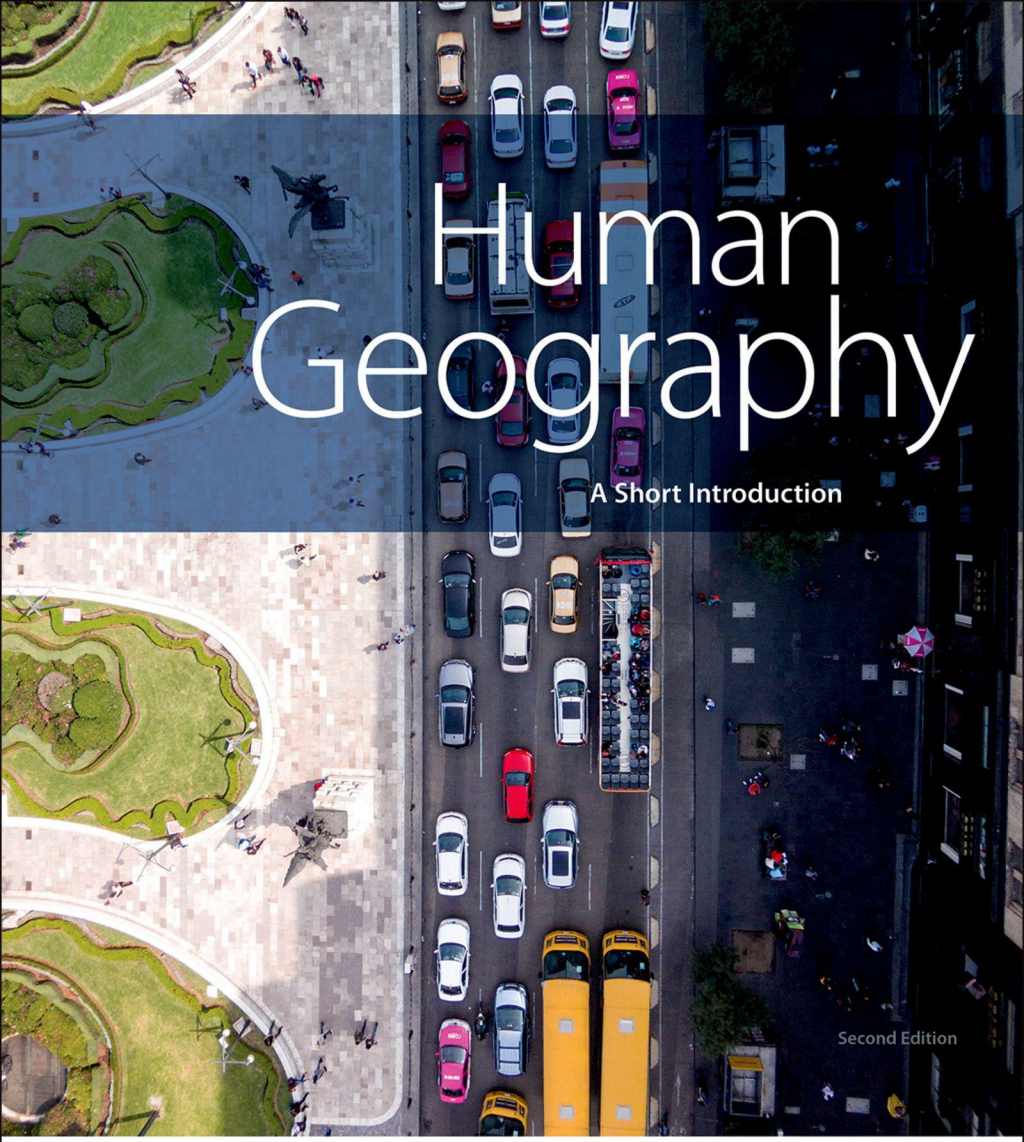


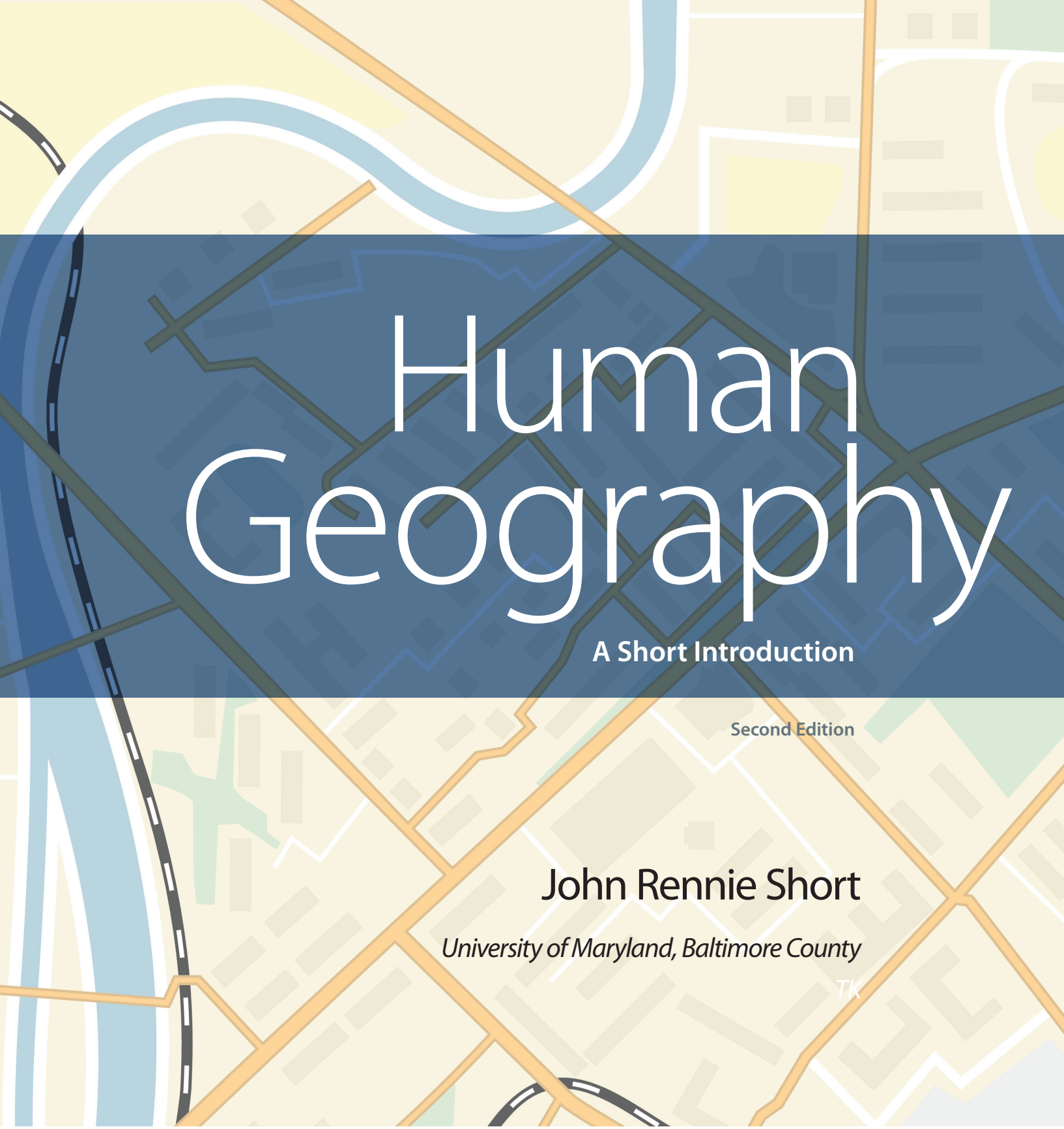
Human Geography

A Short Introduction

Second Edition

John Rennie Short

OXFORD
UNIVERSITY PRESS



Human Geography

A Short Introduction

Second Edition

John Rennie Short

University of Maryland, Baltimore County

TK

New York Oxford
OXFORD UNIVERSITY PRESS

Oxford University Press is a department of the University of Oxford. It furthers the University's objective of excellence in research, scholarship, and education by publishing worldwide. Oxford is a registered trade mark of Oxford University Press in the UK and certain other countries.

Published in the United States of America by Oxford University Press
198 Madison Avenue, New York, NY 10016, United States of America.

Library of Congress Cataloging-in-Publication Data

Names: Short, John R., author.
Title: Human geography : a short introduction / John Rennie Short, University of Maryland, Baltimore County.
Description: Second edition. | New York : Oxford University Press, [2018] | Includes bibliographical references and index.
Identifiers: LCCN 2017014395 (print) | LCCN 2017023027 (ebook) | ISBN 9780190679880 | ISBN 9780190679835 (pbk.) | ISBN 9780190679927 (looseleaf)
Subjects: LCSH: Human geography.
Classification: LCC GF41 (ebook) | LCC GF41 .S488 2018 (print) | DDC 304.2—dc23
LC record available at https://lccn.loc.gov/2017014395

Printing number: 9 8 7 6 5 4 3 2 1

Printed by LSC Communications, Inc.

I dedicate this book to the memory of two of my grandparents.

My paternal grandmother, Janet Adamson Craig Short (1895–1966), had a profound respect for learning and social justice, an endless devotion to my education, and an almost infinite patience with my spelling lessons. I think of her often, especially when my thoughts turn to the connections between love and teaching, devotion and education, wonder and learning.

My maternal grandfather, John Rennie (1903–1963), was a coal miner who spent all his working years in the darkness and the danger. Perhaps because he worked in such cramped and tight spaces, in one memorable holiday, just the two of us, he gave me a sense of limitless freedom.

Brief Contents

PART 5

The Global Organization of Space

PART 6

The Political Organization of Space

PART 7

The Urban Organization of Space

Contents

Preface

The aim of this book is to introduce students to a wide range of important and exciting work in human geography. The primary audience is students in colleges and universities. I decided to write this book because many of the standard texts are too big, and increasingly too expensive, to provide the accessible and affordable base most of us need for our human geography courses. I sense a pushback by teachers and students against the overly large and expensive books available now. They have grown into, to use Henry James's description of many nineteenth-century novels, "loose and baggy monsters." There is room for a more interesting and subtle book than the standard texts. This briefer and more accessible alternative is written in a more familiar style that can be augmented by other resources.

As a former mountain climber I will use as metaphor the attempts on the big Himalayan peaks. In the 1970s, the attempts were increasingly organized as large teams with many climbers and elaborate systems of camps and base camps. Then, in the late 1970s, a number of climbers dispensed with the large teams and sought to climb alone or with one other climber. Less burdened by organizational weight, they were much more successful in reaching the summits in quick direct assaults. This book adapts a similar ethic of "light and fast" that affords more flexibility to instructors than a traditional textbook. Not an exact metaphor, to be sure, but close enough to give you a sense of the book's character and mission.

The title, *Human Geography: A Short Introduction*, employs the word "short" in two ways. First, it indicates a relatively brief introduction rather than a wide survey—although only in the word-rich world of college textbooks can a 100,000-word text be described as short; "concise" may be a more appropriate term. Second, the play on my own name is to signal that it is a book with a distinctive authorial voice. Textbooks are written at specific times in specific places by specific people, and these three basic facts color and shape the material covered and the nature of the coverage. I have drawn heavily on much of my own work conducted over the past thirty-five years. The main title announces the subject matter, while the subtitle lets the reader know that it is the world of human geography as seen by just one person. This is less an act of egotism than a reminder to the reader that the text is not revealed truth but the singular vision of just one scholar.

The aim is to be both engaging and comprehensive. The text is intended to be both student- and instructor-friendly. The structure, while providing a coherent whole, also allows sectional choices to meet the different needs, time constraints, and interests of individual instructors. Each chapter has a list of further readings and websites that instructors can employ in teaching and develop as resources in ways suitable for the size and constitution of their particular classes.

This is an ambitious book that gives readers a sense of the complex human geography of the contemporary world. It brings together a global perspective with an understanding of national concerns and the growth of select urban regions. Broad arguments are enlivened with detailed case studies. The writing style is accessible to the general reader, and the scholarship is comprehensive, so that different interpretations are presented. Six large themes dominate:

- the relationships between people, environment, and resources,
- the economic organization of space,
- the cultural organization of space,
- the global organization of space,
- the political organization of space,
- the urban organization of space.

Running through a discussion of these broad themes are case studies that include examples of specific places as well as examples of the geographical imaginations—models, ideas, and theories—that inform and shape the relationship between people and their environments.

Part 1 sets the context. The first chapter provides a brief introduction to the physical geography of the world, while the second provides an intellectual context by discussing major themes in the development of the discipline of human geography. Not all human geography courses include these topics, but I feel they have a place. To understand contemporary human geography, it is necessary to have a basic grounding in the physical geography of the planet and the intellectual history of the discipline. This section is an elective for those with the time to set the course in its broader physical and intellectual history. Some may elect to move straight to Part 2, which makes the connections between population, environment, and resources. Part 3 discusses the economic organization of space. Part 4, new to the second edition, looks at the cultural organization of space and focuses on the important geographies of population and culture. This section is important because one can't understand much that is current these days without a certain

understanding of human populations, languages, and religions. Part 5 centers on the analysis of global trends and processes. Many introductory texts have only one chapter devoted to globalization, almost as an afterthought. An important part of contemporary scholarship identifies the global scale as important for understanding a wide variety of the world's most pressing issues. The book will enable readers to make sense of complex and seemingly unrelated global and regional phenomenon. Part 6 examines the political organization of space. Here I take as the starting point the idea that space embodies and contains power relations. The book concludes with Part 7, which focuses on cities, now home to the majority of the world's population. Specific chapters examine trends of urbanization, urban networks, and the internal structure of the city.

The text is constructed so that instructors can tailor the readings to suit class needs. The entire book may be used, but some may want to exclude the introductory chapter, while others may want to focus on just four of the five major topic areas. Those with a more economic interest, for example, will certainly want to include Part 3, while those with more cultural emphasis will definitely use Parts 4 and 5. Those with focus on political geography will use Part 6 and those with an interest in cities will use Part 7. Each of the sections is self-contained, so an instructor may elect to choose any four or five and leave more time for other class activities.

New to the Second Edition

A second edition allows for improvements on the first. There are four major changes.

- The first is the addition of an entire new section entitled *The Cultural Organization of Space* that includes three new chapters on the geography of population, geography of religion, and the geography of language. The most recent works in these traditional concerns of human geography are explored and explained.
- The second major change, afforded by a second edition, is a full revision of the entire text making it an even more up to date source of the latest geographical work.
- The third major change is to make the text more student-friendly. Each chapter now opens with a list of learning objectives and closes with a list of learning outcomes. Key terms for each chapter are bolded and defined in a new glossary of over 160 entries. More subheadings make it easier to navigate the text and follow the narrative flow. All these changes make the text even more accessible to teachers and students.
- The fourth change is to the look of the book. New figures, illustrations, and maps complement the revised text. Along with the new fresh design the book is visually appealing and pedagogically adaptable.

Teaching and Learning Package

This book is supported by a carefully crafted ancillary package designed to support both professors' and students' efforts in the course:

- *Digital files of all the graphics in the book*. Instructors will find all of the images from the book available to them, both as raw jpegs and pre-inserted into PowerPoint.
- The book is accompanied by a full complement of digital, interactive materials available on a companion web site (www.oup.com/us/short), via Oxford University Press' Dashboard platform (see description below), or for single sign-on use with most local course management systems. Included here are:
  - *Review questions for students*. Carefully crafted by experienced instructors, these computer-graded review questions accompany each unit of the textbook. Professors can assign them for homework, or students can use them independently to check their understanding of the topics presented in the book.
  - *Interactive exercises based on curated resources*. These exercises—more extensive than chapter review exercises—guide students through visualizations and animations about key geographic topics. These interactives are assignable, and include homework exercises and questions for review.
  - *Test questions and testing software*. Written by experienced instructors and answerable directly from the text, these questions provide professors and instructors with a useful tool for creating and administering tests.
  - *Dashboard*. A text-specific, integrated learning system designed with clear and consistent navigation. It delivers quality content and tools to track student progress in an intuitive, web-based learning environment. Dashboard features a streamlined interface that connects instructors and students with the functions they perform most, simplifying the learning experience to save time and put student progress first.

Instructors should contact their Oxford University Press representative for more information about the supplements package.

Acknowledgments

I'd like to thank the many thoughtful scholars who, during the writing process, dedicated valuable time to reviewing and offering comments on the manuscript. Their comments improved the book significantly.

