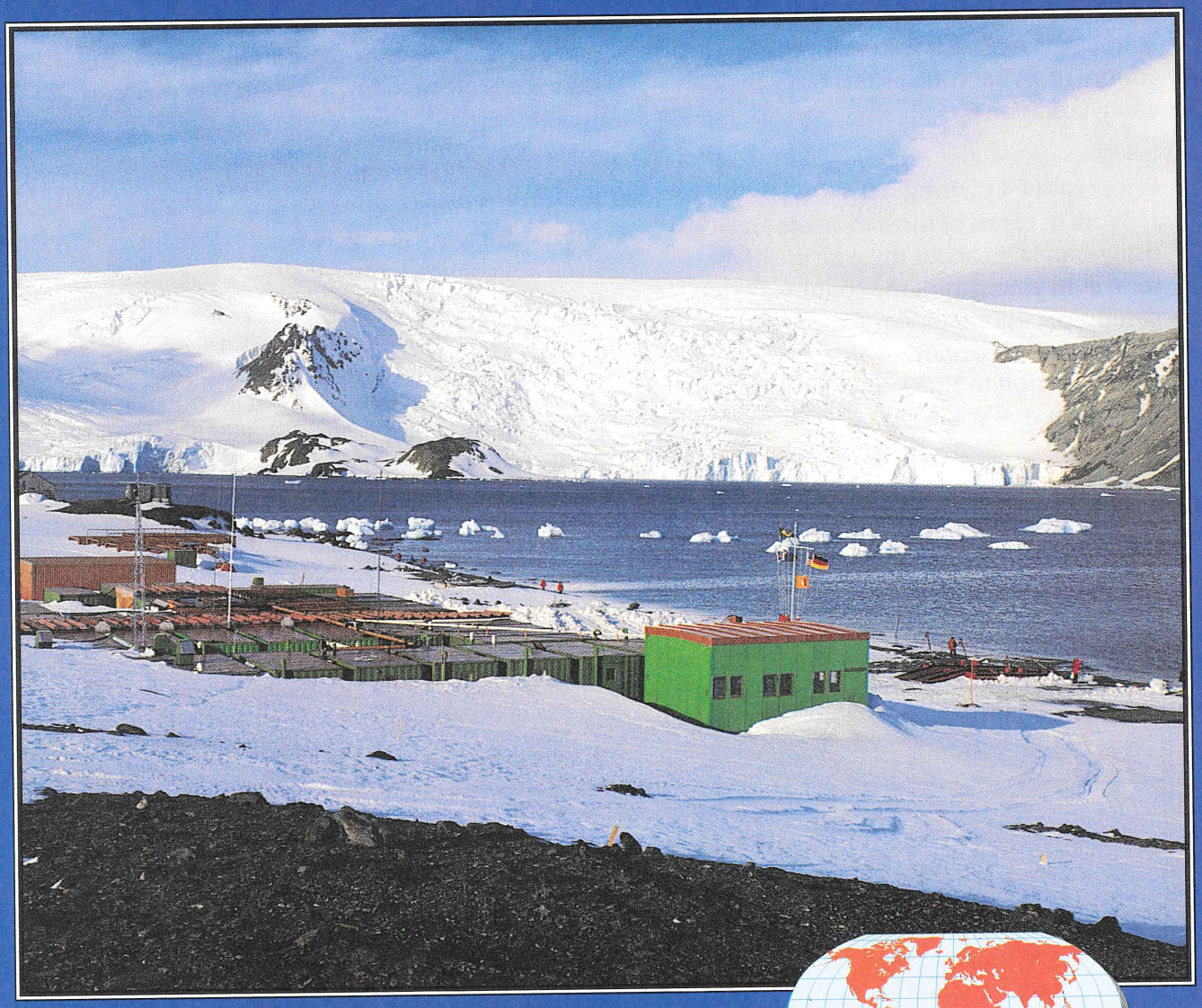
chapter 3

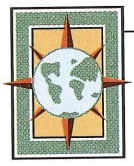
Climates of the Earth



CHAPTER FOCUS

Geographic Setting

Climate is a significant factor in describing the geography of places on the earth. The climate of a place affects the way that people in an area live.



Geographic Themes

Section 1 Earth-Sun Relationships

LOCATION The relationship between the earth and the sun affects climates around the world.

▲ **Photograph:** *Brazilian research station, King George Island, Antarctica*

Section 2 Factors Affecting Climate

PLACE Many factors affect world climate.

Section 3 World Climate Patterns

REGION Temperature, precipitation, and types of vegetation can be used to define climate regions.

