the text is also available for teachers using the book. In addition, a free *PC Globe 3.0* program is available for adopters. Please contact the publisher for further information on these materials.

Acknowledgments

The writing of a book such as this is a massive and time-consuming undertaking, especially for a single author. Its preparation involves a great many individuals, all of whom are essential to its eventual successful completion.

I would first of all like to thank the editorial and production staff at West, some of whom I have never met, who enabled this book to become a reality. Foremost among these individuals is my Acquiring Editor, Clark Baxter, who persuaded me to write a second book just when I was beginning to recover from the first one. In addition, Nancy Crochiere, our Developmental Editor, has provided expert analyses of the numerous manuscript reviews and has kept me on the right track with regard to proper procedures. Beth Kennedy, our Promotion Manager, has been responsible for the development of advertising brochures and for making sure that they reached potential users of the book. Lastly, the individual who has almost been single-handedly turning my manuscripts into books is my good friend Nancy Roth, our Production Editor.

Another group of individuals whose long hours of work with the manuscript have been vital to both its content and quality have been the reviewers. The work of many of the reviewers of my book *Physical Geography* is also reflected in the content of this book, and I would again like to thank them all for their generous assistance. I wish particularly to thank seven reviewers who worked with the manuscript for *Essentials of Physical Geography*. They are William D. Brooks, Indiana State University; Anthony Orr Clarke, University of Louisville; Robert Cullison, Essex Community College; Donald W. Duckson Jr., Frostburg State University; Dennis Edgell, Kent State University; David Fitzgerald, St. Mary's University; Roland L. Grant, Eastern Montana College; Clark Hilden, Blue Mountain Community College; Solomon A. Isiorho, Indiana University-Purdue University, Fort Wayne; Rudi Kiefer, University of North Carolina-Wilmington; Steve LaDochy, California State University-Los Angeles; Francis Magilligan, Georgia State University; Bob Phillips, University of Wisconsin-Platteville; David R. Privette, Central Piedmont Community College; Robert Quinn, Eastern Washington University; Michael Sady, Western Nevada Community College; Brent R. Skeeter, Salisbury State University; Jim Switzer, Southwestern College; Paul Weser, Scottsdale Community College. I also want to thank John Morgan, of Towson State University, for his careful review of the map appendix material, and for supplying information on geographic information systems for use in the appendix.

Still another group of people who played a key role in this project were the artists and photo suppliers. I wish especially to thank Alice Thiede, who drew most of the maps appearing in the book, and the artists at Rolin Graphics, who produced most of the figures and graphs. The majority of the photos were supplied by John S. Shelton, the U.S. Geological Survey, JLM Visuals and H. Armstrong Roberts, Inc. Others were provided by David Butler of the University of Georgia, by my Towson State University colleagues Wayne McKim and John Morgan, and by my mother, Jerry Scott.

Lastly, I again owe a huge debt of gratitude to my wife Judi, who has spent countless hours typing, and on occasion editing, the manuscript. I wish also to thank my daughter Kelli, who provided valuable typing service during the latter, hectic stages of the manuscript preparation period.

Ralph C. Scott

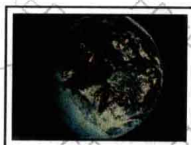
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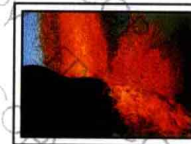
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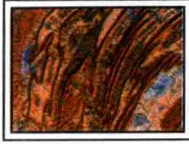
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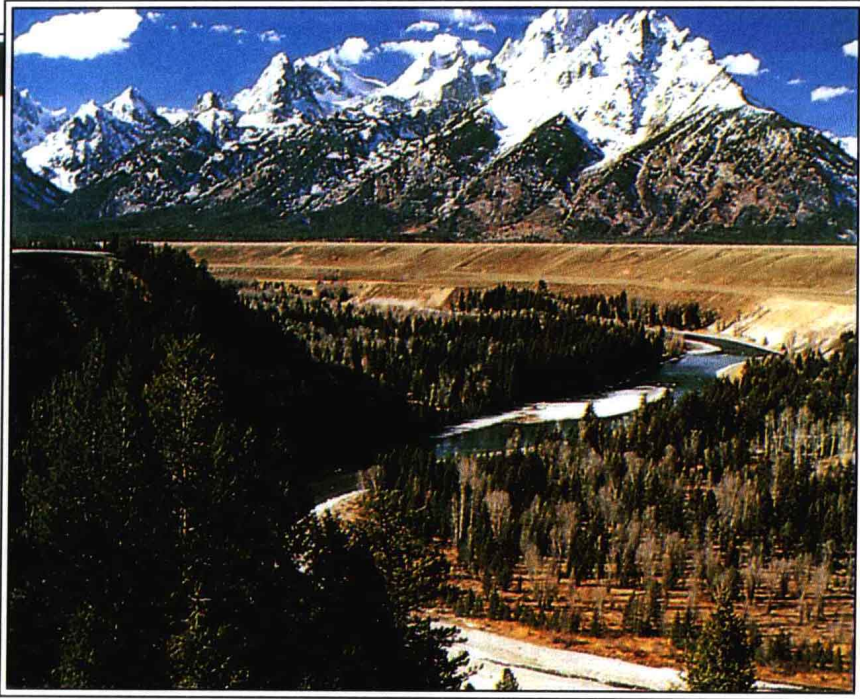