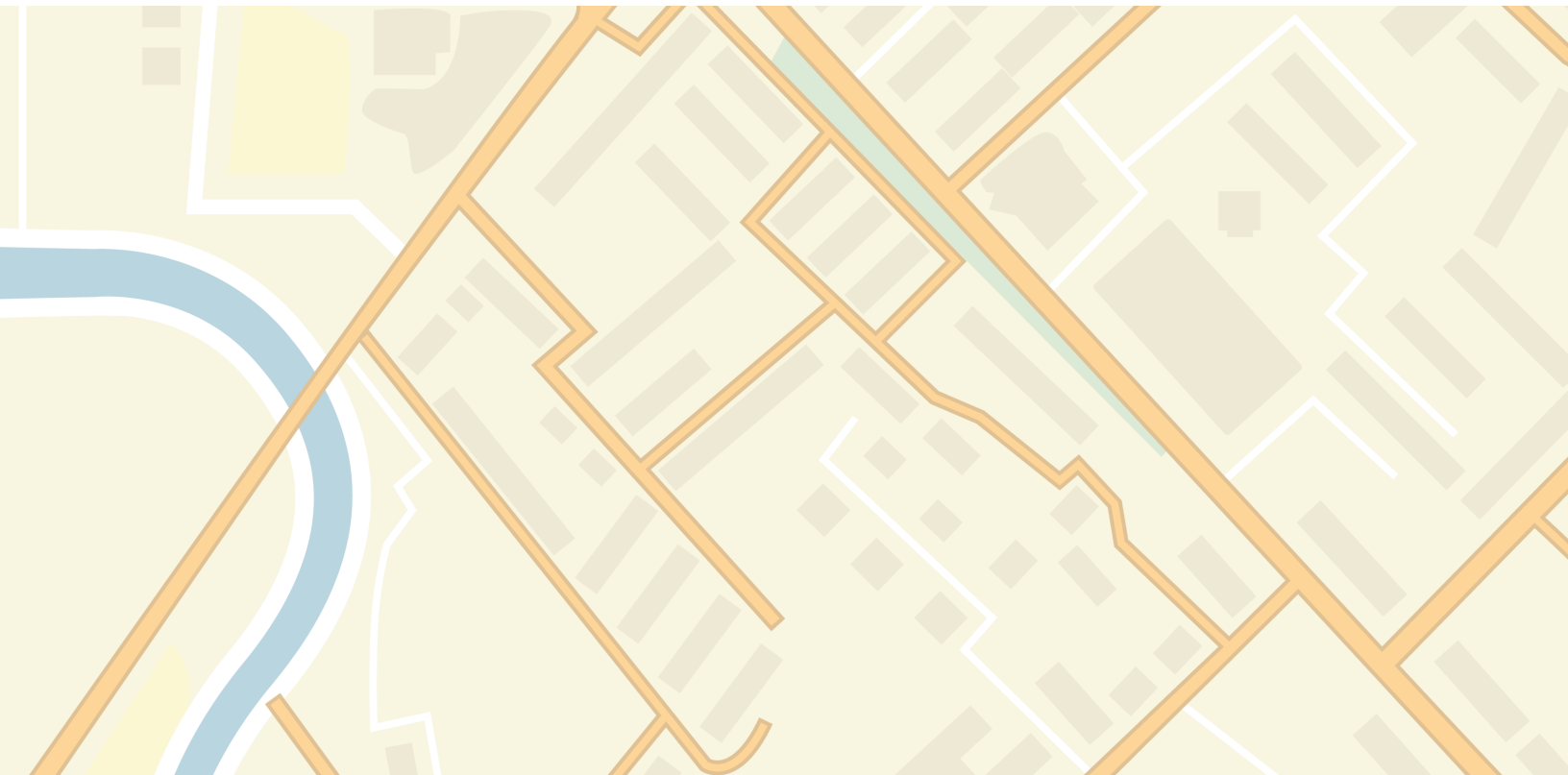
Jeff Baldwin, *Sonoma State University*
Randy Bertolas, *Wayne State College*
Brian Blouet, *The College of William and Mary*
Gina M. Bryson-Prieto, *Hialeah-Miami Lakes Senior High School, Miami, FL*
Karl Byrand, *University of Wisconsin Colleges*
Dorothy Cassetta, *Carroll High School, Southlake, TX*
Thomas Chapman, *Old Dominion University*
Patrick Clancy, *Strath Haven High School, Wallingford, PA*
Timothy W. Collins, *University of Texas at El Paso*
Daniel J Dempsey, *College of the Redwoods*
Mike DeVivo, *Grand Rapids Community College*
Elizabeth Dunn, *University of Colorado Boulder*
Owen Dwyer, *Indiana University–Purdue University Indianapolis*
Kyle T. Evered, *Michigan State University*
Adrienne Goldsberry, *Michigan State University*
Richard Grant, *University of Miami*
Steven M. Graves, *California State University, Northridge*
Benjamin Harris, *Bishop Kelly High School, Boise, ID*
Ann Fletchall, *Western Carolina University*
Joshua Hagen, *Marshall University*
Stephen Healy, *Worcester State University*
Peter R. Hoffman, *Loyola Marymount University*
Valentine Udoh James, *Clarion University of Pennsylvania*
Richard E. Katz, *Roosevelt High School, Seattle, WA*
Heidi Lannon, *Santa Fe College*
Jonathan Leib, *Old Dominion University*
Donald Lyons, *University of North Texas*
Heather J. McAfee, *Clark College*
Richard Medina, *George Mason University*
Douglas C. Munski, *University of North Dakota*
Nancy J Obermeyer, *Indiana State University*
Linda F. Pittman, *Richard Bland College*
Nathan J. Probasco, *Briar Cliff University*
Darren Purcell, *University of Oklahoma*
William Rowe, *Louisiana State University*
James C. Saku, *Frostburg State University*
Arun Saldanha, *University of Minnesota*
Richard H. Schein, *University of Kentucky*
Colleen Schmidt, *Carnegie Vanguard High School, Houston, TX*
Roger M. Selya, *University of Cincinnati*
Jeremy Slack, *The University of Texas at El Paso*
Jill Stackhouse, *Bemidji State University*
Thomas Sullivan, *University of Montana*
Selima Sultana, *University of North Carolina at Greensboro*
Kate Swanson, *San Diego State University*
Rajiv Thakur, *University of Tennessee*
Scott Therkalsen, *Grossmont Community College*
Paul M. Torrens, *University of Maryland, College Park*
Amy Trauger, *University of Georgia*
Erika Trigoso, *University of Denver*
Nicholas Vaughn, *Indiana University*
Jamie Winders, *Syracuse University*
David J. Wishart, *University of Nebraska—Lincoln*
Ryan Weichelt, *University of Wisconsin—Eau Claire*
Max D. Woodworth, *The Ohio State University*

The book in your hands is the product of a collaborative effort. I am very fortunate to work with a team of great professionals at Oxford University Press. The book has benefited tremendously from their hard work and dedication and I am grateful to be associated with them: I owe a special debt to Dan Kaveney, Executive Editor, who believed in the project, gave it his full support, and shepherded it from the idea stage through to publication. Many thanks are due to: Christine Mahon, Associate Editor, for attending to the many details preparing a manuscript for production, and for assembling the supplements package; Megan Carlson, Assistant Editor, for arranging review panels and with manuscript preparation; Sarah Goggin for her excellent work on writing and assembling the supplements package; David Jurman, Marketing Manager, for his tireless work getting the word out; Marianne Paul, Production Editor, for attending to the myriad details involved in turning a manuscript in to a published work; and Michele Laseau, Art Director, for a great design and cover. I also want to tip my hat to the a tireless band of salespeople for promoting the book on campuses all across the country.

Lisa Benton-Short is a constant source of love and endless encouragement with just the right amount of sass to keep me firmly grounded.

Welcome to human geography: an endlessly fascinating and always rewarding subject!

Human Geography



PART 1

The Context

This section sets the stage. Chapter 1 gives a brief account of the planet we call home. Attention is paid to the evolution of the Earth, its emerging physical geography, and its humanization. The term "geography" derives from the Greek for "earth description." Chapter 2 looks at the evolution of earth description from its earliest roots to current concerns.

OUTLINE

1

The Home Planet

LEARNING OBJECTIVES

- **Recall** the theories that describe the formation, size, and structure of the universe.
- **Recognize** and **describe** the effects of Earth's interactions with the Sun and Moon.
- **Summarize** the complex tectonic history of Earth and relate its bearings on human populations.
- **Describe** the developments that are associated with human life on Earth.
- **Relate** the major anthropogenic changes that are impacting Earth.

We inhabit a tiny blue dot in a vast inky darkness. It has been in existence for 4.6 billion years, but our occupancy is more recent. Our species emerged around 200,000 years ago. Later, our immediate ancestors migrated out of Africa to populate the world. Today we live in a humanized world deeply impacted by our presence. The health of the planet is our primary responsibility.

The Big Picture

According to the aptly named **Big Bang theory**, it all started with a very big explosion that produced enough energy to expand a single point outward to infinity. From a singular point in space-time of intense heat and pressure, the universe began to expand, cooling as it spread outward. The universe is still moving outward from this specific moment and particular location. Measuring the speed of the expansion allows us to calculate the approximate moment of the "birth" of our universe, around 13.7 billion years ago. A billion years after the Big Bang (a term coined by cosmologist Fred Hoyle in 1949), galaxies first came into being from differential gravitational pull in the young universe.

The Big Bang expansion exacerbated minutely small differences in density into sites of star clusters and galaxies. For the first 7 to 9 billion years, the attraction of this matter slowed down the rate of expansion of the universe in a cosmic pull of competing forces, the explosive energy of the Big Bang dampened by the gravitational tug of the matter that it created in its wake. Then, the expansion of the universe began to accelerate as a mysterious energy source, with the foreboding name of **dark energy**, overcame gravity. Almost three-quarters of the universe is made up of this unknown force; of the rest, a little under a quarter is made up of dark matter that neither reflects nor emits light, and only around 4 percent is the matter in the universe that we can see and, as yet, understand. We live in a dark universe.

1.1 Poor Pluto

From 1930 to 2006, there were nine planets, a period during which Pluto was discovered, identified as a planet, and then dropped from the list of major planets. The American astronomer Clyde W. Tombaugh discovered the planet in 1930 from the Lowell Observatory in Arizona. Before this date it was too small—only 18 percent of the Earth's diameter—and too far to be visible. It was designated as the ninth and farthest planet from the Sun, but in 2006 it was reclassified as one of the dwarf planets, now classified as *plutoids*, and dropped from the list of major planets. While denied membership in the club of major planets, poor Pluto still makes its eccentric orbit at the edge of the solar system. In a touching moment of solidarity with the marginalized and the shunned, the supporters of the Turkish soccer club Beşiktaş carried banners that proclaimed, "We Are All Pluto."

And to add to the pervasive strangeness of it all, there is also the intriguing proposition that there was more than one Big Bang. We are living in the aftermath of a Big Bang, but perhaps there were more, possibly an infinite number as the universe expands and contracts, each Big Bang leading to a giant implosion followed in turn by another Big Bang in an endless cycle.

The universe consists of around 200 billion galaxies and 30 billion trillion stars. Our home planet is situated in the Milky Way, a galaxy composed of 100 to 400 billion stars bound together by gravity and stretching across 100,000 light years. One **light year** is the equivalent of 5.8 trillion miles; it is calculated from the speed of light in a vacuum, 186,000 miles per second, or 700 million miles per hour. One of the stars, located 24,000 light years from the center of this galaxy, is the Sun, the center of our planetary system and rightfully deserving its capitalization. Eight planets revolve around this star. From near to far they are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. The four nearest to the Sun are relatively small and composed of rock and metal; the four farthest, the gas planets, are larger, with planetary rings of particles and cosmic dust. Jupiter and Saturn are composed of hydrogen and helium, and the two farthest planets, Uranus and Neptune, traveling the darker, colder edges of the solar system, are ice giants made up of water, ammonia, and methane.

In 2016 scientists at the California Institute of Technology presented evidence that there may be a ninth planet with a mass of five to ten times that of the Earth. This planet, only known as Planet Nine, has not been observed directly but only inferred from the orbits of surrounding objects. The same type of inductions occurred in the nineteenth century when observations of Uranus indicated that there may be another planet out there. There was—Neptune. As technology allows us to delve deeper into the darkness of the universe, perhaps one day Planet Nine may be sighted.

We are situated close enough to the Sun to get more heat and light than the farthest planets but not so close as to be burned up by the intense heat experienced by the two planets closer to the Sun. The third planet out from the Sun has enough oxygen and water to support life.

We live on a planet in motion. It revolves around the Sun once every 365.25 days. A year marks how long it takes the Earth to complete one full movement around the Sun. The Earth is tilted approximately 23 degrees from the perpendicular in its orbit. This creates the seasons, especially marked farther away from the equator, where the distance from the Sun varies more substantially when the tilt is angled away or toward the Sun. The tilt of the Earth divides this yearly cycle into seasons; closer to the poles, the seasonal effects are exaggerated, as intense cold turns into a distinct warming when the long, dark days of winter become the light-filled days of summer. At the equator the seasons are less pronounced and the daily division into light and dark more even throughout the year. At the poles the annual cycle moves from a Sun that never sets to a Sun that is barely visible over the dark horizon. At the equator the Sun is a more constant and reliable presence.

Our planet rotates on its own axis on a roughly twenty-four-hour cycle. The daily cycle is created as the Earth turns toward and then away from the Sun. Although we continue to use the terms "rising" and "setting" Sun, it is the Earth that moves. Our planet revolves around the Sun and rotates on its own axis.

The Earth does not revolve in a perfect circle. It wobbles, the angle of tilt moves, and its orbit around the Sun varies in its eccentricity (departure from circularity). These small differences in distance from the Sun may account for very long-term climate changes on the Earth, especially the rise and fall of ice ages.

Soon after the formation of the solar system—after only 30 to 50 million years—a giant **asteroid**, almost half the size of the Earth, hit our planet. The impact created the Moon, which now revolves around the Earth every 27.3 days, its pitted surface a silent witness to the destructive forces still at work in the universe. The gravitational effect of the Moon on the Earth is responsible for the **tides** that move the oceans and seas in ceaseless and regular

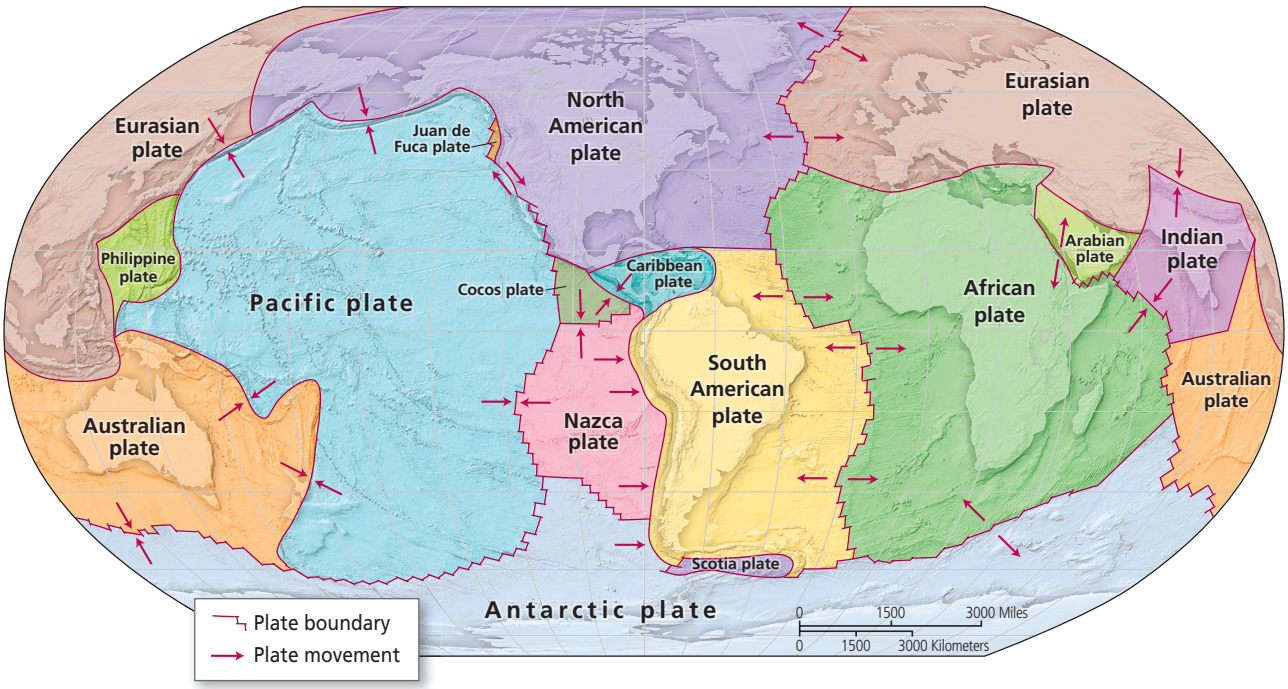
vertical motion. The **lunar cycle** is the source of our division of time into months.

The yearly, monthly, and daily cycles that are such important rhythms of our lives are caused by the movement of our planet and the Moon. Even in a more electronic age we are affected by the beats of the cosmos. Two researchers, Scott Golder and Michael Macy, examined millions of tweets over a two-year period. Using selected words in messages to connote moods, they found that there was distinct periodicity, with more positive words in the early morning. Each new dawn offers the promise of a new beginning. Our moods also vary over the seasons. **Seasonal affective disorder (SAD)** is the tendency for more negative moods among normally healthy people during distinct seasons. Winter blues are more common in northern latitudes because of the rapid decrease in sunlight. SAD varies with latitude, with only 1.4 percent experiencing it in Florida but 9.7 percent in colder, darker New Hampshire.

Shaky Ground: Plate Tectonics

Look at any map of the world. The continents sitting in the blue seas and vast oceans look solid, firm, permanent. From a very long perspective the image is deceptive. The present distribution of landmasses is just the most recent frame in a dynamic, complex picture of continents forming, reforming, splitting up, and moving across the Earth's surface.

Earth came into being around 4.55 billion years ago. Soon afterward, around 4.51 billion years ago, the Earth was hit by a giant asteroid, turning it into a fiery ball of intense heat. Over the years, the surface cooled more than the interior. The Earth's surface, the "solid ground" of so many metaphors, is in fact a thin, brittle crust, no more than four to sixty-five miles thick, that floats precariously on a viscous mass of molten metal. The crust that we occupy is the cold top level that formed on the Earth's surface just as a skin forms when boiling milk cools. Below is the hot mantle and, even deeper, the extremely hot core. The solidified crust fractured across the large round object of the Earth, breaking up into distinct **tectonic plates**. There are nine large plates and numerous small ones (Figure 1.1). They sit atop powerful currents; below them, the mantle of molten metal heaves as hotter liquid moves up in convection currents from the boiling mass at the Earth's core while the cooler liquid closer to the surface sinks to the bottom. This continuous subterranean motion moves the plates on the surface, like bumper cars in a fairground ride that move in a restricted space. Driven by the upward convection currents deep in the Earth's mantle, they bump against, slide past, and move away from each other. Mountains are formed, trenches are created, **earthquakes** occur, and boiling magma spews out in volcanic eruptions to reveal the fiery material that

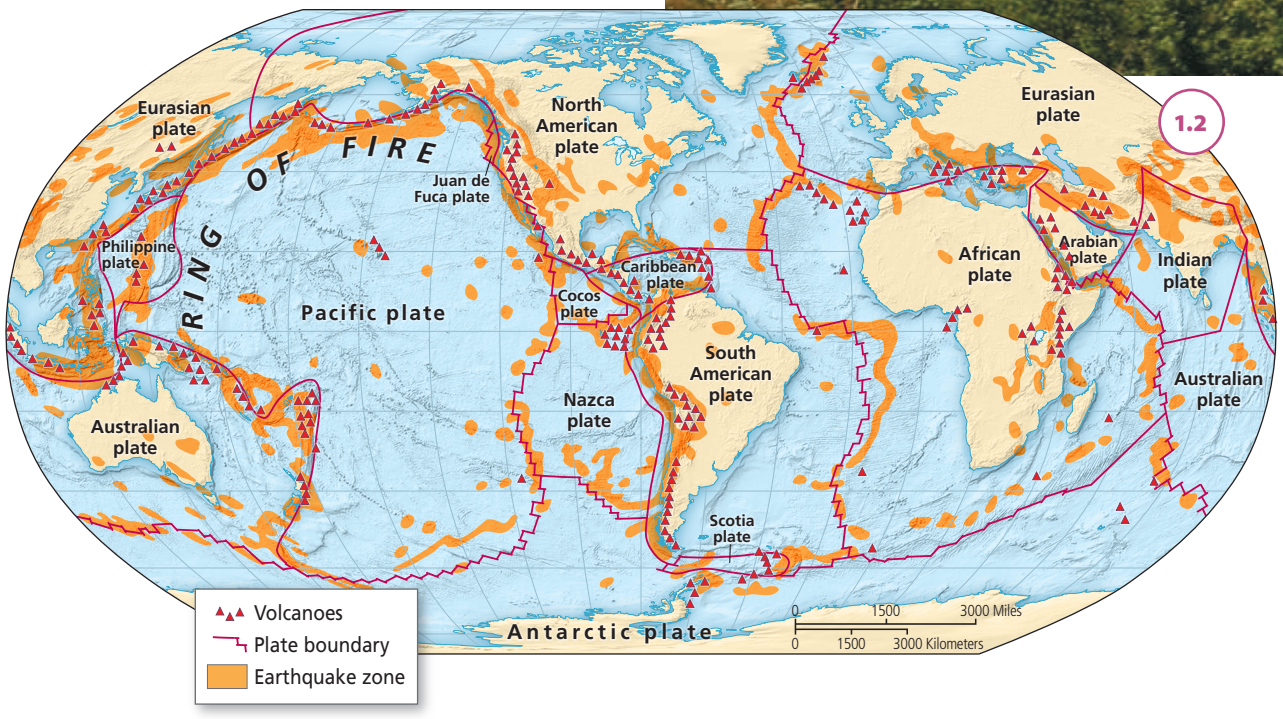


1.1 Plate boundaries

shapes the Earth's geological formations. The surface that we live on is a fragile membrane across deep and powerful subterranean forces. Volcanic and earthquake activity are particularly severe at the edges where plates meet (Figure 1.2 and Figure 1.3).