SECTION 1

Earth-Sun Relationships

SETTING THE SCENE

Read to Discover . . .
- the effect of the earth's tilt on the temperature of places.
- how the spinning of the earth causes day and night.
- how the earth's motion around the sun causes the seasons.

Key Terms
- weather
- climate
- axis
- temperature
- revolution
- equinox
- solstice

Identify and Locate
Tropic of Cancer, Tropic of Capricorn

Weather is the condition of the atmosphere in one place during a short period of time. It can be described as cold or hot, windy or calm, wet or dry. **Climate**, on the other hand, is the term for weather patterns that an area typically experiences during a long period of time. Weather and climate are influenced by the amount of direct sunlight a place receives. They are also affected by ocean currents, winds, and the features of the earth's surface.

The relationship between the earth and the sun especially affects climates around the world. The sun provides the earth with heat and light. Different parts of the earth, however, receive different amounts of sunlight at different times.

The Greenhouse Effect

Only a small amount of the sun's radiation reaches the earth's atmosphere. Some of the radiation is reflected back into space by the atmosphere and by the earth's surface. Enough radiation, however, remains to warm the earth's land and water.

The atmosphere also keeps heat from escaping back into space too quickly. In this sense, the earth's atmosphere has been compared to a greenhouse, which traps the sun's warmth for growing plants. Without this greenhouse effect, the earth would be too cold for most living things.

Even inside the "greenhouse" of the atmosphere, not all places on earth get the same amount of heat and light from the sun. Day and night, seasonal change, and differing climates all depend somewhat on the relative positions of the sun and the earth.

Earth's Tilt and Rotation

The earth has an **axis**—an imaginary line that runs through its center between the North Pole and the South Pole. The earth's axis is tilted at a 23½° angle. The axis is always tilted in the same direction.

Because the earth's axis is tilted, not all places on earth receive the same amount of direct sunlight. Therefore, the earth's tilt affects the **temperature** of places. Temperature is a measure of how hot or cold something is. Temperature is generally measured in degrees on a set scale. Air temperature is usually measured in Fahrenheit (F) or Celsius (C).

The earth rotates, or spins, on its axis. The earth makes one complete rotation every 24

hours, turning from west to east. The earth's rotation causes day and night.

The sun shines on the earth all the time. As the earth spins on its axis, the part of the earth that faces the sun has daylight. The part of the earth facing away from the sun has darkness.