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Introduction

THE DISCIPLINE OF GEOGRAPHY

Most fields of knowledge today are systematically defined; that is, they study everything about one *topic*. An example of a topically oriented discipline is biology, which is the study of living organisms. All lifeforms as well as the environmental factors that directly influence them fall within the bounds of accepted biological studies.

An alternate approach in defining a field of knowledge is to study everything from a single *perspective*. In this case, the topics that can be examined are not restricted, but each topic is properly examined only from the single perspective of the discipline. History, which studies how things change through time, is organized in this fashion. Another such discipline is **geography**, which is concerned with the locational aspects of phenomena. Because virtually all topics change through time and vary in location, neither history nor geography is topically constrained.

The phenomena that can be studied geographically include not only physical objects like people, rivers, or types of vegetation, but also less tangible things such as religious beliefs, military alliances, or tastes in music or clothing. The distributions of these phenomena are not random; everything has a reason for being located where it is. In nearly all cases, the distribution of one type of thing is influenced by the presence or distribution of other things. For example, factors such as climate, landforms, patterns of transportation routes, and the availability of housing and employment influence human population distributions. Factors such as availability of solar energy, proximity to water bodies, and elevation control world climate patterns. In examining the causes for the distributions of earthly phenomena, geographers cannot avoid noting that interrelationships exist among them. The systematic study of these interrelationships has therefore also become a focus of geographic research.

Geographers feel that most fields of knowledge, especially those with rigidly defined topical boundaries, do not adequately emphasize the broader relationships that exist between their topics and other phenomena. The familiar expression of being “unable to see the forest for the trees” is particularly applicable in this context. While many fields of study, by analogy, may provide their practitioners with detailed knowledge of individual trees, the geographer is more concerned with the characteristics of the forest as a whole. Geography is an integrative discipline, then, with a wide breadth of

coverage (see Figure I.1). Like a person assembling a jigsaw puzzle, the geographer’s goal is to put enough pieces of knowledge about the earth and the universe in their proper locational settings to see the “big picture.” The following definition summarizes the concepts presented in the preceding paragraphs: *Geography is the study of the distributions and interrelationships of phenomena*. The geographer is therefore concerned both with the locations of things and with the causes and consequences of those locations. A basic objective of geographic research is to understand better the nature of places, and especially **how** distributions of earth phenomena interact to cause similarities and differences between places. The ultimate goal of geography is to develop, through a sufficient understanding of spatial interaction, a comprehension of the entire earth as a functioning system.

Subdivisions of Geography

As the examination of a college textbook will show, the major academic disciplines are typically subdivided into