The plates are always on the move. In the geological equivalent of political empires, giant landmasses rise and fall. Over 1.4 billion years ago, small masses of land collided to form the supercontinent of Rodinia. This landmass was rent asunder into different blocs including Avalonia; Baltica; Laurentia, eventually to become North America; and Gondwana, the source continent for South America, Africa, India, Antarctica, Australia, and New Zealand. When Baltica and Laurentia joined up with Gondwana around 300 million years ago, a new supercontinent, Pangaea, was created. It took up almost one entire side of the globe—the other side was mostly water—and was centered on the South Pole. This began to break up, but the large landmass of Gondwana remained. Beginning around 200 to 160 million years ago, it too began to break up, as South America broke off and drifted west, and a landmass of what was to become India began a 150-million-year journey northward to Asia, forming the Himalayas when it crashed into the Eurasian plate.

Around 60 million years ago, another landmass, what we now call Australia, detached from what is now



1.2 Location of seismic activity (earthquakes and volcanoes). They cluster along plate boundaries. Notice the **Ring of Fire** around the Pacific. **1.3** Along the line of mountains in Central America is a zone of active volcanic and earthquake events. This is an active volcano just outside the city of Antigua in Guatemala.

Antarctica and began a 45-million-year, 500-mile journey through various climate zones toward the warmth of a more northerly location. Australia was on the move. Slowly. It is still moving northward away from Antarctica at a rate of around 2.7 inches per year. There are many traces of the long journey. Australia shares with South America similar species of marsupials, turtles, and lungfish that are over 400 million years old, a biotic reminder of when the two continents were joined in Gondwana. And the distribution of an extinct fern, *Glossopteris*, in Antarctica, Africa, Australia, India, and South America is a biological reminder of the supercontinent.

The Indo-Australian plate eventually crunched up against the Eurasian plate around 15 million years ago. The border area between the two plates is still one of the most active volcanic zones in the world. Let us consider three events. Around 70,000 years ago, a giant volcano exploded at Mount Toba in Sumatra (now part of Indonesia). Almost a billion tons of ash and dust were thrown into the atmosphere, darkening the skies and reducing global temperatures by around 5°C for up to five years. One anthropologist, Stanley Ambrose, writes of a long volcanic winter, an instant ice age that severely reduced early human populations. The total human population in the world was probably reduced to around 10,000, so that local variations became more pronounced in human **evolution**, creating the contemporary racial differentiation. The huge, violent explosion caused **global climate change** that further impacted human populations. The extent to which the consequent **environmental stressors** may have promoted social cooperation and thus facilitated the human dispersal from Africa is a debatable but intriguing proposition.

The region saw a second event, another massive volcanic explosion, when the island of Krakatoa exploded on August 27, 1883. Not as violent as the Mount Toba explosion, it was still devastating; the resultant tsunami killed approximately 36,500 people in the region as tidal waves drowned towns and villages along the coast. The air pollution caused by all the dust and ash blotted out the Sun's heat and light and reduced the world's temperature by about 0.5°C. Simon Winchester also argues that Krakatoa influenced political developments. He suggests that the 1888 Banten Peasants' Revolt, which pitted local people against Dutch colonial rule, was partly influenced by the cataclysm that befell the Indonesians and fed into an anticolonial and Islamic fundamentalist narrative that "explained" the explosion and mass deaths as the work of a wrathful Allah signaling displeasure at colonial control and lax religious practices.

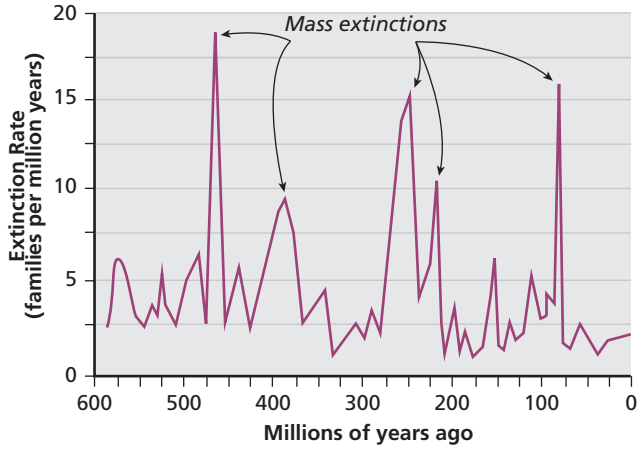
On December 26, 2004, movement along the plate caused the third event—another major disaster. The Sumatra-Andaman earthquake occurred nineteen miles below sea level off the coast of Sumatra. Along a 1,000-mile zone, plates shifted almost fifty feet and raised the surface of the seabed, displacing millions of gallons of water that caused the **tsunami**, the post-earthquake waves that suddenly overwhelmed coastal communities in fourteen countries fringing the Indian Ocean. As waves cresting 100 feet crashed into unsuspecting communities, more than 230,000 people died, 125,000 were injured, and almost 1.7 million were displaced from their homes.

Life on Earth

For half of its entire existence the Earth did not sustain life. It took a long time for the planet to cool down and its landmasses to become more stable. The beginnings of life around 2.2 billion years ago were in the modest form of blue-green algae. Evolution was slow until the development of sexual reproduction. An explosion of life took place around 545 million years ago in the Cambrian period of the early Paleozoic era as living forms with skeletons first appeared. The growth of the amount and diversity of life was not a simple upward trajectory. The same era also marked the first global mass extinction, as many species of shallow water fauna were killed off by rising sea levels.

Around 418 million years ago, the first land animals appeared. Insects and amphibians also emerged. In the Mesozoic era, from 248 to 65 million years ago, the first dinosaur appeared, as did the first mammal, a tiny shrew-like animal dwarfed by the giant reptiles around it. In the late Mesozoic there was another mass extinction of animal life. Dinosaurs became extinct, and birds lost almost 80 percent of their species, as did the marsupials. Some scientists suggest that colossal volcanic eruptions in a mountain chain in eastern India spewed huge amounts of carbon dioxide and **sulfur dioxide** into the atmosphere, poisoning the air. Other scientists point to an asteroid hitting the Earth around the same time, 65 million years ago. A crater measuring 100 miles wide and 6 miles deep was discovered in the Yucatan peninsula near the town of Chicxulub. The impact of the asteroid created global fires that sucked oxygen out of the atmosphere and caused huge shock waves that triggered volcanoes and earthquakes. The volcanic eruptions in India and the asteroid strike in the Yucatan created devastating global environmental conditions. Dust covered the Earth, leading to temperature decrease. **Acid rain** fell. Dark and coldness settled on the Earth, plants stopped growing, and animals died. More than 90 percent of all marine life died as the seas became acid baths. The dinosaurs became extinct, as they could not survive in the wasteland of permanent winter. They starved to death.

The Tertiary period, from 65 million to 1.8 million years ago, is the age of mammals. Whales appear, as do elephants, cats, and dogs. Around 50 million years ago, the first primate appears, a little lemur-like creature barely more than two pounds in weight. The primates diversified and spread. Four million years ago, the first **hominid**



1.4 Mass extinctions

TABLE 1.1 Mass Extinction Events

TIME PERIOD (MYA)	CAUSES	CONSEQUENCES
Ordovician–Silurian (443)	Climate change	85 percent of all sea life was wiped out
Late Devonian (359)	Impact events	75 percent of species wiped out
Permian (248)	Multiple	96 percent of species wiped out
Triassic-Jurassic (200)	Multiple	50 percent of animals wiped out
Cretaceous–Tertiary (65)	Multiple	75 percent of species wiped out

*mya = million years ago

to stand upright, *Australopithecus,* walked on the Earth. Between 2 and 3 million years ago, at least eight different hominid species emerged from this one species, correlating with a time of increased climate change. The rapidly changing conditions rewarded species that could adapt quickly, especially those that had the brain capacity to adjust to constant **environmental change**. Adaptability to diverse environmental conditions is one of the defining hallmarks of our human species.

Mass Extinctions

The fragility of life on Earth is revealed most dramatically during episodes of **mass extinctions**. Five such events are recorded. Figure 1.4 depicts five spikes in extinction events. Table 1.1 provides more detail about the causes and consequences of these events. In the first one, climate change in the form of an ice age disrupted the oceans' chemistry during the Ordovician–Silurian extinction event, killing a majority of sea life species. Impact events, either an asteroid hitting the Earth and/or giant volcanic eruptions around 65 million years ago, were the principal cause behind the more recent extinction event during the Cretaceous–Tertiary, when the dinosaurs were killed off. The catastrophic events caused a massive increase in greenhouse gases and rapid warming that made it unlivable for many terrestrial species, even the fearsome *Tyrannosaurus rex*.

These mass extinctions show that life is fragile, but also resilient, as new life forms emerge in their aftermath.

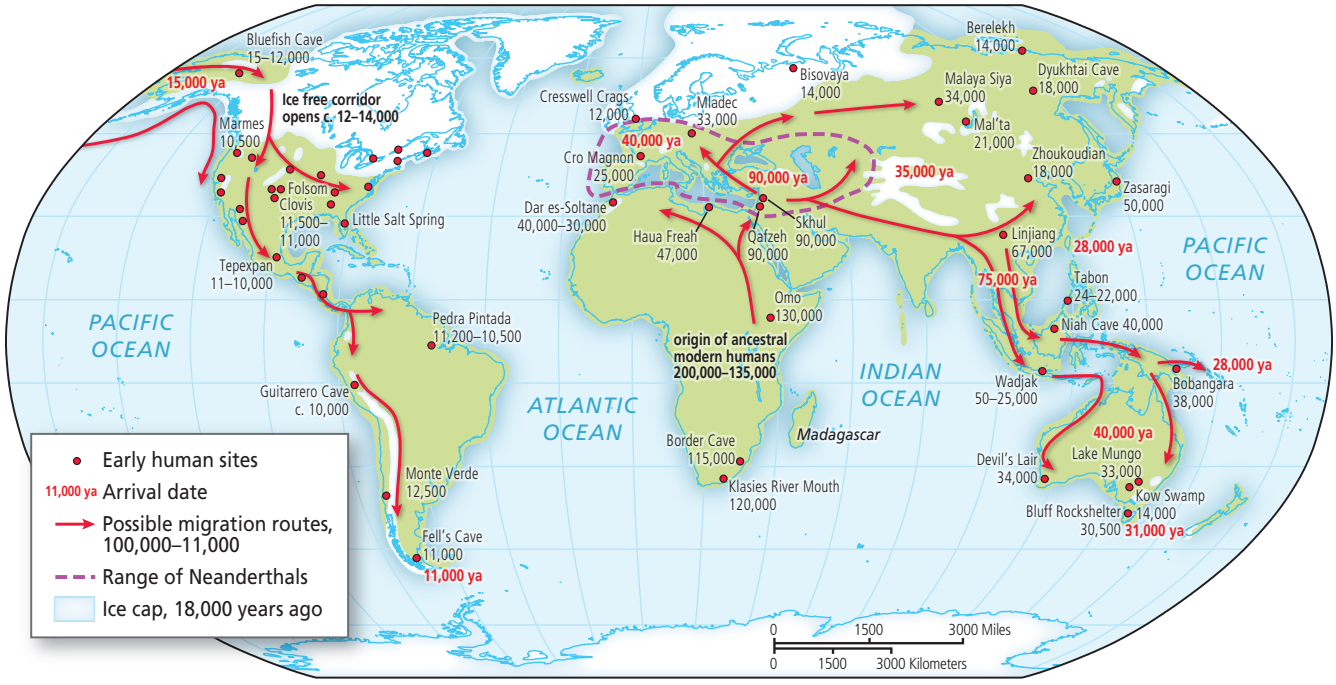
A Humanized World

Tracing human origins was long the preserve of archeologists and physical anthropologists. Digging in old sites and dating the old bones was the preferred method. Dates were always provisional, and the ambiguity of the information always provided lots of room for debate. Things began to change when scientists could use live humans to chart the past. Our bodies, it appears, are the equivalent of an archeological site, containing memories and traces of the far distant past. Plotting the distribution of the information in our bodies allows us to map possible sites of human origin and paths of human dispersal.

In the 1950s, differences in blood group protein were identified that allowed a picture of human ancestry. A more sophisticated analysis was made possible in 1987, when scientists first used the DNA in mitochondria, the rod-shaped "power plants" of cells, to construct a genetic tree. Using this method allowed scientists to examine genetic materials passed from mother to child, and led them to the startling conclusion that we are all descended from one woman who lived in Africa around 200,000 years ago.

Out of Africa

After decades of competing ideas and dueling theories, there is an emerging consensus that all humans are descended from a group of people who left Africa. Human origins lie in Africa. The first humans stepped out of Africa to populate and humanize the world (Figure 1.5). Evidence of **genetic variation** sustains this **Out of Africa** hypothesis. Peoples in central and southern Africa have more genetic variation than elsewhere in the world. The highest levels of genetic diversity in the world are among the Namibian and Khomani Bushmen of southern Africa, the Biaka Pygmies of Central Africa, and the Sandawe of East Africa. There is a decrease of genetic diversity with increasing distance from Africa, suggesting a founder's group in Africa as the basis for all subsequent human population. As smaller subgroups broke off to settle in different places, the amount of genetic diversity decreased. The amount of genetic variation declines with distance from Africa—a classic case of the **distance-decay effect**—



1.5 The peopling of the world

suggesting that humans came out of Africa to populate the Earth. It was the first wave of globalization.

The human diffusion from Africa, around 120,000 to 70,000 years ago, initially involved a tiny population of probably between 3,000 to 5,000 people. Notice the implied leeway in the range. We have gotten a general idea, not a sure fix. The movement out of Africa took different routes at different times. The oldest was a group that moved out through the Horn of Africa into the Middle East. One group then moved along a coastal route skirting the Indian Ocean. They took around 20,000 years to migrate around the Indian Ocean, taking the beachcomber route into Southeast Asia and Oceania. The migration took the form of **budding**, as small subgroups broke away to settle new places. Traveling along the coast and up rivers, they avoided the difficulties of passing through deserts and across mountains. Consider, as just one example, the settling of Australia. Around 50,000 years ago, when sea levels were lower, Australia was linked to Papua New Guinea, and there was only a relatively short distance, probably no more than sixty-five miles, between the edge of Asia and the coast of Australia. Bamboo rafts probably were constructed to make the sea crossing. Current archeological evidence dates the human presence in Australia to between 55,000 to 42,000 years ago. Most of the early Australian sites have deep charcoal deposits that suggest both early settlement and a long record of occupation. The migrants traveled quickly up the rivers and along the coast. Colonization was rapid, as there are sites scattered throughout the vast continent in the north, northwest, southwest, and southeast and as far south as Tasmania, all dated to around 32,000 to 40,000 years ago. Central Australia was settled last, as there were no easy coastal or riverine routes to follow. People had to venture into a dry, forbidding interior. But venture they did. We have a site, the Puritjarra Cave Rock Shelter, with rock art suggesting occupancy as far back as 32,000 years ago.

Another later wave of human migration around 50,000 years ago moved into Eurasia. Giant walls of ice restricted movement north; it was still the Ice Age, also known as the Pleistocene era. However, sea levels were much lower in the Pleistocene, exposing land bridges that are now covered with seawater. The English Channel was dry land, allowing people and animals to move from Europe into what is now Britain and Ireland. On the other side of the world, the **land bridge** between the northeasternmost edge of Eurasia and the northwest edge of America allowed people and animals to make the journey across the continents around 22,000 to 25,000 years ago.

Human groups were restless, continually moving to and settling new areas. People even sailed across the vast expanses of the Pacific Ocean to settle on such distant specks of islands as Hawaii. The early humans explored the world, settled in different habitats, and impacted their environment.

These colonizers' impact was immediate. Despite early interpretations of them as docile elements in the landscape, they were very much active agents in modifying and changing the environment. Early humans first shared the Eurasian landmass with other hominids such as the Neanderthals and the Denisovans. These were cousins to humans on the evolutionary tree, emerging as separate

1.2 Wallace's Line: A Biogeographical Boundary

In the mid-nineteenth century, Alfred Russell Wallace (1828–1913) spent eight years travelling the Malay Archipelago. He travelled over 14,000 miles and collected over 100,000 samples. He was less well known than Darwin, and his letters back to members of England's scientific community indicating a theory of natural selection for the origin of species prompted some to counsel Darwin to publish his own work in 1859. In 1863 Wallace published a paper in the *Journal of the Royal Geographical Society* that identified a boundary line between two realms. This line, now known as Wallace's Line, divides the Australian and Asian biotas.

Wallace's Line

Wallace's work was part of a surge of mapping in the nineteenth-century natural sciences. Maps were, and still are, used as a conceptual framework and as a tool for presenting vast amounts of data in simple yet suggestive ways. Wallace's Line evolved from papers he wrote in 1855 and 1860 as well as the 1863 paper. Later, the zoologist and biogeographer Max Carl Wilhelm Weber drew his own line based on surveys of mammalian fauna. His line is farther to the east than Wallace's Line. The difference between the two lines is that flora found it easier to move across the "line," while the seas constituted a larger barrier to animal movement. The area between the Wallace and Weber lines can be considered a zone of transition.

The biogeographical boundaries identified by Wallace and Weber are a result of **plate tectonics**. The northward drift of the Australian plate made it crash against the Eurasian plate around 15 million years ago. Previously separate biological realms were brought into contact. The Australian plate was like a raft filled with distinctive flora and marsupial animals now abutting the Asian flora and fauna. Without a theory of plate tectonics (Alfred Wegener did not moot it until 1912, or publish it in 1915), Wallace could not discern the geological basis for the division. However, his careful mapping highlighted the benefits of fieldwork and the representation of these data in maps. Wallace's Line is the biological equivalent of plate boundaries, even though Wallace was not aware of the plates and the theory of continental drift.

REFERENCES

Camerini, J. R. (1993) Evolution, Biogeography and Maps: An Early History of Wallace's Line. *Isis* 84: 700–727.

Vetter, J. (2006) Wallace's Other Line: Human Biogeography and Field Practice in the Eastern Colonial Tropics. *Journal of the History of Biology* 39: 89–123.

Wallace, A. J. (1863) On the Physical Geography of the Malay Archipelago. *Journal of the Royal Geographical Society* 33: 217–234.

subspecies around 500,000 years ago. The Neanderthals were not as dumb as common characterizations assume. They walked upright and effectively communicated with each other. They and the Denisovans emerged in and lived throughout Eurasia, but with the entry of *Homo sapiens*, these two hominid species died out around 30,000 years ago. As the human population spread across the Eurasian landmass, we effectively annihilated our closest competition for food and environmental resources. One competitive advantage was the division of labor. Among human populations, women and young children were responsible for skill-intensive crafts such as making clothing and shelter as well as gathering food. Men were primarily responsible for hunting. The division of labor allowed access to a wider range of food sources compared to the other hominids, who, because they did not have the gender and age division of labor that allowed economic specialization, were almost entirely dependent on hunting game.