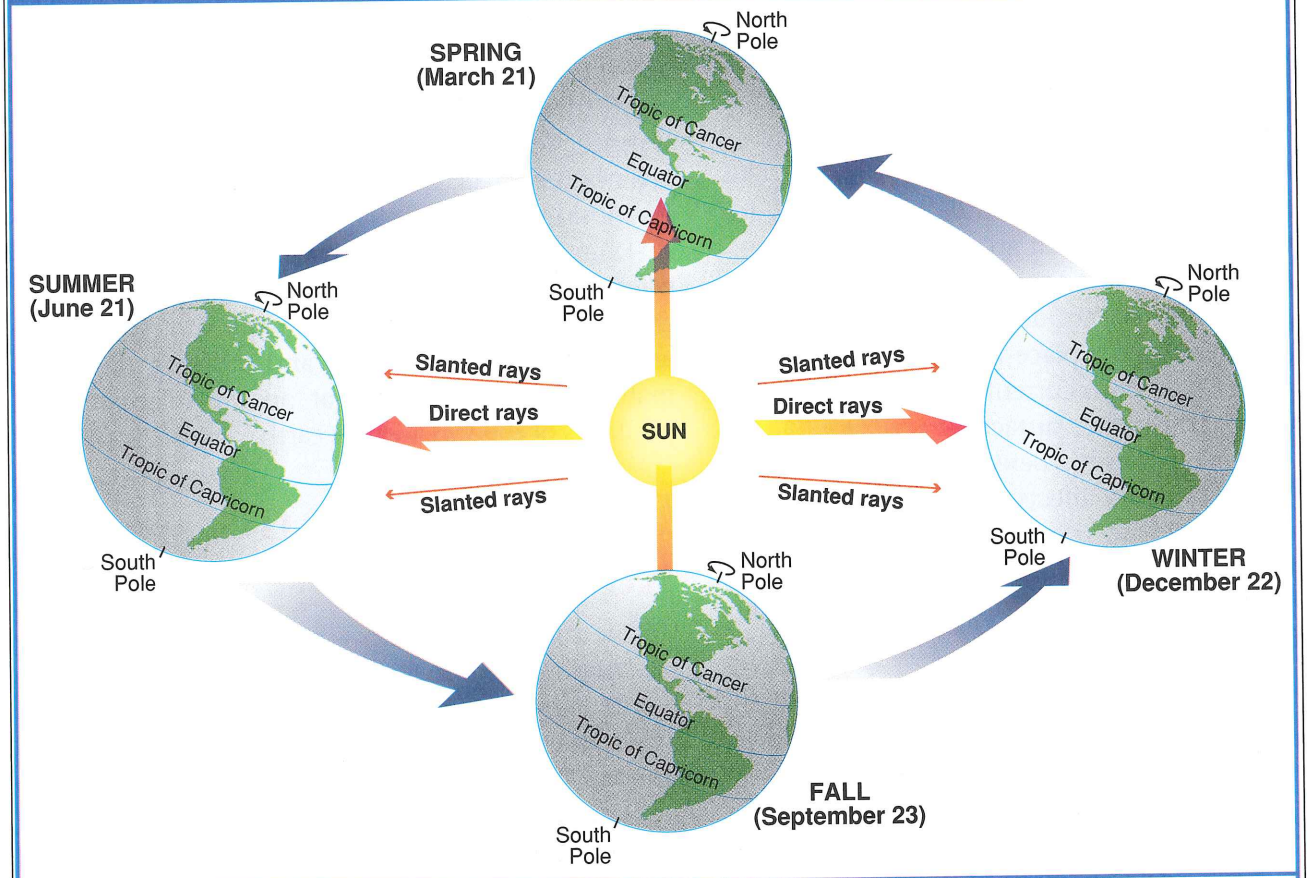
Earth's Revolution

As it rotates on its axis, the earth also travels in an orbit, or path, around the sun. The earth's **revolution**, or trip around the sun, takes 1 year, or 365¼ days.

The earth's revolution and tilt cause the changing seasons. They also cause changes in the amount of daylight during the year.

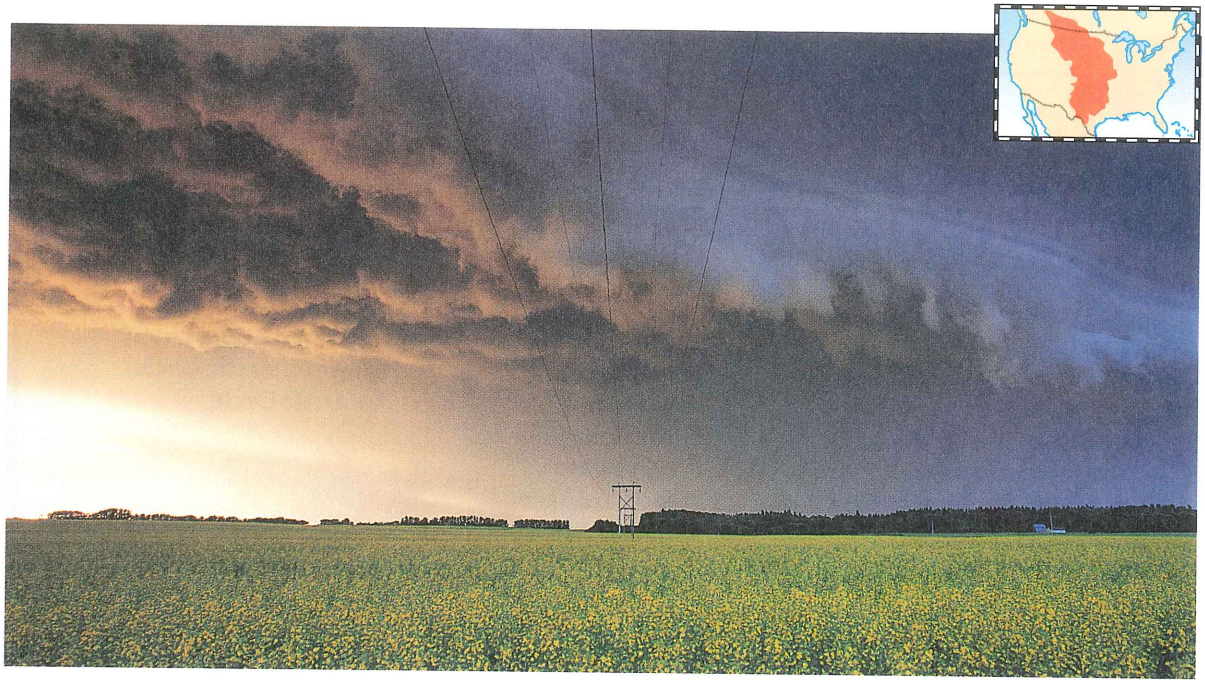
On about March 21, the sun is directly over the equator and the days and nights are equal in length. This day is called an **equinox**. In the Northern Hemisphere, March 21 marks the beginning of spring. In the Southern Hemisphere, the seasons are reversed. The earth gradually moves so that the direct rays of the sun strike the latitude 23½° N, or the Tropic of Cancer, on about June 21. This is the northernmost point on the earth that receives the direct rays of the sun. This day is called a

THE SEASONS IN THE NORTHERN HEMISPHERE



Focus on Geographic Themes

1. **Movement:** Why are the seasons reversed in the Northern and Southern hemispheres?
2. **Movement:** What does March 21 mark in the Northern Hemisphere?
3. **Place:** What is the northernmost point on the earth that receives the direct rays on June 21 (the solstice)?