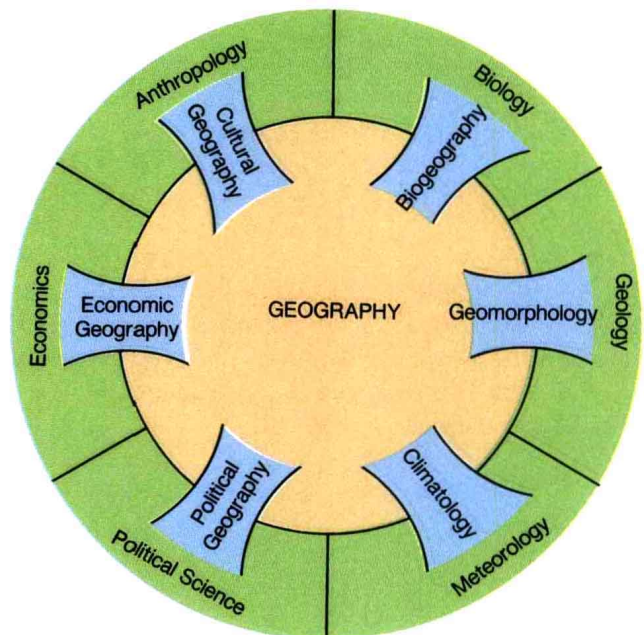


Figure I.1 Geography overlaps with most topically defined fields of knowledge, because each contains spatial components.

(Source: Reprinted with permission from Julia A. Tuason, “Reconciling the Unity and Diversity of Geography,” *Journal of Geography* vol. 86, no. 5, p. 193.)

units of material. The field of geography is no exception. Although geography as a whole is defined by its method of approach rather than by topic, its subdivisions are topically defined. While the basic spatial emphasis remains, each branch of geography deals with a different category of earth phenomena.

A hierarchy of geographical subdivisions exists, and in general, the more advanced a study is, the more narrowly its topical borders are defined. At the most general level, the field of geography is partitioned into two major branches: physical geography and human geography. **Physical geography** is concerned with locational aspects of natural earth phenomena—that is, with those not produced or primarily controlled by human beings. The four major divisions of physical geography are weather and climate, the earth's surface features (including landforms and water bodies), natural vegetation, and soils. Most of this textbook is devoted to the geographical analysis of these four subjects.

Human geography, conversely, deals with those subjects whose distributional patterns are largely or entirely controlled by people. Included are such topics as patterns of population, agricultural and industrial activities, urban areas, religion, transportation routes, political regions, and recreational facilities. A basic understanding of physical patterns, however, is important to the human geographer, as well as to any other informed person, because the earth's physical environment affects nearly all human activities.

In reality, the interaction of earth phenomena, both physical and human, produces a great deal of topical overlap, both in geography and in other disciplines. Geographers, because of their interests and breadth of training, are especially able to appreciate these interrelationships. Geography, then, is both a physical and a social science, and one of the geographer's chief goals is to emphasize the interconnections among the two groups of phenomena.

FUNDAMENTAL GEOGRAPHICAL CONCEPTS

The geographic distribution of the earth's physical features, as already noted, is not the result of chance, but exists in response to natural laws, which provide reasons for the characteristics and locations of terrestrial phenomena. A basic understanding of these laws makes the study of physical geography, and, indeed, of any physical science, much more logical and intellectually

satisfying. Explanations for the distribution of the earth's features will be an essential component of our geographic study throughout the book.

An important method of geographical analysis is the formulation of **regions** that display relative similarity in selected attributes. Regionalization simplifies and organizes patterns of earth phenomena and aids geographers in understanding why these patterns exist. Throughout this book, regional patterns of physical earth phenomena are displayed on maps and diagrams and their causes and characteristics are discussed.

The fact that all earthly phenomena are to some extent interrelated means that any action that affects one component will ultimately influence everything else. We can therefore view the earth as a single system of enormous complexity. A **system** is a set of interrelated components through which energy flows to produce orderly changes. In contrast to a **closed system**, which contains a finite and confined supply of energy, an **open system** has access to an unlimited supply of energy from one or more external sources. The earth system can be considered as an open system powered by two different "unlimited" energy sources. These consist of solar energy and of heat from the decay of radioactive elements inside the earth. The total quantity of energy reaching the earth system from these two sources is relatively constant but is capable of powering a great number of earth processes because of the many routes it can take as it permeates the earth system.

The earth system is composed of a number of interconnected subsystems, often described as "environmental spheres" (see Figure I.2). The four major subsystems are the *atmosphere*, the ocean of air that overlies the entire earth's surface; the *hydrosphere*, the water of the surface and near-surface regions of the earth; the *lithosphere*, the massive accumulation of rock and metal that forms the solid body of the planet itself; and the *biosphere*, the layer of living organisms of which we are a part. All four respond in various ways to the flow of energy and materials through the earth system. The resultant distributional patterns and movements of these subsystems form the basis for the material content of this book.