When the game disappeared, they starved and died out. The gender and age division of labor in early human populations created more specialized economic roles that allowed a more efficient use of labor and gave access to a wider food resource base.

The other hominid groups died out, but they live on in our genetic makeup. They must have been close enough to humans so that interbreeding occurred. We have a genetic record of the process. All non-Africans have between 1 and 4 percent of Neanderthal DNA. The people of New Guinea have around 5 percent of Denisovan DNA. Most of the world's non-African population carries this genetic reminder of the width of human sexual appetite and willingness to "interact" with their evolutionary cousins. The distinction between human and nonhuman hominids was more of a liminal area than a sharp and fixed boundary.

Pleistocene Overkill

The early human colonization of the Earth was also marked by ecological changes. The most pronounced is the **Pleistocene Overkill**, which refers to the extinction of **megafauna** such as the mammoth and the mastodon that occurred around 11,000 years ago. This extinction occurred on every continent and was experienced by every community of large terrestrial vertebrates at a time of humans' increased technological sophistication in hunting. While there has been some debate about the relative role that climate change played in the mass extinction, human hunting definitively contributed. In some continents both hunting and climate change were important, while in others only hunting was the primary cause. The extinction was particularly marked in North America around 20,000 years ago.

America is a test case of the **overkill**, since human entry into the region was relatively late, and there are no records of other hominids. John Alroy created a grid of 754 spatial cells of one degree of latitude and one degree of longitude. His computer simulation model for North America clearly shows that human population growth and hunting led to mass extinction 1,200 years after humans first appeared.

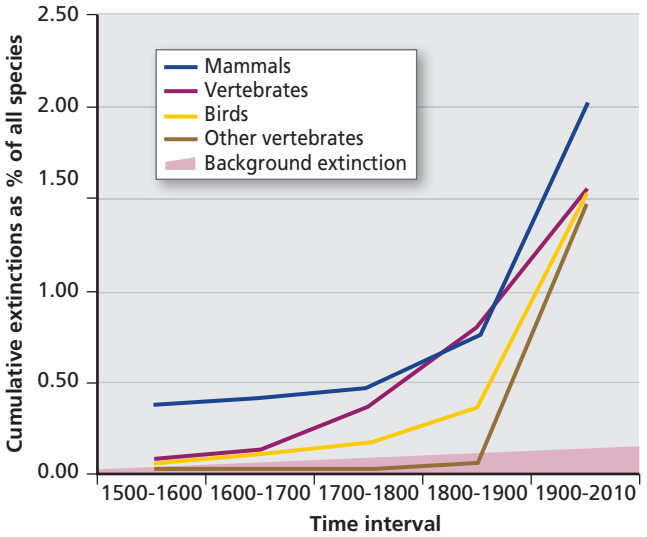
The larger and slower megafauna were very vulnerable to skilled hunters. The megafauna, weighing more than 220 pounds and thus slower than other animals, became especially vulnerable. In Australia, for example, many megafauna became extinct around 46,000 years ago, soon after the entry of humans into Australia. We will never again see the three-meter-high giant kangaroo, the rhino-sized wombat, or the marsupial lion. We do have a visual record from rock paintings in Arnhem Land in northern Australia, which may depict a *Palorchestes*, a large browsing animal; a *Genyornis*, similar to an emu but three times as tall; and a marsupial lion. Farther west in Kimberley, rock paintings depict giant kangaroos and huge echidnas. The paintings are a reminder of the time when megafauna and humans shared the same space and an early example of the immense role that humans played and continue to play in shaping the global ecosystem.

Climate Change

Over the long history of the Earth, its climate has changed. Over the past 100,000 years the Earth has warmed, ice sheets have melted, and sea level has risen. In the past 1,000 years the climate warmed during the Medieval Warm Period from 1100 to 1300, and then cooled from 1300 to 1700 in what is known as the Little Ice Age. In the past 100 years our planet's average temperature has heated up by 1.5°F and is projected to rise even more in the next 100 years due to human impact, the most important being **greenhouse gas** emissions (especially **carbon dioxide**), which warm the atmosphere.

The full implications of climate change have yet to be unraveled, but a number of major trends are now identified. At the higher latitudes and altitudes, glaciers are shrinking and **permafrost** is warming and thawing. Animal life has responded in a variety of ways including shifts in geographic range (with heat-loving species able to live farther north in the Northern Hemisphere and farther south in the Southern Hemisphere), migration patterns, and species interaction. There is mounting evidence that climate change is increasing the risks of extinctions and the potential impact on human health as changing ecologies provide new opportunities and vectors for viruses and the diseases they cause.

A number of respected scientists now argue that we are in a sixth mass extinction event, caused by climate change



1.6 The sixth extinction

and human activity. There is a background rate of around two mammal extinctions per 10,000 species per 100 years, but in the last century the rate is now 110 times higher than this level. Over the past 500 years there has been a 10 percent reduction in land-based wild animals and a 13 percent reduction in the number of bird species. The rapid loss of biodiversity means that a sixth extinction event may be underway.

More extreme weather events including drought, floods, and major storms are also more likely, owing to climate change. The consequences vary with location. In North America there is greater risk of drought in the west and southwest, and a higher chance of more powerful tornadoes in the central region and more punishing storms along the east and southeast coasts. This increased likelihood is not a straight-line relationship such that each year sees more frequent extreme weather events; rather, the probability of their happening is greater, so that "100-year storms" occur once every ten years.

Some ecosystems are especially threatened. Coral reefs survive in only a very narrow temperature range and are thus highly vulnerable to warming oceans. **Climate change** is particularly marked in the high latitude due to what is known as the Arctic Amplitude, which causes greater near-surface warming than at middle and low latitudes.

Humans have responded to climate change in two main ways: adaption and mitigation. Adaption involves engineered and technological solutions such as building storm barriers, or changing behaviors such as the shift in garden preferences from lawns to desertscapes in the southwestern USA. Mitigation involves trying to reduce our **carbon footprint** and lessen the emission of greenhouse gases.

Cited References

Alroy, J. (2001) A Multispecies Overkill Simulation of the End-Pleistocene Megafaunal Extinction. *Science* 292: 1893–1896.

Ambrose, S. (1998) Late Pleistocene Human Population Bottlenecks, Volcanic Winter, and Differentiation of Modern Humans. *Journal of Human Evolution* 34: 623–651.

Ceballos, G., Ehrlich, P., Barnosky, A. D., Garcia, A., Pringle, R. M., and Palmer, T. M. (2015) Accelerated Modern Human-induced Species Loss: Entering the Sixth Mass Extinction. *Science Advances*. http://advances.sciencemag.org/content/1/5/e1400253

Golder, S. A. and Macy, M. W. (2011) Diurnal and Seasonal Moods Vary with Work, Sleep, and Daylength across Diverse Cultures. *Science* 333: 1878–1881.

Grove, M. (2011) Change and Variability in Plio-Pleistocene Climates: Modelling the Hominin Response. *Journal of Archaeological Science* 38: 3038–3047.

Kuhn, S. L. and Stiner, C. M. (2006) What's a Mother to Do? The Division of Labor among Neanderthals and Modern Humans in Eurasia. *Current Anthropology* 47: 953–980.

Urban, M. C. (2015) Accelerating Extinction Risk from Climate Change. *Science* 348: 571–573.

Winchester, S. (2003) *Krakatoa: The Day the World Exploded: August 27, 1883*. New York: Viking.

Select Guide to Further Reading

Hazen, R. M. (2012) *The Story of Earth: The First 4.5 Billion Years, from Stardust to Living Planet*. New York: Viking Penguin.

Kolbert, E. (2014) *The Sixth Extinction: An Unnatural History*. New York: Henry Holt.

Stix, G. (2008) Traces of a Distant Past. *Scientific American* 299, 1: 56–63.

Tattersall, I. (2009) Human Origins: Out of Africa. *Proceedings of National Academy of Sciences* 106: 16018–16021.

Selected Websites

Shifting plates
https://ees.as.uky.edu/sites/default/files/elearning/module04swf.swf
http://geology.com/plate-tectonics.shtml
http://www.nasa.gov/audience/forstudents/5-8/features/F_Earth_Has_Faults_prt.htm

An interactive atlas of human origins and dispersal
http://www.bradshawfoundation.com/journey/
http://www.businessinsider.com/prehistoric-human-migration-from-africa-animated-map-2015-5

The Biodiversity Heritage Library
http://www.biodiversitylibrary.org

Convention on Biological Diversity
http://www.cbd.int

The World Meteorological Organization is a specialized agency of the United Nations that provides information on the state and behavior of the Earth's atmosphere, its interaction with the oceans, the climate it produces, and the resulting distribution of water resources.
https://public.wmo.int/en

The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change.
http://ipcc.ch

The US EPA site is a useful source of data on climate change across the regions of the USA.
https://www.epa.gov/cira

Interactive Map Websites

http://nhb-arcims.si.edu/ThisDynamicPlanet/index.html
https://www.learner.org/interactives/dynamicearth/plate.html
http://geology.com/plate-tectonics.shtml
http://www.businessinsider.com/prehistoric-human-migration-from-africa-animated-map-2015-5

Learning Outcomes

This chapter provides a basic grounding into the history of the Earth.

- The Big Bang theory comes from the observation the universe is infinitely expanding. By calculating its current rate of expansion, we are able to theorize on a specific time and location where all matter first aggregated, then exploded outward to its current state of existence, propelled by dark energy and a possible succession of multiple subsequent Big Bangs.
- The universe consists of approximately 200 billion galaxies and 30 billion trillion stars. Our own galaxy, the Milky Way, consists of 100 to 400 billion stars, is 100,000 light years across, and contains our Sun, which is surrounded by eight planets.
- The Earth is at a distance from the Sun that allows it to support life, with a tilted axis that allows its 365.25-day orbital cycle to be defined by the seasons we now know. Seasonal effects in any specific location are defined by one's location between the equator and the poles. The Earth's daily rotation produces the "rising" and "setting" Sun.
- The Moon, created by an asteroid's impact with the Earth, is responsible for the ebbs and flows of tides as well as our division of time into months.
- Researchers have found that the movement of our planet and the lunar cycle have profound effects on human moods, such as seasonal affective disorder (SAD) and "winter blues," which are more commonly found during periods of decreasing light in northern latitudes.
- The Earth's crust was formed around 4.51 billion years ago. It is a brittle layer, ranging from four to sixty-five miles thick, floating upon the liquid molten metal of the planet's mantle, below which is the much hotter inner core.
- The crust is composed of nine large plates and numerous smaller ones. They sit atop the continuous currents of the mantle, which push the plates against, past, and away from each other. Such movement forms many geological features, such as mountains and trenches, and results in what we refer to as natural disasters such as earthquakes and volcanic eruptions.
- Over the last 1.4 billion years, the Earth's continents formed as plates separated from a single mass called Pangaea, with some later colliding with each other, but leaving clues as to their origins and movement.
- There are numerous examples of the effects of plate tectonics on human movement and development, including the impact that ice ages have had on human dispersal and social cooperation, as well as the disastrous effects of earthquakes, volcanoes, and tsunamis.
- Although life on Earth began around 2.2 billion years ago, the evolution of animals and humans began much later, perhaps as recently as 200,000 years ago for humans, and was marred by periods of climate change and geological disaster.
- At least five major mass extinctions have occurred.
- Most scientists now conclude that the first humans diffused from Africa, settling as new subgroups and spreading around the planet over the next tens of thousands of years.
- *Homo sapiens* effectively annihilated other related species around 30,000 years ago while competing for food and other resources. The division of labor among these early humans helped lead to greater adaptation and our lasting survival.
- Human development helped contribute to ecological changes by, for example, aiding in the extinction of megafauna as humans became more sophisticated and advanced hunters.
- Climate change has become more pronounced in the last 100 years, leading to warming of land and sea, more extreme weather events, changing patterns of disease, and more extinctions.
- We may be in the sixth phase of mass extinction.
- Humans' two major responses to climate change have been adaption and mitigation.

2

The Nature of Geography

In this chapter I will place the contemporary study of human geography in a deeper historical context. Human geography of today is shaped by the debates of the past. I will identify five particular themes that resonate down through the years: coordinating absolute space, the emergence of geography from **cosmography**, the discussion of relative space, environment and society, and the links between geography and society. A discussion of these themes is a revealing entry point into the history of human geography. I will also explore the contemporary concerns of human geography.

LEARNING OBJECTIVES

Recall the key historical developments that have shaped the nature of geography overall and human geography specifically.

Explain the contributions made by ancient world scholars and early explorers in expanding geographical knowledge.

Summarize geography's human applications as well as the expressions of the discipline in early modernity.

Describe the variety of approaches in contemporary human geography and the major critiques of the discipline.

Mapping Absolute Space

A significant and recurring theme in geography is the attempt to accurately represent the world we live in through maps. It is an important element of the geographical imagination. One of the earliest geographers who sought to measure and coordinate the world was Claudius **Ptolemy**. He was a Greek-Egyptian who worked in the great library of Alexandria. He lived sometime between 90 CE and 168 CE and spent his adult life in Alexandria, a Greek city founded in 331 BCE and named after Alexander the Great. The city was one of the wonders of the classical world, and its population grew to almost half a million. It featured palaces and large public buildings, and at the heart of its intellectual life was the library, a major center of scholarship with over 700,000 volumes. Euclid and Archimedes worked at the library, and Eratosthenes was, for a time, the chief librarian.

In one of his major books, *Geography*, Ptolemy defined **latitude** and **longitude**, discussed methods of mapmaking, and posed the problem of how to represent the round world on a flat surface. He proposed two map projections, a **conic projection** and a partial conic projection, on which to represent the habitable world. Conic projections map the Earth on a cone

2.1 Measuring the World

The measuring of the world is a significant part of the early history of geography. By the fifth century BCE, the Greeks knew that the world was a sphere. Eratosthenes (ca. 276 BCE–ca. 194 BCE), who, like Ptolemy, worked at the great library of Alexandria, calculated the circumference of the Earth. Assuming a spherical Earth, he calculated the circumference with only a 1–2 percent difference from the correct figure of 24,901 miles.

Ptolemy's measurement of the circumference was much less accurate, around 18,000 miles. The wide diffusion of Ptolemy's writings meant that this figure was taken as fact during the early modern period. Columbus probably had this much smaller value in mind when he was planning to sail to the East Indies; Ptolemy's shorter value made the voyage that much less intimidating.

In 1669–1670, the Frenchman Jean Picard tried to accurately measure the Earth by extrapolating from the distance of one degree of latitude measured in the French countryside. However, similar surveys of a degree of latitude undertaken in Peru and Scandinavia at the same time had different values. The reason was not an instrumentation error but because the Earth is oblate, flattened at the poles. We live on a less than perfect sphere in all its misshapen complexity.

2.1 Ptolemy's map of the world in a conic projection, ca. 1300

and then show it as flattened with lines of latitude as concentric circles (Figure 2.1). He compiled lists of the latitude and longitude of places in the world known to him, basically a world centered on the Mediterranean.

In the European Dark Ages, Ptolemy's influence quickly disappeared. His work, however, was kept alive in the Arab world. Ptolemy's work was translated by the Arab cosmologists of the Abbasid court in Baghdad. Al-Battani (ca. 880) restated the *Almagest,* Ptolemy's work on astronomy, with improved measurements, and *Geography* was revised by al-Khwarizmi around 820 in his *Face of the Earth*, which included a map of the world. Al-Idrisi (ca. 1100–1166) was a practicing geographer who traveled through the Arab world. He constructed a celestial sphere and a map of the world. He was part of a larger geographical school of scholarship in the Arab world, involving book knowledge as well as geographical fieldwork and travel, that included the *Book of Countries* by Al-Yaqubi (ca. 891), Al-Balkhis's *Figures of the Climates* (921), Al-Muqaddasi's *The Best Description for an Understanding of All Provinces* (ca. 985), and Al-Bakri's *Book of Roads and Kingdoms* (ca. 1050).

In the early 1400s, Byzantine scholars brought their Greek manuscripts, including manuscripts of Ptolemy's writings, to Italy. The first printed copy of *Geography* appeared in Vicenza in 1475. Other editions appeared in Rome (1477), Florence (1480), and Ulm (1482). The Ulm edition, with its richly colored woodblock maps featuring deep blue seas and bright yellow borders, is arguably one of the most beautiful. The printing of Ptolemy's *Geography* stimulated new knowledge and innovative cartographic techniques. After 1508, editions of Ptolemy's *Geography* included maps that incorporated the discoveries of the New World. The first printed map of the New World appeared in an edition of *Geography.* Ptolemy's continuing legacy includes orientating maps with north at the top, the grid of latitude and longitude, using gazetteers in maps and atlases, and employing a variety of map projections. Ptolemy introduced us to the idea and practice of a coordinated world.

It is important to remember, however, that Ptolemy's view of the world was centered on the West. It was not the only view. Figure 2.2 is one of the oldest extant world maps from East Asia, created around 1389, roughly the same time as the world's map shown in Figure 2.1. Notice how China sits in the center of the map, the pivot of the world's

2.2 Korean map of the world, ca. 1389

landmass, with a hazily outlined Europe located on the far western periphery.

The Shift from Cosmography to Geography

Geography was part of a much wider cosmographical understanding of an interconnected cosmos that also included astronomy, astrology, and magic. The history of geography in the past five hundred years is the dismemberment of this cosmological enterprise.

It begins in the Renaissance, where there is evidence of both continuances and ruptures. There was an esoteric side to the Renaissance that included alchemy, astrology, and magic. These were not marginal concerns but rather central to the life and work of influential Renaissance scholars. John Dee (1527–1608) was a mathematician, mapmaker, and astrologist. His writings combine an interest in exploration and travel, magic and alchemy, mathematics and geography. Dee, like Ptolemy, had a concern with a cosmography that linked the Earth and the heavens, people and their wider environment.

We sometimes assume that the Scientific Revolution marked a major change: before was superstition; after was rational, enlightened thought. Recent scholarship has questioned the traditional assumption of such a radical break.

The shift from magus to scientist and from cosmography to geography was neither sudden nor abrupt. The new scientific order bears the mark of the old cosmologies. These connections are clear when we look at some of the early cosmographer/geographers. The great mapmaker Gerard Mercator (1512–1594) had a religious dimension to his work. Born Gerard Kremer into a modest household in the small town of Rupelmonde near Antwerp, he went to Louvain in 1530 and Latinized his surname to Mercator. He was always interested in theology; he wrote religious tracts, and his first map was a map of the Holy Land. In 1544 he was accused of heresy, one of forty-three accused in Louvain. Two of the accused were burned at the stake, one was beheaded, and a woman was buried alive. Supported by friends and colleagues at the university, he was released. Mercator was a friend of John Dee; they corresponded, and Dee visited him in 1547. Mercator is best known today for his maps. In 1585 he published volumes covering France, Belgium, and Germany. In 1589 he published twenty-two maps, including those of Italy, Slovakia, and Greece. He died in 1594, but his son Rumold collected all the maps in one volume, entitled it *Atlas,* and published it in 1595. We continue to use the term "**atlas**" to describe a collection of printed maps.