Geographic Themes

Place: Great Plains, United States

This meeting of two dissimilar air masses over part of the Great Plains is bringing dramatic changes in weather to the region. *What factor distinguishes weather from climate?*

solstice. In the Northern Hemisphere, June 21 marks the beginning of summer. It is the day of longest sunlight there.

The earth moves until on about September 23, the sun is again directly over the Equator. In the Northern Hemisphere, this equinox marks the beginning of fall. The earth gradually moves so that the direct rays of the sun strike 23½° S, or the Tropic of Capricorn, on about December 22. This is the southernmost point that receives the direct rays of the sun. In the Northern Hemisphere, this solstice marks the beginning of winter and is the shortest day of the year. Then the earth's movement causes the direct rays of the sun to move north, and the cycle repeats itself.

The amount of sunlight at the poles varies the most dramatically as the earth's revolution and tilt causes the changing seasons. At the North Pole, the sun never sets from about March 20 to September 23. At the South Pole, it never sets from about September 23 to March 20. The tilting of the earth's axis as it revolves around the sun causes this natural phenomenon, known as the midnight sun. For six months one Pole is slanted toward the sun and receives continuous sunlight, while the other Pole is slanted away from the sun and receives no sunlight at all.

SECTION 1 ASSESSMENT

Checking for Understanding

1. **Define** weather, climate, axis, temperature, revolution, equinox, solstice.
2. **Locating Places** What latitude is the Tropic of Cancer? Tropic of Capricorn?
3. **Movement** How does the revolution of the earth cause seasons?
4. **Movement** How are the temperatures of places affected by the earth's tilt?

Critical Thinking

5. **Analyzing Information** Why does March 21 generally mark the beginning of spring in the Northern Hemisphere?

SECTION 2

Factors Affecting Climate

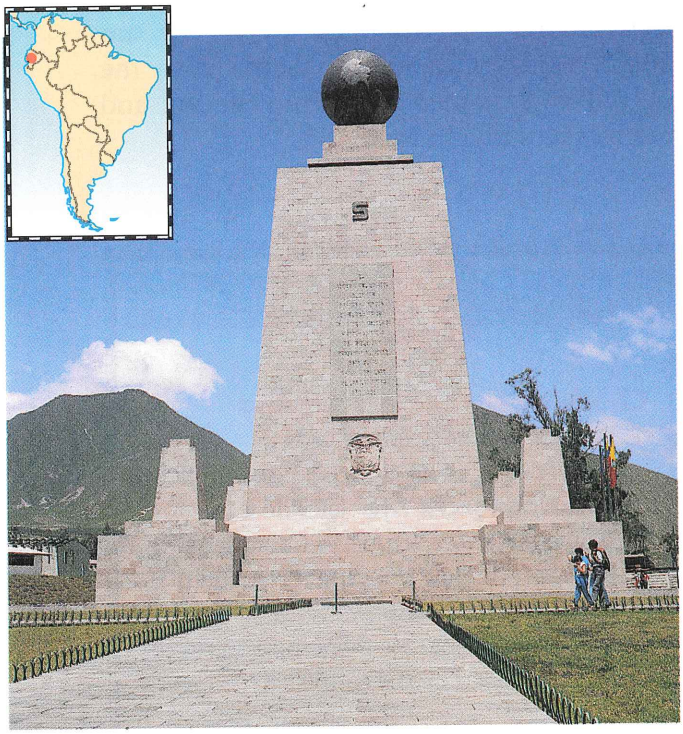
SETTING THE SCENE

Read to Discover . . .
- the patterns of wind and ocean currents.
- the role temperature and precipitation play in describing climates.
- the factors that control the locations of climates around the world.

Key Terms
- prevailing wind
- doldrums
- current
- precipitation
- windward
- leeward
- rain shadow

Identify and Locate
High, middle, and low latitudes; Arctic Circle, Antarctic Circle

All places on the earth are not heated or cooled equally. The kind of climate that a place has depends in part on latitude, elevation, wind and ocean currents, and landforms.