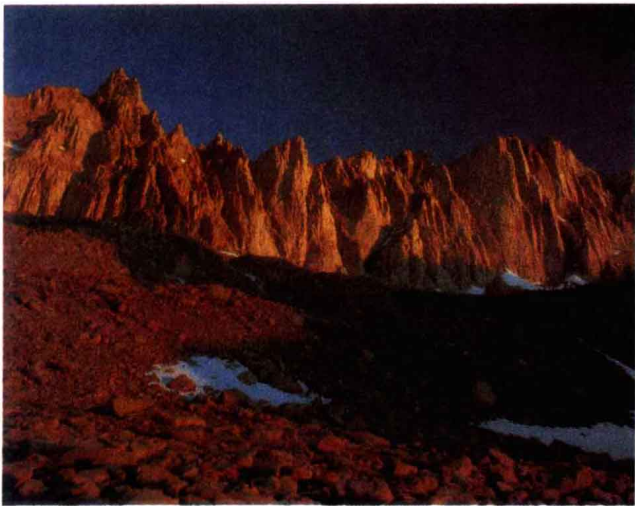
Human activities are increasingly altering or disrupting natural terrestrial processes. This disruption produces rapid environmental changes, often of an undesirable nature. Although this textbook deals primarily with the natural environment, Case Studies at the end of each chapter and Focus Boxes throughout the text examine human influences on the environment.



(a)



(b)



(c)



(d)

Figure I.2 The four major terrestrial subsystems, or "environmental spheres," are the (a) atmosphere, (b) hydrosphere, (c) lithosphere, and (d) biosphere. (a: Jerry Scott; b & c: H. Armstrong Roberts; d: M. Thonig/H. Armstrong Roberts)

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The following books are recommended for those seeking a more comprehensive discussion of geographic methodology, philosophy, and history:

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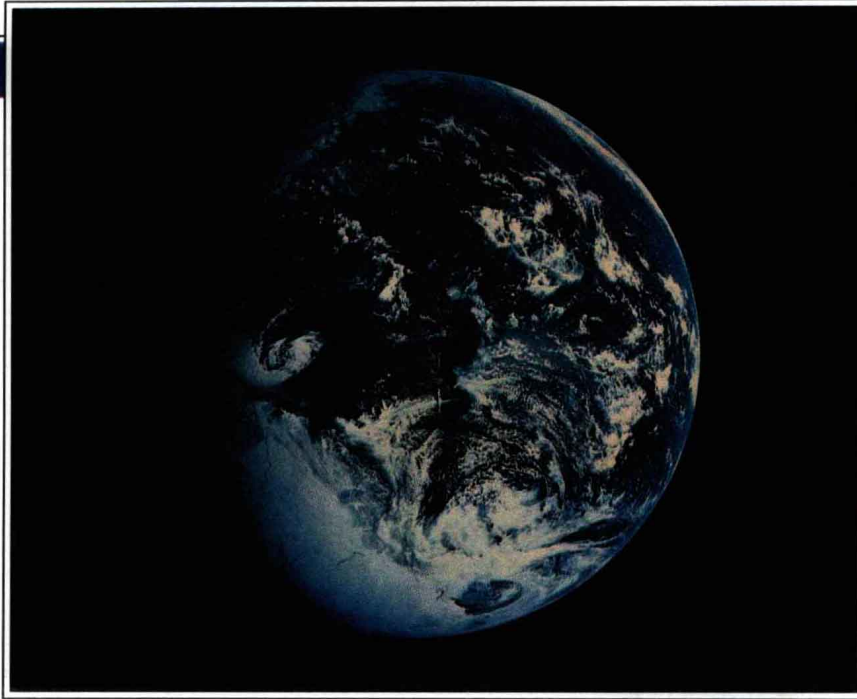
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Key Terms

Geography	System
Physical geography	Closed system
Human geography	Open system
Region	

Chapter One



The Planetary Setting

Outline

- The Place of the Earth in the Universe
- Planetary Motions
 - Large-scale Motions
 - Small-scale Motions
- Size and Shape of the Earth
 - Departures from Perfect Sphericity
- Directions
 - Magnetic North and South
- Latitude and Longitude
- Time
 - Local Time
 - Standard Time
 - Daylight Saving Time
- The Seasons
 - Cause of the Seasons
 - Lengths of Day and Night

Focus Questions

1. What is geography? How does the geographic approach differ from other approaches to information?
2. What is the geographical setting of the earth in space, and what movements is it making through space?
3. How is the global system of time zones organized?
4. What causes the changing seasons?