Perhaps the last cosmographer and first modern geographer was Baron Friedrich Wilhelm Heinrich Alexander von Humboldt (1769–1859; see Figure 2.3). Born in Berlin,

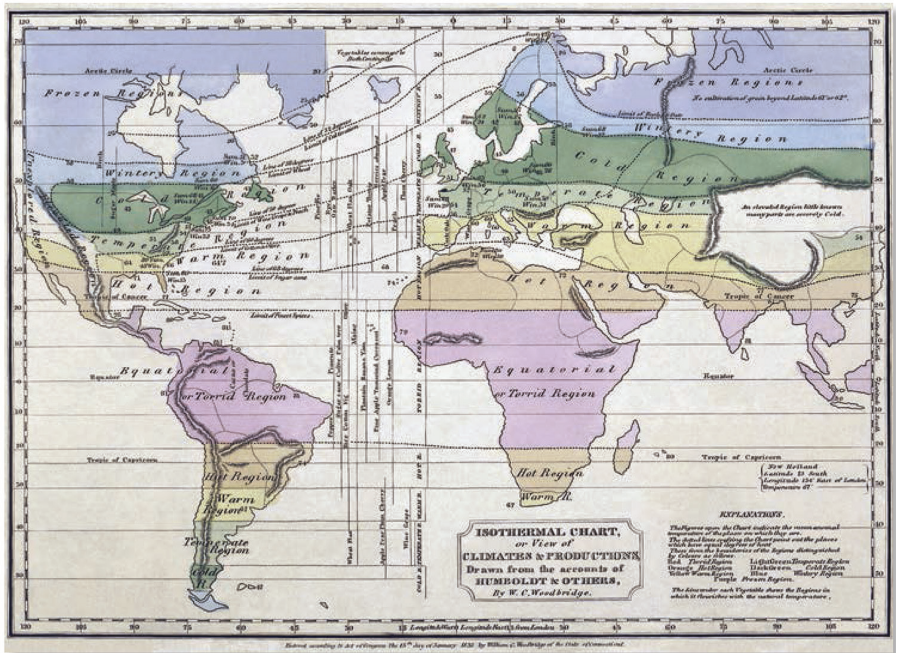
2.3 Portrait of von Humboldt, 1843

2.2 Thinking about Maps

Maps and mapmaking are an integral part of the history of geography. The history of cartography was long dominated by a narrative that stressed mapping as a steady rise in greater knowledge and increased understanding of the world. It was a tale of the increasing scientific rationality of mapmaking from a dim and distant premodern past to an increasingly enlightened present. Maps were milestones along this journey. This discourse was undermined by the postmodern turn, which emphasized maps as social constructions, stories with a purpose, full of erasures and silences as well as inscriptions and disclosures. Maps have since been deconstructed according to their ideological basis, political undertones, and social contexts. They are now no longer seen as uncomplicated pictures of the world. They reflect power relations and embody the knowledge and ignorance, articulations and silences, of the wider social world. The accuracy or provenance of maps is no longer the only consideration in the new history of cartography. It is important to uncover their narrative context—their truths as well as their lies. Mapping is not innocent science—it is a political act.

REFERENCES

Harley, B. (2001) *The New Nature of Maps*. Baltimore and London: Johns Hopkins University Press.



2.4 Isothermal chart, 1823

he was privately tutored as a young boy and then studied at universities in Frankfurt, Göttingen, Hamburg, and Freiburg. He traveled widely. He arrived in Paris shortly before the storming of the Bastille; he wrote later that it "stirred his soul." He had a lifelong social concern with social reform and improvement. A recurring theme of his intellectual curiosity was to identify the "life force." His belief in universal harmony echoed concerns of John Dee. He was also deeply empirical; measurement and numbers were important to him.

After 1796, when he inherited money after his mother's death, he was able to pursue his dream of traveling, exploring, and writing about the world. He traveled to France and Spain—a "measuring expedition," he called it—so he could practice surveying techniques. He traveled to South America in 1799 and stayed until 1804. He passed through Cuba, Colombia, Ecuador, Mexico, and Venezuela, recording, measuring, and explaining. He gathered 60,000 plant specimens, made maps, and amassed a range of data from climate to linguistics. His careful mapping of plants in different places demonstrated the effect of altitude and latitude on plant communities.

Humboldt was an influential figure. His fame and reputation stimulated the adoption of measurement and observation in various expeditions and surveys throughout the world. He stimulated geographical measurement and observation. Figure 2.4 is an 1823 **isothermal map** of the world, as the text notes, "drawn from the account of Humboldt and others." Humboldt traveled throughout his life, in later years venturing east to Siberia and covering almost 9,000 miles at a time when transport was rudimentary. His travel journal consisted of thirty-four volumes.

His best-known work, *Cosmos*, was published in four volumes from 1845 to 1862. It deals with responses to the physical environment and explores the world of perception and feelings. There is extensive treatment of poetic descriptions of nature, from the Greeks to modern travelers, and more standard scientific works that discuss astronomy,

geology, and physical geography. Humboldt thought of calling his work *Cosmography* but stayed with *Cosmos* because it implied order. On the pivot of intellectual change, he shared some of the concerns of the older cosmographical tradition while inaugurating modern geography.

Mapping Relative Space

Absolute space is the grid of latitude and longitude. It is now easy to note that as I type these lines, I am located at 38.87 degrees north, 77.00 degrees west. We have come very far in giving an accurate spatial fix. In absolute terms, the Earth is accurately mapped, gridded, and coordinated. However, this locational fix says little about the neighborhood where I live. What kind of people live here? What are the housing conditions and neighborhood characteristics? Absolute location tells us nothing about the character of places. Much of contemporary human geography is concerned with the **relative space** of social connections, political arrangements, and economic conditions. We can consider the development of relative space by sampling some varied endeavors: the history of the mappings of crime, health, and social deprivation.

Crime

The term "**moral statistics**" first appears in an essay by André-Michel Guerry in 1833. It was used to refer to crime, pauperism, and a wide range of social phenomena. Such statistics were an important part of nineteenth-century thematic mapping. Maps of crime in France first appeared in 1829, when Guerry used data from 1825 to 1827 to plot, for each of the *départements* in the country, the incidence of crimes against persons, crimes against property, and educational instruction. Mapping in the early nineteenth century predated the development of statistical techniques. Maps and mapping were thus an important way to identify and suggest causal connections. Belgian statistician Adolphe Quetelet also used maps to suggest connections. His carefully gradated shading maps of France, the Low Countries, and parts of the Rhineland, published in 1831, show statistics on crimes against property and people. Quetelet was an influential figure in Europe, and his work and maps were translated into other languages. In the United States, Chicago was an early laboratory of social analysis and spatial mapping. A 1942 study by Shaw and McKay, for example, maps the covariation of various social conditions with reported incidences of juvenile delinquency.

Today the mapping of crime is an important element in policing. Keith Harries summarizes the now vast material on this practice. Maps of crime allow a spatial visualization vital to patrol officers, investigators, police managers, policy makers, and community organizations. Improvements in GIS (geographic information systems) now allow data to be mapped, presented, and correlated. Maps are used to identify areas of high crime activity (so-called hot spots), and mapping the timing and spacing of crimes allows a more efficient use of police resources. **Crime maps** of local areas are regularly posted by police departments.

Mapping is also used helps to solve crimes. **Geographic profiling**, like psychological profiling, has become an important part of law enforcement. Geographic profiling assumes that criminal activity is place-specific and that criminals like to use known areas that are not too close to their home location. Criminals do not travel very far from their anchor points to commit crime. The dates and places of committed crimes can thus be mapped to create a probability surface of clues to the location of criminals.

The background to the mapping of these "moral" statistics is not only the concern to know where social deviance occurs but also to look for the covariance of other factors so that the deviance can be understood, controlled, and negated. Mapping moral statistics is not innocent of wider political considerations. "Deviance," for example, is a politically freighted term whose definition tells us about those with power, their concerns and perceived threats. Contemporary human geographers no longer concern themselves just with mapping crime. A large body of work is now concerned with exploring the socio-spatial nature of crime and the policing of space. Phil Hubbard, for example, looks at the geographies of prostitution, while Katherine Beckett and Steve Herbert study how the spatial strategies of policing in Seattle banish certain types of people, especially the poor and indigent, and enforce zones of exclusion in the city.

Public Health and Disease

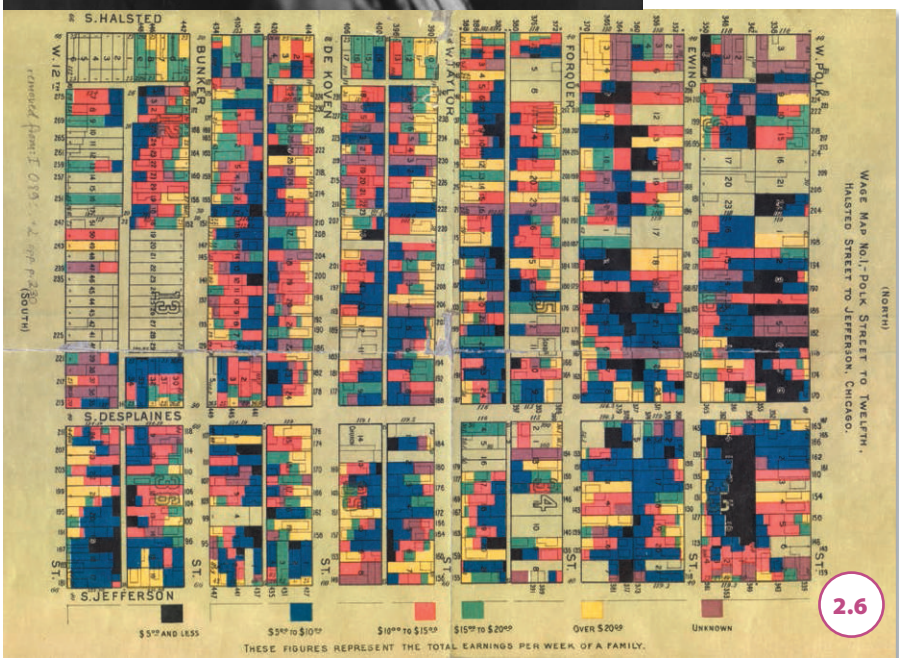
The first maps of the incidence of disease, at least in the United States, were by Valentine Seaman (1770–1817), who identified individual cases of yellow fever along the New York City waterfront. Mapping the spread of disease became more common in the nineteenth century. Public anxiety over the health of industrial cities in Britain led to the creation of the Poor Law Commission, which prompted the Ordnance Survey, the government mapping agency, to produce detailed maps of towns and cities.

One of the most famous sets of medical maps was drawn by John Snow, a doctor working in mid-nineteenth-century London. He was convinced that cholera was communicated by contaminated water. The 1855 second edition of his work *On the Mode of Communication of Cholera* contained two maps. The first showed the areas of London served by two different water companies. These companies used different sources for their water. While the area served by the company using fresh water had death rates due to cholera of 5 per 1,000, the one that drew polluted water from the River Thames had rates of 71 per 1,000. Snow's second map plotted the distribution of cholera cases at a more finely grained

level and showed that they clustered around particular pumps. People using the water pump in Broad Street, poisoned by a leaking cesspool, were more likely to come down with cholera than those using water from unaffected pumps. The maps highlighted the fact that cholera was caused by contaminated water and not, as the prevailing view at the time believed, contact with polluted air.

Social geographers have long mapped diseases and epidemics, and the interest in mapping disease continues. Two human geographers, Andy Cliff and Peter Haggett, along with various colleagues, have produced a large body of work plotting the spread of diseases. They have produced studies of disease diffusion through islands as well as case studies of individual diseases such as AIDS, influenza, and measles. Geographer Andrew Lawson, for example, works on **disease mapping** and analyzes how diseases cluster. In one paper with colleagues he showed how minority and low-income children in South Carolina were more likely to live in areas with lead-contaminated soils. The work confirmed the existence of **environmental racism** and reaffirmed the connection between lead exposure in children and increased incidence of intellectual disabilities.

There is more to the contemporary **social geography** of health and disease than mapping. More recent work examines the geographies of health inequalities, health care provision, health, and well-being.



2.5 Jane Addams, 1914. **2.6** Wage map published in *Hull-House Maps and Papers* in 1895. Courtesy of the Newberry Library, Chicago, Illinois.

Deprivation and Inequality

London in the 1880s was a place of turmoil: an economic depression in the middle of the decade increased unemployment and heightened social unrest. Charles Booth, a wealthy ship owner, established a social survey, one of the first. His multivolume *Life and Labour of the People in London* (1892–1903) quantified social problems in the metropolis. Booth's use of **social statistics** to measure and map urban inequality inaugurated an important strand of urban research in which empirical methods were tied to welfare reform objectives. This strand of urban investigation became a common feature of urban studies in the early twentieth century.

Jane Addams was a social activist (Figure 2.5). In 1889 she founded Hull House on Chicago's Near West Side. She worked there until her death in 1935. She and the other residents of the settlement provided services for the neighborhood, such as kindergarten and daycare facilities for children of working mothers, an employment bureau, an art gallery, libraries, and music and art classes. Hull House surveys of the local areas, similar to Booth's survey, led to the construction of maps of household income levels and ethnicity (Figure 2.6). One interesting feature of Hull House was the important role of women. Eight out of ten of the contributors to the 1895 volume *Hull-House Maps and Papers* were women. The Hull House residents and their supporters forged a powerful reform movement that launched the Immigrants' Protective League, the Juvenile Protective Association, the first juvenile court in the nation, and a Juvenile Psychopathic Clinic.

They lobbied the Illinois legislature to enact protective legislation for women and children and to pass, in 1903, a strong child labor law and an accompanying compulsory education law. The Keating–Owen Child Labor Act of 1916 was the legislative result of their efforts.

Jane Addams was tireless in her dedication. She wrote many popular books and numerous articles, maintained speaking engagements around the world, and played an important role in many local and national organizations, such as the Consumers League, the National Conference of Charities and Corrections (later the National Conference of Social Work), Campfire Girls, the National Playground Association, the National Child Labor Committee, the National Association for the Advancement of Colored People, and the American Civil Liberties Union. She was awarded the Nobel Peace Prize in 1931.

The concern with urban social difference continues to be an important part of urban social geography. To take just one example from thousands: Alasdair Rae highlights areas of deprivation in the English city of Sheffield as he maps health, education, skills, and crime, and plots the trajectory of change. While the maps and techniques have become more sophisticated, there remains at the core of human geography a consistent interest in documenting, mapping, and explaining the socio-spatial patterns of inequality.

Environment and Society

One goal of early-twentieth-century geography was to study the causal effects of environment on society. Ellsworth Huntington (1876–1947), a professor of geography at Yale University, argued that certain climatic conditions are "especially favorable to human progress." His **environmental determinism** was a form of racism. In his 1924 book *Civilization and Climate* he argued, "We know that the denizens of the torrid zone are slow and backward, and we almost universally agree that this is connected with the damp, steady heat" (p. 2). Climate, for Huntington, created culture.

Geography, like all intellectual disciplines, reflects and embodies current beliefs and ideologies. In the late nineteenth and early twentieth centuries, geography was often used to justify imperial adventures as well as to back up belief systems that ranked humans and societies. At the top were the white Protestant people and societies of Northwest Europe and North America. At the bottom were the black and brown peoples of the world. Racism and imperialism were an integral part of geography.

Writing at approximately the same time as Huntington, Ellen Churchill Semple (1863–1932), who taught geography at the University of Chicago and Clark University, developed a more probabilistic view of the role of environment in human progress. She was concerned with examining the relationship less deterministically and with less emphasis on racial differences and cultural hierarchies. Her writing needs to be placed in context. At a time when technological triumphalism was dominant, she was suggesting a counter-narrative that humans are connected to the land. In her classic work *Influences of Geographic Environment* (first published in 1911), she writes on page 2: "Man has been so noisy about the way he has 'conquered Nature,' and Nature has been so silent in her persistent influence over man, that the geographic factor in the equation of human development has been overlooked." Semple's book, a product of its time in its use of such terms as "savage," is still worth reading for both its eloquent style and its sensitivity to the relationship between people and environment.

Modern geography has long moved past issues of environmental determinism. However, a socially sensitive environmentalism still has some value. At the macro level, for example, climate change plays an important role in the rise and fall of civilizations. Mesopotamian civilization collapsed around 3,400 years ago due in part to a severe 200-year drought. The Mayan civilization of Central America collapsed almost 1,100 years ago, again due to a combination of social and environmental factors. The environmental context is an important one for looking at the big picture of societies' rise and fall. Echoing the basic theme of Huntington, but with a very different emphasis, Christian Parenti considers in his book *Tropic of Chaos* the area between the Tropics of Cancer and Capricorn. The **tropical zone** is one where issues of climate change and especially water availability are partial causes behind social conflict and political ruptures. Parenti draws a connection between climate change and violence through preexisting conditions, such as the legacy of Cold War militarism and the destructive consequences of neoliberal economics. He describes a catastrophic convergence of societies littered with cheap weapons and fractured by the lack of social connectivities now worsened by the wrenching effects of climate change. In an even broader perspective, Jared Diamond identifies the links behind social collapse and environmental degradation. This is not the simple determinism of earlier geographers but a more nuanced account that shows how social change is embedded and embodied in environmental relations.

Geography and Society

The history of an academic discipline is tightly bound up in broader social developments. Three themes spring to mind when discussing the evolving relationship between geography and society: the connection with wider intellectual debates, the varied relationships to political power, and contemporary concerns.

Intellectual Debates

One historian of geography, David Livingston, describes the discipline as a contested tradition. He argues for a history of geography that does not assume an unchanging metaphysical core but rather a series of situated geographies, ones that shape and are shaped in turn by the time and place of their making. To write a global geography in London in 1910 or Washington, DC, in 1945 is a very different enterprise from a global geography written in twenty-first-century Beijing. A comparison of the different worldviews embodied in Figures 2.1 and 2.2 is instructive. Practices and procedures vary, and this variation is not incidental to the evolution of geographic writing but rather fundamental. What interests are advanced, what assumptions are made, and what underlying model of how the world hangs together all depend on the time and place. Historians of the discipline, for example, are often appalled at the **casual racism** prevalent in the work of geographers writing in decades past. In other words, there is a historical geography to the evolution of **human geography**.

The situated and compromised nature of knowledge production is best summarized in the title and subtitle of Steven Shapin's 2010 book on the history of science, *Never Pure: Historical Studies of Science as if It Was Produced by People with Bodies, Situated in Time, Space, Culture, and Society, and Struggling for Credibility and Authority*. The history of geographic thought is intimately bound up in the historical geography of ideas.