Geographic Themes
Location: Quito, Ecuador
This monument near Quito, Ecuador in South America marks the line of the Equator. *What major lines of latitude define the low latitudes?*

PLACE

Latitude

Bands of latitude can be used to describe climate in a general way according to certain climate zones. The zones indicate how the rays of the sun strike the places within the zones. During the earth's yearly revolution around the sun, the sun's direct rays fall on the earth in a regular pattern.

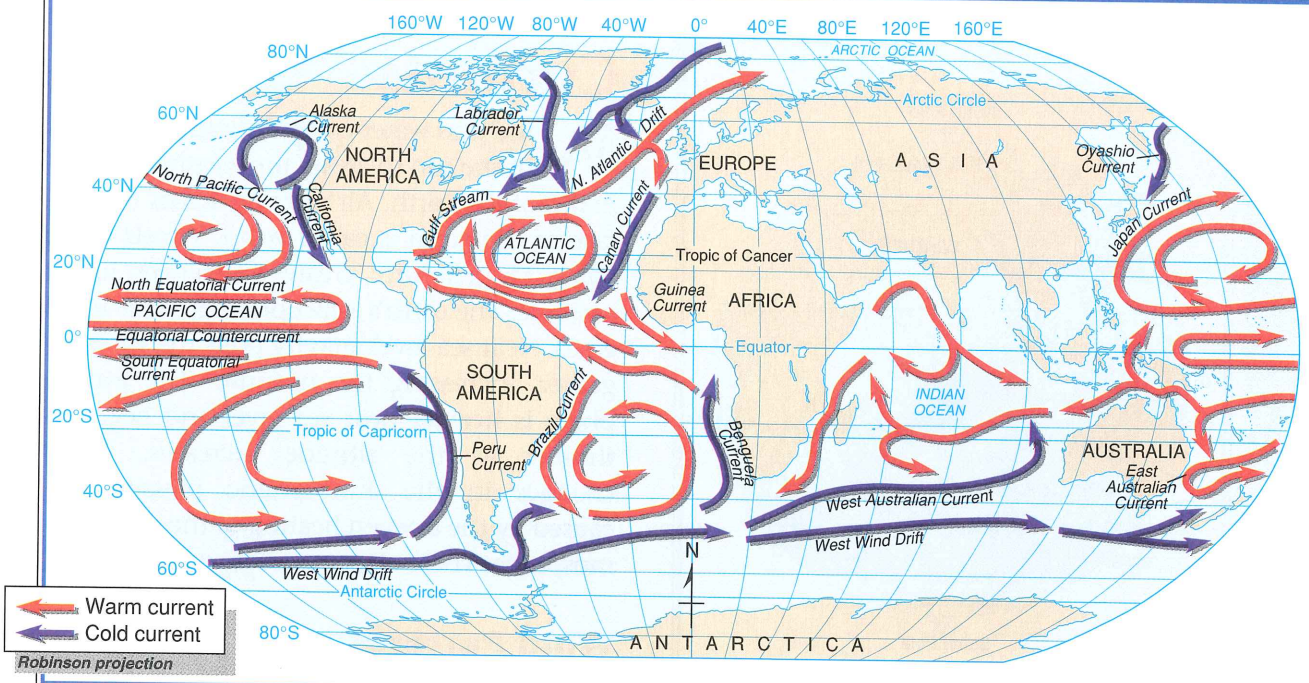
Low Latitudes

The latitudes between the Tropic of Cancer and the Tropic of Capricorn are known as the low latitudes. The low latitudes receive direct rays of the sun year-round. Places in these latitudes have a very warm to very hot climate and are often said to be in the tropics.

Polar Areas

When either the Northern Hemisphere or the Southern Hemisphere is tilted toward the sun, its polar area receives continuous sunlight. Starting on about June 21, the sun never sets above a line called the Arctic Circle (66½° N). In the Southern Hemisphere, the Antarctic Circle (66½° S) is a line that marks the boundary of endless daylight starting on about December 22. During the times when there is

OCEAN CURRENTS AND CONTINENTS



FOCUS ON GEOGRAPHIC THEMES

1. **Region:** What continent is affected by the North Atlantic Current?
2. **Movement:** What current moves along the northwestern coast of Africa?
3. **Movement:** What currents cross the Tropic of Cancer?
4. **Place:** What current brings cooler temperatures to Japan?

endless daylight at the poles, they actually receive very little heat from the sun. This is because the sun's rays that far from the Equator always hit the earth as slanted rays rather than as direct rays.

High and Middle Latitudes

The latitudes between the North Pole and the Arctic Circle and between the South Pole and the Antarctic Circle are known as the high latitudes. Places in the high latitudes receive slanted rays of the sun throughout the year and have a generally cold climate.