Geography and Politics

The development of human geography is intimately connected to the interests of powerful groups, whether they are private and corporate or public and governmental. John Dee was an important intellectual figure in Renaissance England. He cast horoscopes for Queen Elizabeth I, promoted the expansion of English mercantile interest, and "proved" English claims in the New World. The production of geographical knowledge is intimately connected to national economic interest. Fast-forward over three hundred years: geography, according to Sir Halford Mackinder (1861–1947), was an aid to **statecraft**. What he meant by that was that geography could help frame geopolitical strategies for the nation state; in his particular case, Britain and the British Empire. He developed a **heartland theory** to argue that whoever ruled the central part of the Eurasian landmass, the heartland, ruled the world. The idea was first formulated in 1904 and appeared in book form in 1919. At the time he was a fervent anti-Bolshevik, and so his argument can be seen in one light as a rationale for providing a cordon around Bolshevik Russia. His ideas influenced Nazi strategic thinking and US Cold War strategy.

Isaiah Bowman (1878–1950), a contemporary of Mackinder, was director of the American Geographical Society for over twenty years. He was also the chief territorial advisor to President Wilson and to the US State Department during the First World War. He had a strong belief in US expansionism based on penetration of foreign markets by US capitalism. He provided a **geographical imagination** to ideas of US global superiority and dominance. His book *The New World*, written in 1921, is still a very well written and accessible account of geopolitical issues and problems facing the world in the aftermath of the First World War and in the wake of the fragmentation of prewar empires.

Dee, Mackinder, and Bowman are at one end of the applied geography scale, their work and ideas directly shaping and influencing national interests. At the other end are more antiestablishment figures. Peter Kropotkin (1842–1921) provides an interesting contrast. He was born into the privileged life of pre-Revolutionary Russian aristocratic society; his father owned vast tracts of land and over 1,200 serfs. In 1864 he led a geographical expedition to Siberia, and on his return to St. Petersburg he became secretary to the Imperial Russian Geographical Society. His interests widened to include a more radical vision of society: an **anarcho-communist** society based on mutual aid and voluntary associations. In 1875 he was imprisoned, but because of his social status was allowed to finish a geographical report on the last Ice Age, based on the fieldwork he had conducted earlier in Finland and Sweden. Students who are late with their work might like to think of Kropotkin, who finished his geography report even while in jail. He managed to leave Russia and lived in Switzerland and England, but returned in 1917 after the February Revolution overthrew the czar. He spoke out against the authoritarian socialism inaugurated with the October Revolution and the Bolshevik accession to power. Since 1957 a Moscow subway station has borne his name.

A more intellectual radicalism shapes the work of some contemporary human geographers. David Harvey (b. 1935) is a human geographer whose PhD work was on hops production in the English county of Kent. His first book, *Explanation in Geography* (1969), was an argument for the adoption of the deductive approach in geography. The context for Harvey's next book, *Social Justice and the City* (1973), was the wider world of the Vietnam War, the persistence of poverty in the richest countries, intractable racial divisions, and the decline of the long postwar economic boom, exposing inequalities and social discontent. There was a growing dissatisfaction in the academy with traditional methods of scholarship. In *Social Justice*, Harvey reflects upon and informs the debates surrounding these societal and academic issues. *Social Justice*, then, is really two books. The first part, "Liberal Formulations," focuses geographical inquiry on socially relevant topics. The second, "Social Formulations," marks a distinct **epistemological break**. The concept of the city is radically altered between parts one and two. Rather than being an independent object of inquiry, it is an important element that mediates and expresses social processes.

In subsequent books, Harvey continues to provide radical critiques of capitalism. *The Enigma of Capital* (2010) outlines the tendency of crisis in capitalism, while *Rebel Cities* (2012) argues for the importance of the city and the neighborhood as sites of political struggle. The title of his 2014 book, *Seventeen Contradictions and the End of Capitalism*, summarizes his focus on exposing the internal working of the capitalist system and highlighting its inherent long-term instability.

Contemporary Debates

Human geography has undergone profound change in the past fifty years. A number of "turns" can be identified. The turn of **quantitative geography**, associated with such people as Peter Haggett and Brian Berry in the 1960s, was concerned with measurement, calibration, the creation of spatial models, and the testing of hypotheses. It was not just a fascination with numbers. Waldo Tobler, for example, sought to represent flows in maps and to add a much needed temporal dimension to cartographic representation and the geographical imagination. He is also credited with devising **Tobler's Law**, which states, "Everything is related to everything else, but near things are more related to each other." The quantifiers also excavated previously neglected scholars such as the 1930s German geographer Walter Christaller, whose work we will consider in chapter 17. This excavation of previously ignored work is a consistent theme of all the different approaches, and leads to a constant recreation of the history of human geography.

But the quantitative turn, which built on a long tradition of quantitative geography, was not a revolution that came to dominate the entire discipline. It is more appropriate to think of it as a seismic shudder with multiple epicenters: Cambridge and Bristol in Britain and the University of Washington in the United States. In many places the seismic shift was scarcely recorded, and if it was, it was dismissed as of minor, ephemeral significance. And here we come to another trait of contemporary human geography: no turn has involved all of the discipline, because it is just too big and too varied.

The quantifiers had an uphill task against the entrenched forces of reaction. Old men (and most of them were men) with established reputations rarely take much heed of young scholars in a hurry who make very negative statements about the work of their elders. It was in one sense a generational struggle for power and status. But scarcely had the quantifiers established a beachhead in the discipline, through creating mandatory courses on statistical techniques and establishing their own publishing outlets, before counter-critiques and new turns emerged from the early 1970s. We can identify five from the many.

First, the notion of dispassionate, objective observers was criticized for its lack of social relevance and its connections with the corporate world. In effect, the "scientific" endeavor was neither socially neutral nor politically innocent. The emphasis shifted from identifying the spatial structure of society—a world of surfaces, edges, nodes, hierarchies, and flows—to the analysis of the social organization of space. This involved a more radicalized human geography.

Second, there was a criticism of the quantifiers from a humanist perspective. The **humanist critique** pointed to the lack of concern with personal geographies, the fact that statistical averaging ignored the whole realm of feeling, perception, and intersubjectivity. The work of Peter Jackson and Susan Smith showed what a radically informed **cultural geography** could look like. In the United States, cultural geography was revived through a concern with landscape as a socially contested, materially produced cultural artifact. Geographers like Jim Duncan and Denis Cosgrove reinvigorated old concerns of landscape with the new interest in social theory.

Third, in the 1980s feminists appeared as a significant voice in the struggle for the hearts and minds of human geography. The **feminist critique** drew attention to the bias in the academic practice of geography and geographical writings. It was a discipline dominated by men and a discourse that rarely connected with the reality of gendered spaces and gendered lives. There is now a considerable body of work on the gendered separation of productive and reproductive spheres, issues of domestic labor, work–home separation, and the overall living and working experience of women. The feminist perspective also shows how gender interacts with race, class, and sexuality to produce socio-spatial patterns of inequality and marginalization. Geographers such as Doreen Massey, Linda McDowell, and Gill Valentine, to name just a few feminist scholars, have widened my own angle of vision.

Fourth, the adoption of **postmodernism** in human geography was a significant development. Postmodern geographers such as Michael Dear, Gillian Rose, and Ed Soja criticized the notion of objective universal constructs. Knowledge was not revealed to socially objective viewers but socially constructed by the perspective of the viewer. The postmodern turn shifted the debates by introducing notions of hybridity, alternative rather than dominant narratives, and a multiplicity of ways of knowing.

Fifth, there is now a greater concern with the marginal and the marginalized. For much of the history of geography in the past two hundred years, the subject was written about by a relatively small sample of people—generally men in positions of power and authority in the richer countries of the world. Geography was linked to the existing global and national power structure. In recent years, however, there has been a growing body of work that we can call **subaltern geographies**. More geography is being written from outside the circle of usual suspects. More female scholars and scholars from developing countries are beginning to shift the angle of vision. There are

2.3 The Spatial Turn

The "spatial turn" is the name given to a greater emphasis on space and place in the social sciences and humanities. It was promoted by two trends. The first is an increasing recognition that space and place play important roles in the issues and concerns important to social scientists and humanity scholars. Of course it is at the heart of the geographical enterprise, so we have been practicing the spatial turn long before it became fashionable in other disciplines. A spatial turn is noted in anthropology, architecture, history, psychology, religion, literature, sociology, and history. Topics such as maps and mapping, territoriality, landscape, spatial change, and the transformations of place are the heart of new ventures in other disciples that have found a shared interest in describing and explaining the culturally inscribed meanings of place and power relations of space.

The second trend is the growing use of GIS in the social sciences and humanities—for example, mapping in the digital humanities. One research project generated a 1.5-million-word corpus from 80 texts written about the Lake District in England between 1622 and 1900. Places that were described with terms such as "beautiful," "majestic," and "sublime" were mapped. The analysis showed the influence of the Romantic sensibilities, how "sublime" is used to refer to wide sweeps of landscapes while "majestic" is more specific. The mappings reveal the different ways used at different times to describe and evaluate the landscape of the Lake District.

REFERENCES

Gregory, I. and Donaldson, C. (2016) Geographical Text Analysis: Digital Cartographies of Lake District Literature. In: *Literary Mapping in The Digital Age. Digital Research in the Arts and Humanities*. London: Routledge, pp. 67–78.

Warf, B. and Arias, S. (eds) (2008) *The Spatial Turn: Interdisciplinary Perspectives*. London: Routledge.

also more geographical studies of marginalized groups: women, children, migrant workers, peasants, slum dwellers, sexual minorities, and so forth. Geography is enriched by these developments.

Today human geography is a rich area of intellectual inquiry. The discipline continues to be contested in a lively fashion.

The Concerns of Human Geography

Geography has some enduring concerns. Geographers are interested in the reasons behind and the consequences of the spatial distribution of human activities and human environmental interactions. Geographers look at space and place as containers, stages, sites, and outcomes of human activities and environmental interactions. They are always asking two major and related questions: where and why?

Fundamental Concepts

Space and place are fundamental concepts in human geography. Space is a more generalized place such as the nation state, the region, the city, or the neighborhood, while places include the USA, southeast England, Shanghai, and Bukchon, South Korea.

Understanding how space becomes place and how places are incorporated into space is at the heart of the human geography enterprise. Culture turns space into places. Place is space made more intimate by culture. But places are in turn incorporated into space, as when the USA is linked to the global economy by flows of people, goods, and ideas. Space and place are more than mere background; they are stages for performances, given meaning and significance by social actions, political conflict, and economic processes. Space and place are active moments, not static categories.

Geographers are concerned with the spatial organization of society and the social organization of space: how spaces and places are produced, used, consumed, destroyed, represented, managed, and controlled. They are concerned with spaces of hope and spaces of exclusion, the reconstructions as well as the destructions of place.

Spatial Categories

There is a range of spatial categories that hold special meaning for geographers: they include the nation state, the region, landscape, the city, and the neighborhood, home. Other spatial categories include the frontier, boundary, territory, and turf. Geographers look at the physical and discursive construction of these categories, their changing usage and meaning. The categories are employed not as reified spatial abstractions, but as social constructions full of cultural meaning and political significance. They are not unchanging verities but the outcome and site of negotiation and conflict.

There is spatial imagination at work in the study of human geography, and so a wide range of spatial categories are employed, including location, which is a point or

place on the Earth's surface. Location can be used in absolute terms, such as latitude and longitude, as well as in relative terms, such as describing a country or region as rich or poor.

Distributional categories employed include density, concentration, and pattern. Typical questions: What is the density of population in a certain place and why? Why are certain economic activities concentered in certain locations? Is there a pattern to events such as the distribution of towns and cities?

Movement across space and between places is another important topic. Geographers are interested in how the friction of distance influences things. The time taken to travel is improved by transport improvements, leading to what is known as space-time convergence, the collapse of the time taken to travel the same distance.

The term "diffusion" is used to describe the spread of things, ideas, people, or practices across space. Diffusion occurs in different ways. It can occur through relocation, as when people often take their language and religion with them when they move, diffusing it more widely; through contagion, as when diseases spread through contact; or through hierarchical diffusion, as when ideas flow from large to small cities.

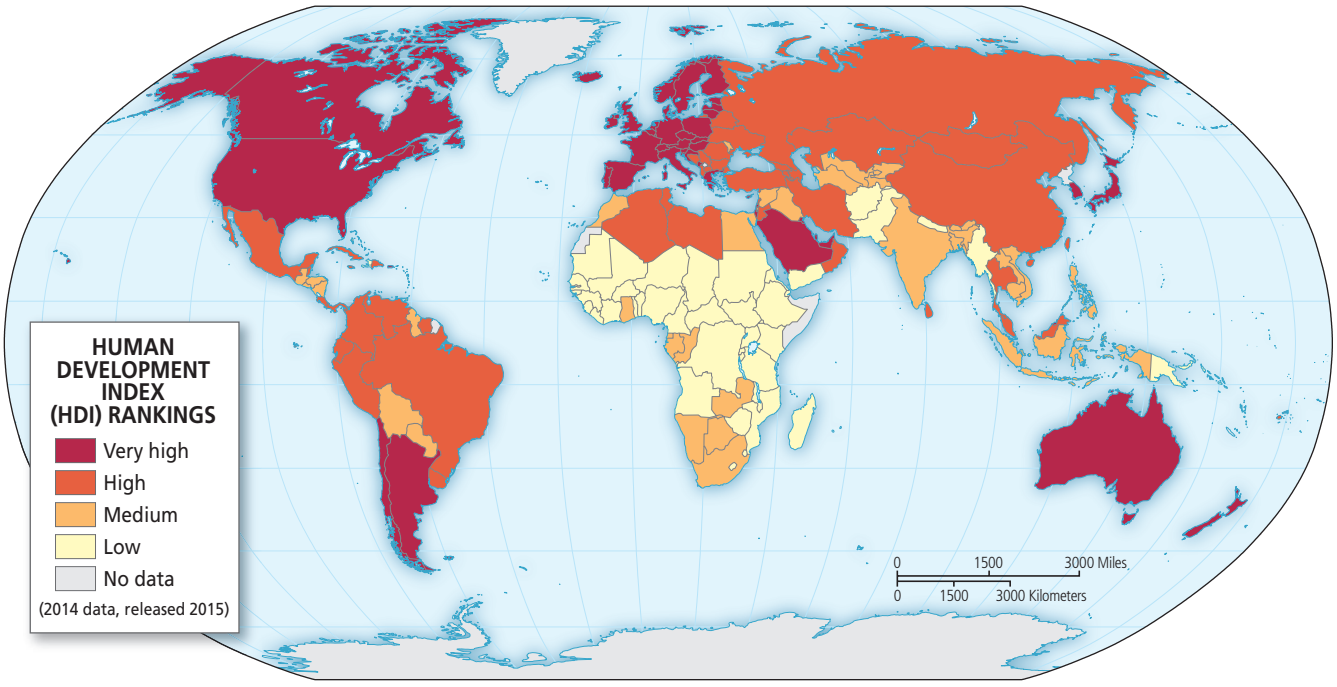
Geographers study different types of regions, which we can define for the moment as demarcated areas of the Earth's surface. Regions are defined by different criteria and so we refer to cultural regions and economic regions. Hollywood, the Rust Belt, and the Asian Tigers are all examples of some of the regional definitions used in economic geography. Human geography employs different types of regions at different spatial scales.

The last few paragraphs are very dense. However, think of them as mere pointers that introduce you to spatial categories that are more carefully defined and strategically employed throughout the rest of this book.

Methods

Geographers work at a variety of scales, from the global and national to the more intimate spaces of our personal interaction. Human geography has a large bandwidth and so employs a variety of techniques. There is an enduring concern with spatial representation and mapping. Figure 2.7 maps the Human Development Index (HDI). This is a composite index that combines measures of a long and healthy life, being knowledgeable, and having a decent standard of living. From this map, what conclusion can you make about the global distribution of human development? In which countries would you choose to live, and why?

In recent years, mapping has been dramatically altered by the rise of **Geographic Information Systems (GIS)**, systems that store geographic data and allow their manipulation and representation. GIS is used by governments and companies to store, access, and display data. Geographers also use remote sensing, which involves the collection of data taken from aircraft, satellites, and more recently drones. For example, a recent study by geographer Do-Hyung Kim and colleagues used satellite imagery to examine tropical forests



2.7 Human Development Index.

in 34 counties. They discovered that the rate of loss was higher than then suggested by the United Nations, which had been using self-reported data. While UN data showed deceleration in forest loss, their detailed study showed a 62 percent acceleration in deforestation in the humid tropics from the 1990s to the early 2000s.

Remote sensing allows us to utilize data that would be difficult to map, such as ice sheet shrinkage or the emergence of slums at the edge of cities in the developing world. Figure 2.8 shows a space-based perspective of the Kansas City metro area taken in September 2014 by astronauts on the International Space Station.

Geographic profiling is now an often-used technique. Initially used in crime studies to identify patterns of crime and locate criminals, it is now used to identify disease outbreaks and control invasive species. It was used to solve an art mystery: who was the insurgent artist Banksy? It was also used to help narrow down the location of Osama bin Laden while he was in hiding. Assumptions included a distance decay function: he would not move far from his last sighting in Afghanistan, he would be in Pakistan because it was a similar culture, and he would be in a town or city in a dwelling large enough to house his retinue with high walls to provide privacy and security. His precise location in Abbottabad was confirmed by following a courier. DNA evidence from people in the house provided **ground truthing**.

A range of techniques is employed in contemporary human geography. Quantitative analysis relies on data and statistical analysis, while qualitative techniques include storytelling and the use of focus groups and participant observation. The combination of the qualitative and quantitative provides sympathetic and grounded accounts. In my own case study of Aboriginal art production and racial tensions in Alice Springs, Australia, I mapped peripheral settlements, and studied government data and city records, but also visited the city over many years to interview people, cultivate connections, and immerse myself in the world of art production and sale.

Human geographers look at space and society from a variety of scales, encompassing approaches that range from GIS, remote sensing, and statistical analysis techniques to qualitative ethnographic studies. They intersect with other researchers to consider such important topics as the flexible identities of gender, ethnicity, and nationality; the measurement, explanation, and understanding of globalization; the connections between space and place; the recurring question of how we represent the world around

2.8 Remotely sensed image of Kansas City metro area

2.4 GIS, Remote Sensing, and the Democratization of Mapping

While it is often used in the worlds of national security and as part of corporate research, GIS can also be used to map social inequalities. Alasdair Rae uses GIS to identify areas of deprivation in Scotland in an interactive map that employs Google Maps. His website is Stats, Maps n Pix.

There also has been a democratization of mapping. OpenStreetMap is a collaborative effort with 2 million registered users who generate a free map of the world. The community plays an important role in **crisis mapping**. During the 2010 Haiti earthquake, volunteers used satellite data to provide a real-time digital atlas of the road system, vital information in a country desperate to get aid supplies to affected communities. The project was so successful that now the OpenStreetMap community regularly teams up with aid organizations in the wake of disasters to provide urgent and much-needed spatial data.

Open source software and global volunteer networks are now an important part of crisis mapping. GIS and social media are being used to provide real-time georeferenced data in places experiencing violence or disruption. Patrick Meier provided examples from Haiti, Japan, Kenya, Russia, Somalia, and Syria.

There are also more focused examples. Geography students at the University of Montana used satellite images to construct a detailed topographic map of a tiger reserve in Nepal, which allowed people on the ground to reconcile their position on the map and track down poachers.

GIS and remote sensing can also be used in more open and democratic way, especially for societies that are closed and undemocratic. Curtis Melvin used Google Earth to a create map of North Korea that highlighted missile-storage facilities, mass graves, labor camps, and the palaces of the elite. He went on to work on a crowdsourced atlas of the secretive state, opening up one of the world's most isolated and brutal countries to greater public scrutiny.

REFERENCES AND WEBSITES

Meier, P. (2012) Crisis Mapping in Action: How Open Source Software and Global Volunteer Networks Are Changing the World, One Map at a Time. *Journal of Map and Geography Libraries: Advances in Geospatial Information, Collections and Archives* 8: 89–100.

Chaney, R. (2015, December 16) Nepali Tiger Poachers Fear University of Montana Mapmakers. *Missoulian,* http://missoulian.com/lifestyles/recreation/nepali-tiger-poachers-fear-university-of-montana-mapmakers/article_40c44f52-bbe2-5c87-80f0-ab5668c58ad0.html

https://www.openstreetmap.org/#map=5/51.500/-0.100
https://sites.google.com/site/scotdep2012/home
http://www.nkeconwatch.com/north-korea-uncovered-google-earth/
http://www.statsmapsnpix.com
http://www.38northdigitalatlas.org

2.9 Two young people studying a globe in a park in Vienna, Austria

us; and the pressing concerns of sustainability, environmental transformation, and climate change. At its very best, the discipline exhibits an environmental sensitivity with a social awareness. And like the two young people in Vienna shown in Figure 2.9, it looks at the world as a constant source of fascination and interest.

An editorial opinion piece in the influential British newspaper *The Guardian* summarizes the attractions of the discipline:

> *[G]eography is a subject for our times. It is inherently multidisciplinary in a world that increasingly values people who have the skills needed to work across the physical and social sciences. Geographers get to learn data analysis. . . . They learn geographic information systems. They can turn maps from a two-dimensional representation of a country's physical contours into a tool that illustrates social attributes or attitudes: not just where people live, but how, what they think and how they vote. They learn about the physics of climate change, or the interaction of weather events*

and flood risk, or the way people's behaviour is influenced by the space around them. All these are not just intrinsically interesting and valuable. They also encourage ways of seeing and thinking that make geographers eminently employable.

As you read these lines, you are now an active participant and creator in this fascinating discourse. At it very best, the study of geography exercises the spatial imagination and cultivates a profound sense of place. Welcome to the most exciting and engaging of subjects.

Cited References

Aelion, C. M., Davis, H. T., Lawson, A. B., Cai, B., and McDermott, S. (2013) Associations between Soil Lead Concentration and Populations by Race/Ethnicity and Income-to-poverty Ratio in Urban and Rural Areas. *Environmental Geochemical Health* 35: 1–12.

Balch, E. (1895) *Hull House Maps and Papers*. http://www.jstor.org/stable/2276290

Beckett, K. and Herbert, S. (2009) *Banished: The New Social Control in Urban America*. New York: Oxford University Press.

Booth, C. (1903) *Life and Labour of the People in London*. London: Macmillan.

Bowman, I. (1921) *The New World: Problems in Political Geography*. Yonkers: World Book Company.

Diamond, J. (2005) *Collapse: How Societies Choose to Fail or Succeed*. New York: Penguin.

Editorial Opinion (2015, August 13) The Guardian View on Geography;It'stheMustHaveA-level.http://www.theguardian.com/commentisfree/2015/aug/13/the-guardian-view-on-geography-its-the-must-have-a-level?CMP=share_btn_tw

Kim, D. H., Sexton, J. O., and Townshend, J. R. (2015) Accelerated Deforestation in the Humid Tropics from the 1990s to the 2000s. *Geophysical Research Letters* 42: 3495–3501.

Harries, K. (1999) *Mapping Crime: Principle and Practice*. Washington, DC: Department of Justice. NCJ 178919.

Harvey, D. (1973) *Social Justice and the City*. London: Arnold.

Harvey, D. (2010) *The Enigma of Capital*. London: Profile.

Harvey, D. (2012) *Rebel Cities: From the Right to the City to the Urban Revolution*. London: Verso.

Harvey, D. (2014) *Seventeen Contradictions and the End of Capitalism*. Oxford: Oxford University Press.

Hauge, M. V., Stevenson, M. D., Rossmo, D. K., and Le Comber, S. C. (2016) Tagging Banksy: Using Geographic Profiling to Investigate a Modern Art Mystery. *Journal of Spatial Science* 61: 185–190.

Hubbard, P. (1999) *Sex and the City: Geographies of Prostitution in the Urban West*. Aldershot: Ashgate.

Humboldt, A. (1897) *Cosmos: A Sketch of a Physical Description of the Universe*. New York: Harper.

Huntington, E. (1924) *Civilization and Climate*. New Haven: Yale University Press.

Livingstone, D. N. (1993) *The Geographical Tradition: Episodes in the History of a Contested Enterprise*. Oxford: Blackwell.

Parenti, C. (2011) *Tropic of Chaos: Climate Change and the New Geography of Violence*. New York: Nation.

Rae, A. (2011). Deprivation in Sheffield. http://www.sheffield.ac.uk/polopoly_fs/1.137936!/file/ajr_sheffield_deprivation_nov_2011.pdf

Shapin, S. (2010) *Never Pure: Historical Studies of Science as if It Was Produced by People with Bodies, Situated in Time, Space, Culture, and Society, and Struggling for Credibility and Authority*. Baltimore, MD: Johns Hopkins University Press.

Semple, E. C. (1911) *Influences of Geographic Environment on the Basis of Ratzel's System of Anthropogeography*. New York: Holt. https://archive.org/details/influencesofgeog00semp

Short, J. R. (2012) Representing Country in the Creative Postcolonial City. *Annals of Association of American Geographers* 102: 129–150.

Snow, J. (1855) *On the Mode of Communication of Cholera*. London: John Churchill. http://www.ph.ucla.edu/epi/snow/snowbook.html

Select Guide to Further Reading

On maps and mapping:

Krygier, J. and Wood, D. (2011, 2nd ed) *Making Maps*. New York: Guilford.

Short. J. R. (2003) *The World through Maps*. Toronto: Firefly.

Tyner, J. (2015) *The World of Maps*. New York: Guilford.

For contemporary discussion of the geographies of health:

Anthamatten, P. and Hazen, H. (2011) *An Introduction to the Geography of Health*. New York: Routledge.

Brown, T., McLafferty, S., and Moon, G. (2010) *A Companion to Health and Medical Geography*. Malden: Wiley-Blackwell.

Cliff, A. D., Haggett, P., and Raynor, M. S. (2004) *World Atlas of Epidemic Diseases*. London: Hodder Arnold.

Koch, T. (2011) *Disease Maps: Epidemics on the Ground*. Chicago: University of Chicago Press.

Two sample papers on crime:

Andresen, M. A. and Brantingham, P. L. (2012). Visualizing the Directional Bias in Property Crime Incidents for Five Canadian Municipalities. *The Canadian Geographer/Le Geographe Canadien* 57: 31–42.

Rossmo, D. K. and Harries, K. (2011) The Geospatial Structure of Terrorist Cells. *Justice Quarterly* 28: 221–248.

A useful entry point into the history of an intellectual discipline is to read the biographies and autobiographies of its practitioners. Here is a very small sample of a range of human geographers:

French, P. J. (1987) *John Dee: The World of an Elizabethan Magus*. London: Routledge.
Gould, P. (1999) *Becoming a Geographer*. Syracuse, NY: Syracuse University Press.
Gould, P. and Pitts, F. (eds) (2002) *Geographical Voices*. Syracuse, NY: Syracuse University Press.
Haggett, P. (1990) *The Geographer's Art*. Oxford: Blackwell.
Hubbard, P. and Kitchin, R. (eds) (2011) *Key Thinkers on Space and Place*. London: Sage.
Kearns. G. (2009) *Geopolitics and Empire: The Legacy of Halford Mackinder*. Oxford: Oxford University Press.
Kropotkin, P. (1927) *Memoirs of a Revolutionist*. London: Smith Elder. First published 1899. http://theanarchistlibrary.org/library/petr-kropotkin-memoirs-of-a-revolutionist
Moss, P. (ed) (2000) *Placing Autobiography in Geography*. Syracuse, NY: Syracuse University Press.
Rupke, N. A. (2008) *Alexander von Humboldt*. Chicago: University of Chicago Press.
Smith, N. (2004) *American Empire: Roosevelt's Geographer and the Prelude to Globalization*. Berkeley and Los Angeles: University of California Press.

On human geography, ancient and modern:

Association of American Geographers (2017) *International Encyclopedia of Geography*. Chichester, UK: Wiley-Blackwell.
Agnew, J. A. and Livingstone, D. N. (eds) (2011) *The Sage Handbook of Geographical Knowledge*. Thousand Oaks, CA: Sage.
Cox, K. (2014) *Making Human Geography*. New York: Guilford.
Cresswell, T. (2013) *Geographic Thought: A Critical Introduction*. Chichester, UK: Wiley-Blackwell.
Gregory, D., Johnston, R., Pratt, G., Watts, M. and Whatmore, S. (eds) (2011) *The Dictionary of Human Geography*. Chichester, UK: Wiley-Blackwell.
Martin, G. J. (2005) *All Possible Worlds: A History of Geographical Ideas*. 4th ed. Oxford: Oxford University Press.
Thomson, J. O. (2013) *History of Ancient Geography*. Cambridge: Cambridge University Press.

On GIS:

Bolstadt, P. (2016) *GIS Fundamentals*. Ann Arbor: XanEdu.
Nyerges, T. L., Couclelis, H. and McMaster, R. (eds) *The Sage Handbook of GIS and Society*. London: Sage.

Selected Websites

On GIS
https://www.youtube.com/watch?v=j5WmvTxQF5w
https://www.youtube.com/watch?v=bLnJpkqjlwo

Humanitarian Open Street Mapping
https://hotosm.org

Just one of the many urban police websites that map crime
http://oakland.crimespotting.org/map

A website run by geographers that maps and analyzes user-generated geocoded data; it uses social media to produce some very cool maps
http://www.floatingsheep.org/

Websites of selected geographical societies and organizations:
American Association of Geographers: http://www.aag.org
American Geographical Society: http://americangeo.org
International Geographical Union: http://igu-online.org
National Geographic magazine: http://www.nationalgeographic.com
Royal Geographic Society: http://www.rgs.org/HomePage.htm

Learning Outcomes

- Human geography is shaped by the debates of the past, with five particular themes that have resonated through the years: the coordination of absolute space, the emergence of geography from cosmography, the discussion of relative space, environment and society, and the links between geography and society.
- Ptolemy was one of the earliest known mapmakers.
- The shift from cosmography to geography was neither sudden nor abrupt. Humboldt was on the cusp of the change.
- There is a long and enduring interest in human geography in mapping and explaining the socio-spatial patterns of crime, public health, and inequality.
- Geography, like all intellectual disciplines, reflects and embodies current beliefs and ideologies. In the late nineteenth and early twentieth centuries, for example, geography was often used to justify imperial adventures as well as to back up belief systems that ranked humans and societies.
- Modern geography has moved past issues of environmental determinism to a more sensitive environmental understanding.
- Human geographers use a variety of techniques and different scales to understand a wide range of topics.
- Human geography today has developed in response to various critiques of its lack of relevance, lack of humanism, and gender and racial biases.
- Human geography now incorporates an environmental sensitivity and a social awareness.

PART 2

People, Resources, and Environment

Part 2 takes up the general themes of population and resources. Chapter 3 outlines the basic trends of growth and decline and examines the dynamics of the demographic transition. The relations between population and food supply are detailed in chapter 4 and those between population and resources in chapter 5. Chapter 6 examines people–environment relations through exploring environmental impacts on society and human influences on environment change.

OUTLINE

3

Population Dynamics

LEARNING OBJECTIVES

Describe the historical factors that trigger major population changes.

Describe the main trends of world population change with associated economic and cultural impacts.

Identify the four phases of the demographic transition.

Explain the social and economic concerns that accompany each stage of the demographic transition.

Relate current global cultural and political occurrences to contemporary population geographies.

Human population levels have risen and fallen in line with climate change and availability of food. In the past two hundred years there has been a steady increase in the world's population. Population dynamics have changed. The demographic transition is a shift from high birth and death rates, through declining death rates and high birth rates, to declining birth and death rates. Different parts of the world are at different stages of this transition. Some have high growth rates, while others are experiencing net population decline.

The world population is now close to 7.5 billion. It grew from a very small base. The number of humans poised to leave Africa to populate the world probably ranged from 3,000 to 5,000 souls. This tiny group was the basis for the spread and growth of human population around the globe. Global population remained small and steady until 4,000 years ago, when there was a slow, steady rise, then an explosive upward growth beginning around 1800 (Figure 3.1). Population growth accelerated in the past century. It took thirty years, from 1930 to 1959, for an extra billion people to be added. It took only another thirteen years, from 1998 to 2011, for yet another billion to be added.

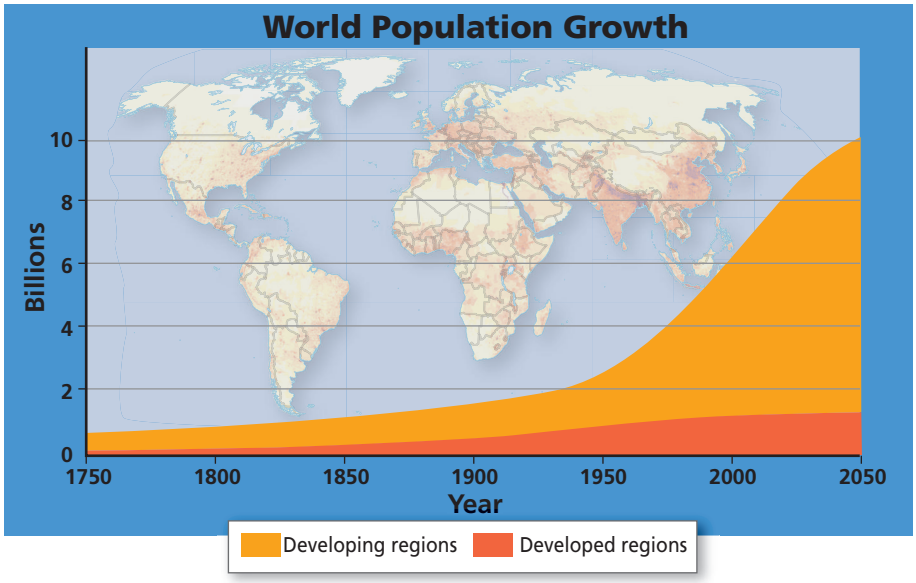
Throughout most of human history, the world's population was relatively small. Specific bottlenecks occurred when the human population came precariously close to extinction. Around 70,000 years ago, the eruption of the volcano Toba in Sumatra caused a volcanic winter of a long stretch of colder, cloudier weather. The total human population may have been reduced to only thousands. The result was a very small pool of genetic diversity. Today's huge population is genetically very close. We share a common ancestry, and despite the cultural production of racial and ethnic differences, we are biologically just part of one large extended family.

Despite such setbacks, humans prospered. They were adaptable, smart, and mobile. They transformed their surroundings, trapping animals,

creating gardens, and efficiently developing gender divisions of labor between male hunting and female gathering and foraging. Men and women accumulated a long-term, deep, and sophisticated knowledge of the environment.

Population Declines

The long-term trend is one of global population growth. The increase in the **world population** masks significant examples of population decline. While wars and social conflict can reduce population in specific regions at specific times, longer-term declines are mainly due to disease and climate change.



3.1 World population growth

Disease

In Athens between 430 and 427 BCE, almost a third of the population of the city-state died from a disease as yet undetermined, likely a form of typhus. Yet disease has sometimes reached pandemic proportions. A **pandemic** is an epidemic on a wide geographic scale. We can consider three examples.

The first was the **bubonic plague** that swept in a series of waves across the world from 541 to 747 CE. It was especially pronounced in the Byzantine Empire. The first wave occurred from 541 to 544 and is named after the ruling emperor of the time, Justinian. It spread quickly along trade routes. The total death toll is estimated at 25 million people. In Constantinople, at the height of the first wave, almost 5,000 people were dying every day, ultimately halving the city's population. The disease spread as far west as England and as far east as Persia. The mass death created social confusion, caused economic dislocations, and prompted political upheaval. Villages were abandoned. Arable land lay fallow, and labor was in short supply. The lack of labor stimulated technological improvements such as improved plow design and new crop rotations. The pandemic impeded the growth of the Byzantine Empire and led to what some describe as the birth of Europe, as there was a localization of economies and political systems rather than unification under an empire. It was the pivot of large-scale social change, including the shift from antiquity to the Middle Ages and the opening stage of the rise of Western Europe to continental and then global dominance.

A second pandemic, a recurrence of bubonic plague, swept throughout Asia, North Africa, and Europe: the "**Black Death**," first mentioned in written records in 1346, by 1353 had killed between 30 and 40 percent of the population, with some estimates of up to 60 percent mortality in Europe. The population of Europe probably declined from 80 million to 30 million. The effects of such a rapid population loss were immense. Forests regrew throughout Europe. Societies dominated by low wages, high rents, and high prices were quickly transformed into ones of high wages, low rents, and low prices. The lack of population forced the development of more efficient, less labor-intensive technologies. Landowners switched from the strenuous **arable agriculture** of grain production to the less taxing **pastoral farming** of producing meat, wool, and dairy products. The switch "from corn to horn" also gave more employment opportunities to women, who were traditionally employed in the pastoral sector. There were also social upheavals. In England the 1381 **Peasants' Revolt** was the organized resistance to attempts by authorities to reduce wage levels to pre–Black Death levels. The wider significance of the Black Death is debatable. There are those who argue for continuities before and after, while others see a more profound shift from the medieval world to the modern world—a world where religious devotion was undermined for some, strengthened for others; a world where minorities, especially Jews, could become scapegoats for disasters; a world where the authorities were made responsible for public health; a world where the relationship between rich and poor was dramatically revealed as based less on unchanging

3.1 The Reproductive Revolution

The demographic transition is less a natural fact than a social revolution. It is a result of changes in public health and nutrition that extended the average life span. It is also the consequence of a reproductive revolution. The reproductive capacity of women is potentially very high. In theory, each fertile woman can have up to, and in some cases have had more than, fifteen children. Before the demographic transition, the reproductive efficiency was low, with few women living to puberty, high **infant mortality rates**, and low life expectancy. Fewer than one in ten girls reached the age of puberty. The result was a relatively low reproductive capacity. Each child born had limited chances of reaching adulthood. Emphasis was thus placed on each and every woman having as many children as possible. This largely defined the role of women and is the fundamental basis of **patriarchy**, the belief system and practice that men are the authority figures and women are restricted to home, hearth, and the bearing and rearing of children. Patriarchy—although mediated through different cultural and religious filters—is an attribute of low reproductive efficiency.