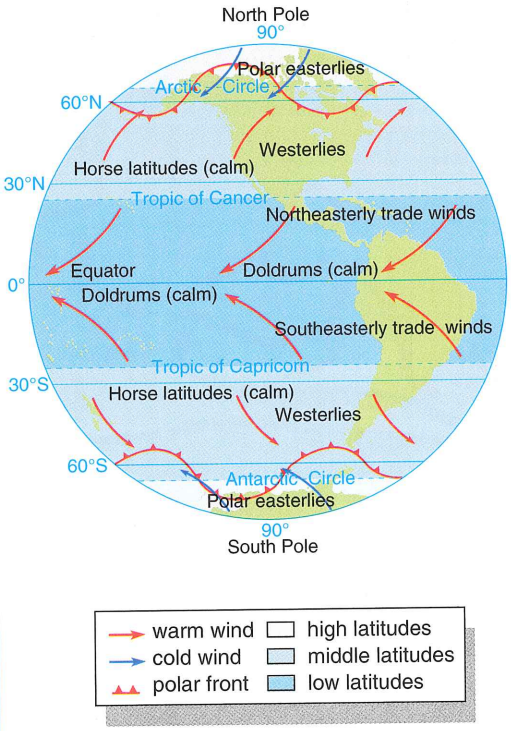
The latitudes between the Tropic of Cancer and the Arctic Circle in the Northern Hemisphere and between the Tropic of Capricorn and the Antarctic Circle in the Southern Hemisphere are known as the middle latitudes. The middle latitudes receive warm masses of air from the tropics during summer and cold masses of air from the high latitudes during winter. Thus, many places at these latitudes have a temperate climate—or one that ranges from fairly hot to fairly cold. The weather of most places in the middle latitudes changes dramatically with the seasons.

PLACE

Elevation

The temperature of a place depends on its elevation. The earth's atmosphere gets thinner as altitude increases, so air temperatures decrease with elevation. For every 1,000

ZONES OF LATITUDE AND WIND PATTERNS



FOCUS ON GEOGRAPHIC THEMES

1. **Location:** Where are the high latitudes located?
2. **Region:** What air currents flow over the middle latitudes?

feet (305 m) gained, the temperature drops about 3.5°F (1.9°C). For example, Quito, the capital city of Ecuador, lies nearly on the Equator. Nevertheless, Quito's elevation of more than 9,000 feet (2,743 m) causes its average temperature to be about 25°F (14°C) cooler than that of the surrounding lowlands.

Sunlight is very bright on top of mountains because there is less atmosphere to filter out rays of the sun. High mountains, however, are generally cold places covered with ice and snow year-round, even if the mountains are located near the Equator.

MOVEMENT

Wind and Ocean Currents

Wind and water combine with the effects of the sun to create the weather and climates of the earth. Air moving across the surface of the earth is called wind. Winds occur when temperatures create differences in air pressure. The earth's atmosphere is made up of gases. Near sea level, gravity pulls the gases together, increasing the pressure. The atmosphere is heavier near sea level and becomes thinner as the altitude increases. Other changes in the atmospheric pressure are caused by the uneven heating of the earth's atmosphere. These changes create winds.

Wind Patterns

Winds that blow in fairly constant patterns are called **prevailing winds**. The prevailing winds are divided into belts of latitude. Trade winds are the prevailing winds in the low latitudes. They blow toward the Equator from about 30° N latitude and 30° S latitude. The prevailing winds in the belts between 30° N and 60° N latitude and between 30° S and 60° S latitude are called westerlies. These winds generally blow in a west to east direction. The belts of the polar easterlies lie between 60° N latitude and the North Pole and between 60° S latitude and the South Pole. These winds blow somewhat from east to west and push cold polar air toward the middle latitudes. At the Equator is a frequently windless area called the **doldrums**.