After the demographic transition, more women survived into their fertile years, and infant mortality rates fell. This higher reproductive capacity means that women can have fewer children. As the risk of each child dying declines, women do not need to have so many children to ensure that some survive into adulthood. The increased life expectancy also extends more women's lives beyond childbearing ages. The reproductive revolution calls into question the basis of patriarchy. McInnes and Diaz argue that the origin of other social changes, including the deregulation and privatization of sexuality and the rise of the importance of individual identity, also ultimately resides in the increased efficiency of reproduction. Their case is suggestive and intriguing, yet like all ambitious arguments it is open to debate and discussion, criticism, improvement, and refinement.

REFERENCE

McInnes, J. and Diaz, J. P. (2009) The Reproductive Revolution. *Sociological Review* 57: 262–284.

custom and tradition than on the brute facts of labor supply and demand.

Perhaps the most dramatic relationship between disease and population declines involves the **Columbian Encounter** that took place when Europeans discovered and colonized the Americas. The impact on the indigenous population was devastating. The pre-Columbian population of the Americas is difficult to gauge precisely, but estimates put the figure between 50 million and 100 million. The indigenous population was descended from peoples who had come from Eurasia before the development of agriculture. There was thus a major difference between the Eurasian and the American human populations. In Eurasia the agricultural revolution involved a closer association between animals and people. Over time diseases that passed from animals to humans, such as influenza and measles, were less fatal, as those fatally susceptible died out, leaving behind a more resilient human population. This process did not occur in the New World, making its indigenous inhabitants fatally susceptible to everyday diseases from the Old. Diseases such as influenza, measles, and smallpox proved fatal to the people of the Americas. Soon after contact, indigenous populations collapsed as fatal diseases spread quickly with devastating effect. "Great was the stench of the dead," noted a 1571 report of an epidemic in Guatemala. In the northwest region of Guatemala, the population fell from 260,000 in 1520 to 47,000 in 1575. Across the entire continent, from 1492 to 1640, the indigenous population was reduced by close to 90 percent. Later European colonists arrived in a land largely emptied of its original inhabitants. The wilderness that nineteenth-century observers noted—the vast forests, empty plains, and abundant animal life—was not a pristine landscape but an environment of much reduced human impact. Geographer William Denevan deconstructs the "**pristine myth**" that North America was a vast wilderness before the coming of the Europeans. The later colonists encountered not what they thought of and described as a "natural" wilderness but what was in fact a regenerated wilderness, the product of a dramatic decline in the indigenous population and its environmental impact. The American landscape of the eighteenth and nineteenth centuries was not an unchanging wilderness but the result of the population collapse of the sixteenth and seventeenth centuries. The Columbian Encounter did not reveal the American wilderness but created it.

Societies develop equilibrium when demographic trends stay the same or exhibit only slight increase or decrease. Change, even large change, if it develops slowly, can be easily incorporated into social institutions. But when population levels fall drastically, the resultant ruptures and tears in social norms and social relationships produce dramatic changes and long-term unfolding consequences. All three pandemics had dramatic effects. The rise of Western Europe, the creation of modernity, and the decline of American indigenous people all partly originate in rapid population loss.

Climate Change

The development of agriculture made human population more dependent on **agricultural productivity**. A decline in agricultural output could increase mortality and lead to fewer births. The decline in food supply occurred especially when climate change reduced the length of the growing season. Patrick Galloway noted a connection between population change and fluctuations in climate change for the mid-latitude regions of the world. Across these regions there was a warming trend, peaking around 1200 CE, followed by cooling until 1450; then warming until 1600, followed by a rapid cooling until around 1690. These changing temperatures caused a decline in agricultural productivity—colder weather reduced harvests and increased the risk of hunger and starvation—that suppressed population growth. In England, for example, during the cooling period of 1600 to 1650, population levels declined because, with lower food supplies, women had fewer children.

Harry Lee and colleagues, testing Galloway's model, examined the data for China over the past thousand years. They found that five major population contractions occurred during cooler temperatures. Long-term cooling led to falling harvest yields, fewer births, and increasing mortality rates.

Historian Geoffrey Parker extended the analysis to the global level. He pulled together a vast array of material to consider the political implications of global climate change in the seventeenth century. From around 1640 to 1690 the climate was appreciably colder, at a time when most people were dependent on agriculture. This **Little Ice Age** led to harvest failures, food shortages, and hunger. A third of the world's population died and the unfolding consequences rocked the political foundations. From China to England there was an unparalleled outbreak of revolts and revolutions as people rebelled against and resisted an existing order unable to cope with the crisis.

The Demographic Transition

Until 1800, global demographics were characterized by short life expectancy, high fertility, a young population, and slow population growth. In 1800 the average lifespan was only twenty-seven years, most fertile women gave birth to six children, one in three people were less than fifteen years old, and the annual population growth rate was around 0.51 percent. People's lives were short, women spent much of their time having and raising children, and there were very few old people.

Around 1800, changes in mortality and fertility, known as the **demographic transition**, altered this global pattern. The transition has two dominant trends. First, there was the decline in **mortality rates**, initially in the richer parts of the world, such as Western Europe and North America, brought about by improved personal hygiene, public health measures, and increased affluence, which led to better diets. These all combined to reduce death rates and lengthen **life expectancy**. More people lived longer. A benign cycle was created in which increased affluence led to more food being available, which led to longer and more productive lives, which in turn led to increased economic development. In 1950 the average life expectancy in Japan was 63.5 years; by 2015 it had reached 84.7. Lower-income countries have taken longer to increase life expectancies. Zimbabwe, for example, still has an average life expectancy of only 55.6 years. Malaria, largely eradicated elsewhere, annually sickens more than 200 million people and kills close to 800,000 children in Africa, where it is the leading cause of death for those under five years old. There are still global disparities in health care provision that have led to marked spatial differences in child mortality and overall life expectancy.

Second, the increase in life expectancy was soon followed by a decline in **fertility,** at first only in the richer countries and then later more widespread. In 1800 there were an average of 6 births for every woman; by 2015 the figure was 2.3. This is very close to the **replacement rate**, or the number of births needed to keep the population stable. The replacement rate is 2.1 in richer countries and 2.3 in poorer countries. The difference is the result of increased juvenile mortality rates in poorer countries.

Many countries moved toward lower birth rates between 1890 and 1920. Today, in rich countries like Japan, the birth rate is 1.4. In the United States, it is 1.9. Many factors were involved, including access to more reliable birth control methods, changes in household economies such that children were not so much workers as dependents, and increased investment in an individual child's caring and rearing. Family size declined. In the lower-income countries the fertility rates began to drop later, beginning in the 1960s. They are still higher than in the richer countries—6.3 births per woman in Mali, for example—but across the world, there is a transition toward lower birth rates.

This demographic transition has transformed the human population. Life is now longer as life expectancy increases and mortality rates decline. There is also a steady graying of the population. In 1950 only 4 percent of the total global population was over sixty-five; by 2000 this had increased to almost 6 percent. By 2100 it is estimated to be 21 percent. The world's population is aging, a trend especially marked in the richer countries of the world.

These demographic changes have cultural consequences. Consider, for example, gender roles and representations. Masculinity was often constructed around the image of the strong, virile body. But what of masculinity

3.2 Ireland: The Demographic Base of the Celtic Tiger

The demography of Ireland is an interesting one. The graph of its demographic history, like most of the rest of the world, shows a steady increase from 1700 with acceleration from 1800 until it peaks at over 6 million in 1840. After the Great Famine of 1845 to 1849, the population plummeted as 1 million died and 2 million more left the country, leveling off at around 4 million. The country was slow to pass through the demographic transition, with 3.5 births per woman even into the early 1980s. High levels of emigration to Australia, Britain, and the United States kept the population level down. Then two things happened. First, after 1979 contraception was readily available, and the birth rate fell sharply. The demographic dividend of increasing working-age population was a factor in accelerated economic growth, which reached almost 6 percent annually in the 1990s. Ireland became the Celtic Tiger of rapid economic and demographic growth. Second, as the economy grew stronger, providing more employment opportunities, fewer young people left the country's shores, and indeed there was increased immigration, with Poland being a rich source. So while birth rates fell, the population increased. There was also a marked increase in female participation rates.

Since 2008, Ireland's economy has been badly hit by the global recession and risky investments by banks that were underwritten by the government, which in turn led to fiscal crisis, deep cuts in public spending, and a decline in economic growth. Immigration has fallen off, emigration has increased, and Ireland has joined Portugal, Greece, and Italy as ground zero for the European debt crisis.

REFERENCE

Bloom, D. E. and Canning, D. (2003) Contraception and the Celtic Tiger. *Economic and Social Review* 34: 229–247.

when men live long past their peak physical strength and virility? Similarly, as birth rates drop, women are freed from constant childrearing. As their lives extend beyond their fertility, we need new models of what it means to be woman. Family size declines, so that large families are now replaced by smaller, nuclear families. The family is less a large extended group of people than a tight nexus of a few individuals. Family life takes on a new hue from how it was long imagined and lived. And what of the elderly? When they were a small group, they were revered and often subsidized. But when this group grows in size and lives long past its economic productivity, they can become a fiscal liability as well as an important resource of accumulated knowledge and wealth. With a rapidly aging population, **intergenerational inequities** and conflicts can become more pronounced, just as intergenerational transfers of wealth can become more important.

Phases of the Demographic Transition

There is a chronology and a geography to the demographic transition. In the richer countries, the transition is almost complete. Life expectancy has increased, and birth rates have dropped. In poorer countries, while life expectancy has increased, the birth rate has declined more slowly. The result is a complex pattern of different demographic regimes in countries at different phases of the transition.

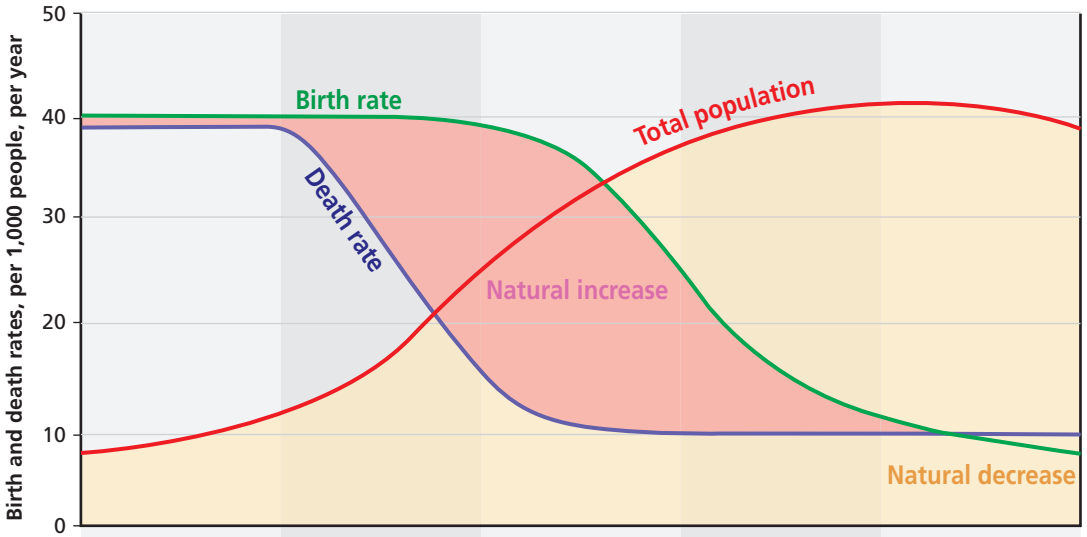
Figure 3.2 highlights five distinct phases of the demographic transition. Figure 3.3 depicts the population pyramid of four individual countries at different stages in this transition. The pyramids are the graphic representation of the national population along the vertical axis in five-year age cohorts, with males to the left and females to the right of the vertical line through the middle of the pyramid.

The First Phase

The first phase is one of high birth and death rates and stable slow population increase. This was the pattern across most of the world prior to 1800.

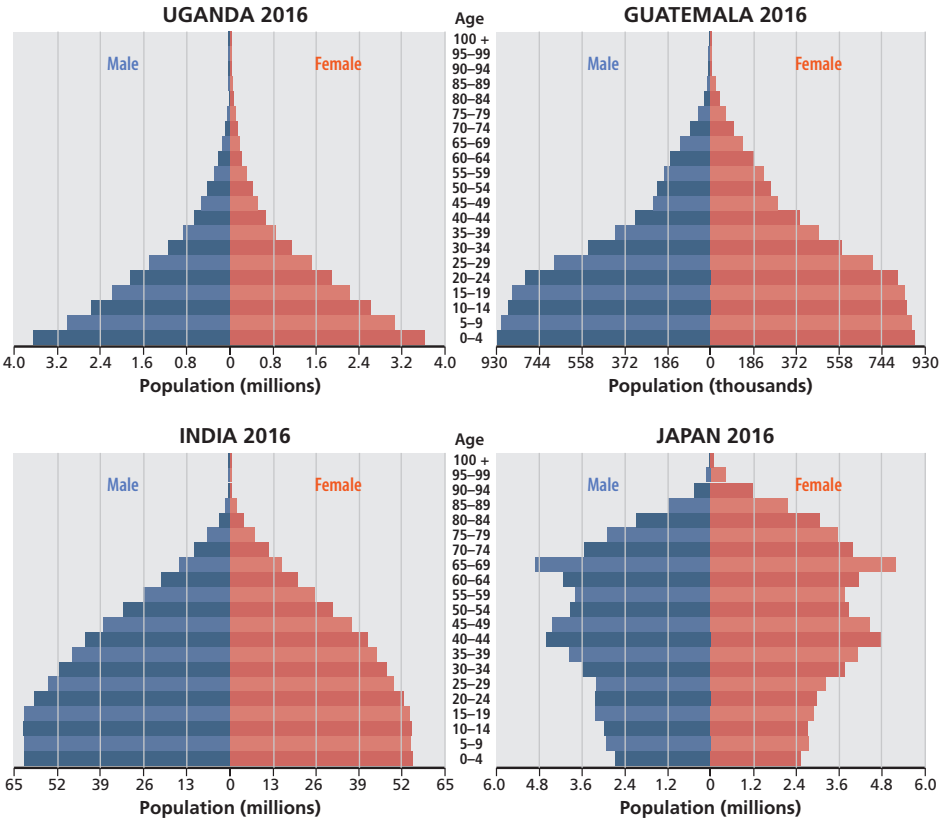
The Second Phase

The second phase is associated with high birth rates, falling death rates, and—because death rates are falling faster than birth rates—a very rapid increase in population. Countries with this profile include Afghanistan, Uganda, and Zambia. In Uganda, for example, with a population of 38.8 million, population growth is around 3.4 percent, driven by the high average birth rate of 5.9 births for every woman. The population pyramid depicted in Figure 3.3 shows the typical pattern of a large youthful base, because of the high birth rates, tapering off quickly because of the relatively low life expectancies. Birth rates are high



	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Birth rate	*High*	*High*	*Falling*	*Low*	*Very low*
Death rate	*High*	*Falls rapidly*	*Falls slowly*	*Low*	*Low*
Natural increase	*Stable or slow increase*	*Very rapid increase*	*Increase slows down*	*Stable or slow increase*	*Stable or slow decrease*

3.2 Phases of the demographic transition



3.3 Population pyramids

because there is little effective contraception and cultural mores inhibit its use. High infant and child mortality rates may encourage parents to have more children so that at least one or more survive into adulthood. The net result is a very young population with high growth rates. Almost half of the population of Uganda is younger than fifteen. There are also considerable **gender inequalities** in income and job opportunities, since a woman's role is largely defined as giving birth to many children. The challenge for Uganda, as for all second-phase countries (which now constitute 9 percent of the world's population), is how to slow down the rate of growth to provide enough jobs and opportunities for a young population coming on to the job market and to extend the economic opportunities for women.

The Third Phase

In phase 3, birth and death rates fall and population increase begins to slow. Countries in phase 3 constitute 7 percent of the world's total population and include middle-income countries such as Ghana, Guatemala, and Iraq. In Guatemala, because of improved public health, life expectancy is now seventy-one years. The birth rate has declined to three births per woman. The decline is due to increased use of modern family planning methods and the desire for smaller families. Almost half of all women in Guatemala use modern family planning methods. The population growth rate is still high at 2.6 percent, and more than half of the population is aged below nineteen, so Guatemala, like Uganda, shares the problems of finding opportunities for its many young people. A distinctive feature in Guatemala is the difference between the indigenous Mayan and non-Mayan populations. The indigenous Mayan population has a birth rate of over five per woman, whereas it is less than two for richer, non-Mayan women. National population statistics can hide marked differences in income, race, and ethnicity (Figure 3.4). In the case of Guatemala, there is a difference between the indigenous Mayan population, which is more engaged in peasant agriculture, where children are important contributors to family income, and the non-Mayan, which tends to be more affluent and less reliant on children's labor.

3.4 Throughout Central and South America the birth rates for indigenous peoples is much higher than for nonindigenous peoples. An Embera family in Colón, Panama.

The Fourth Phase

Phase 4 of the transition is associated with low birth and death rates and a stable or only a very slow increase in population. Countries in phase 4 now constitute 38 percent of the world's population and are characterized by sharply falling birth rates of below three per woman. Figure 3.3 shows the population pyramid of India. Compared to Uganda and Guatemala, there is a thickening in the middle cohorts, from ages twenty to fifty, and less marked tapering as the population ages. India has seen a remarkable decline in birth rates from over 5 births per woman in the 1950s to around 2.4 by 2015. There are marked regional variations. Birth rates per woman in the southern state of Kerala have dropped below 2, while they are still high in the poorer states of the north. In Uttar Pradesh, with a population of 200 million, the rate is 4 births per woman. With 1.3 billion people, India is one of the most populous countries in the world. In ten years' time, it may overtake China as the most populous country on the planet.

The Demographic Dividend

For countries at phase 3 moving into phase 4, there is the possibility of a **demographic dividend**. The dividend occurs when birth rates fall substantially, requiring less investment in the very young, and before the population starts to age dramatically, requiring more money spent on caring for the elderly. As the cohorts from previous growth spurts enter the job market, there are proportionately more people of working age compared to the very young (as birth rates decline) or the very old (as life expectancy for the older groups is still relatively low). The net effect is a relative and absolute increase of younger, more productive workers. Between one-third and one-half of economic growth in states such as India may be due to the demographic dividend.

One way to highlight the demographic dividend is to estimate the **dependency ratio**. One measure is calculated by dividing the working age population, those aged fifteen to sixty-five, by the nonworking age population, those aged zero to fourteen and those older than sixty-five. The higher the ratio, the larger the demographic dividend. Figure 3.5 shows how the ratio and the dividend decline as societies pass through to the later stages of the demographic transition.

The dividend pays out in several ways. It increases the labor supply and reduces the relative size of the **dependent population** of the very young and the very old. More public and private investment can thus be devoted to increasing productive capacity as less public money is spent supporting the very young and very old. Working-age adults tend to save more, and this can create a larger pool of capital available for investment. The human capital of the country is increased, because with many fewer children, women