Ocean Currents

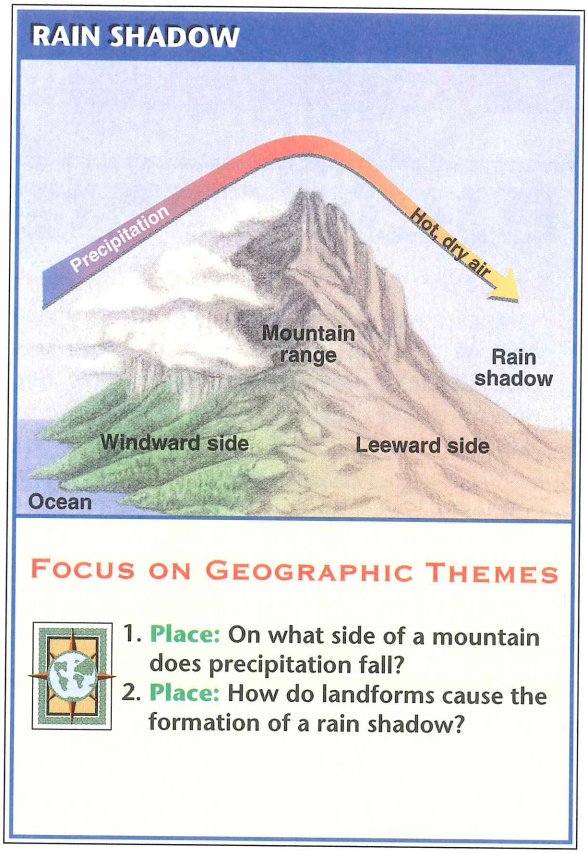
Cold and warm "rivers" of seawater, known as **currents**, flow in the oceans. Ocean currents generally flow in circular patterns, moving clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere.

Currents are caused by the rotation of the earth, moving air, and differences in water temperature in the ocean itself. Currents may be warm or cold.

Cold water from the polar areas moves slowly toward the Equator. The water warms as it nears the Equator. The warm water, in turn, moves away from the Equator. This water forms the warm ocean currents. As the warm water moves away from the Equator, it becomes colder and forms a cold current.

Ocean currents affect the climates of coastal lands that they flow along. Cold currents cool the lands they pass. Warm currents have a warming effect. For example, the warm water extension of the Gulf Stream current—called the North Atlantic Drift—flows near western Europe. This current gives western Europe a rather mild climate in spite of its northerly latitude.

Water and winds interact with temperature to cause **precipitation**—the falling of moisture to the earth. Precipitation falls in the forms of rain, sleet, hail, or snow.



FOCUS ON GEOGRAPHIC THEMES

1. **Place:** On what side of a mountain does precipitation fall?
2. **Place:** How do landforms cause the formation of a rain shadow?

PLACE

Landforms

The earth's surface features can also affect climates. The climates of places located at the same latitude can be very different depending on whether large bodies of water are nearby. Water is slower to heat and to cool than land. Therefore, water temperatures are more constant and uniform than land temperatures. For the same reason, temperatures of land areas located near oceans do not change as much as temperatures of interior land areas.

Interior land temperatures can change dramatically. The middle of a landmass will generally have much hotter summers and much colder winters than land areas near the ocean, even though these locations may be on the same line of latitude.

Temperatures, precipitation, and surface features interact with wind to affect climate. Winds that blow over an ocean and then meet a mountain range on the **windward** side—the side facing toward the direction from which the wind is blowing—are pushed upward. As the winds rise and cool, they drop moisture gathered through evaporation. Thus the air that descends the other side of the mountains, the **leeward** side, is dry and becomes warmer as it falls. This hot, dry air results in a dry area called a **rain shadow.**

SECTION 2 ASSESSMENT

Checking for Understanding

1. **Define** prevailing wind, doldrums, current, precipitation, windward, leeward, rain shadow.
2. **Locating Places** What and where are the trade winds, westerlies, and polar easterlies?
3. **Region** Why do the climates of the low latitudes, the high latitudes, and the middle latitudes differ?
4. **Movement** How do winds and ocean currents affect climate?

Critical Thinking

5. **Making Generalizations** What factors affect climate in your region?

SECTION 3

World Climate Patterns

SETTING THE SCENE

Read to Discover . . .
- the climate regions of the world.
- ways that climate affects humans and their environment.
- how climates change over time.

Key Terms
- natural vegetation
- oasis
- deciduous
- mixed forest
- chaparral
- prairie
- permafrost
- taiga
- timberline
- hypothesis
- smog

Identify and Locate
Major global climate regions: tropical, dry, mid-latitude, high latitude, highland

Climate affects the soil and **natural vegetation.** Natural vegetation is the plant life that grows in an area if the natural environment has not been changed by people.

Geographers often divide the earth into five major climate regions—tropical, dry, mid-latitude, high latitude, and highland. Because climates vary within these broad regions, geographers further divide the major regions into smaller ones.

REGION

Tropical Climates

Tropical climate regions are found in or near the low latitudes—the tropics. The two kinds of tropical climate regions are tropical rain forest and tropical savanna.

Tropical Rain Forest Climate

Hot and wet throughout the year, tropical rain forest climate regions are found near the Equator. Direct rays of the sun keep the temperatures high, averaging around 80°F (27°C), year-round. The warm, humid air produces rain almost daily. Yearly rainfall averages about 80 inches (203 cm).

Tropical rain forest vegetation grows thick in layers formed at different heights. Tall teak or mahogany trees form a high canopy over shorter trees and bushes. Vines and shade-loving plants grow on the floor of the rain forest.

The Amazon River basin in South America contains the world's largest tropical rain forest. This same climate is found in other parts of South America, in the Caribbean area, and in parts of Africa and Asia.

Tropical Savanna Climate

Areas that have a dry season in winter and a wet season in summer are called tropical savanna climate regions. Although savannas are located farther from the Equator than tropical rain forest regions, temperatures are high.

In the dry season the tough ground is covered with clumps of coarse grass. Few trees dot the large savannas of Africa and South America.

REGION

Dry Climates

Because of vegetation, dry climate regions are also divided into two types, desert and steppe.

Desert Climate

Dry areas with sparse plant life are called deserts. Scattered vegetation such as scrubs and cacti can survive with little rain. Flowering plants that lie dormant during the dry season bloom when the rains come.

Yearly rainfall in deserts seldom is more than 10 inches (about 25 cm). Underground springs, however, may support an **oasis**, an area of lush vegetation. Some deserts have fertile soil in which plants can grow if irrigated. Others have dunes or rocky surfaces.

Deserts can be extremely hot during the day and cold at night. The Gobi in central Asia has hot summers and harsh winters with temperatures as cold as –40°F (–40°C).

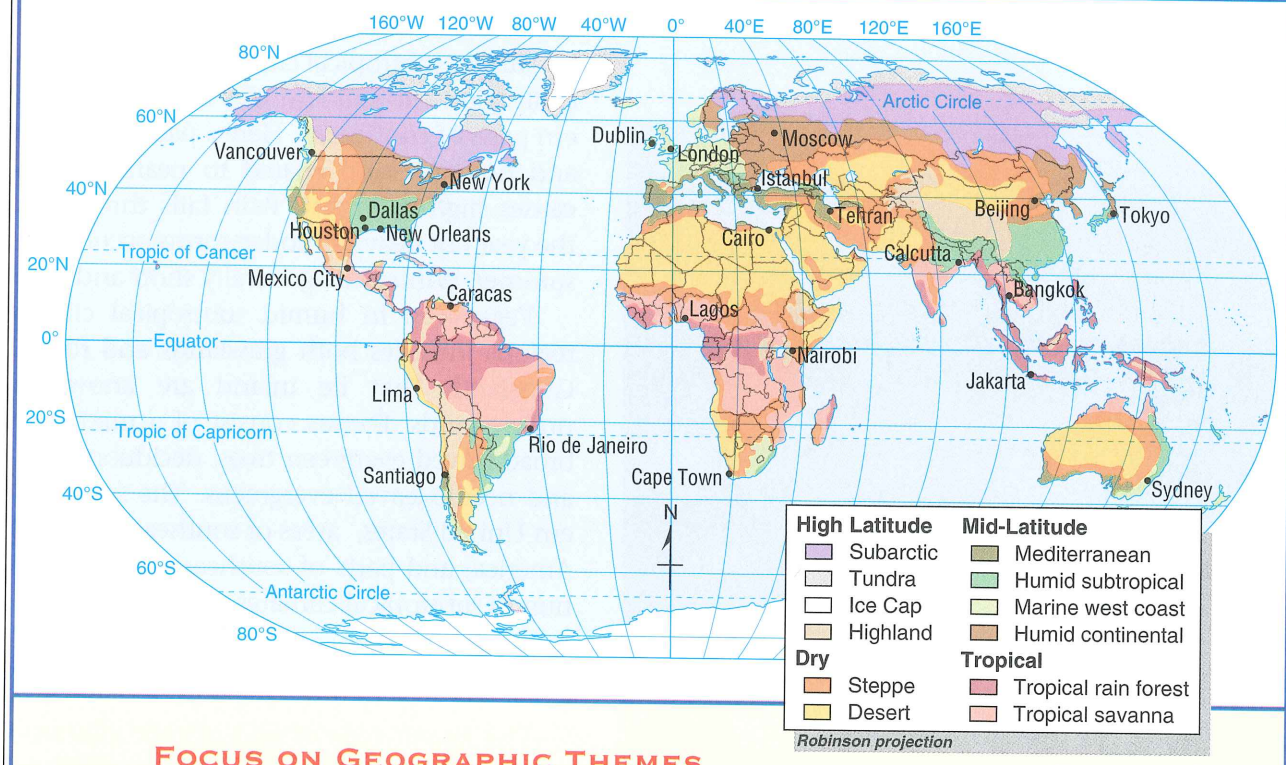
Desert climates cover about one-fifth of the earth's land surface. The Sahara extends over nearly the entire northern one-third of Africa.

Steppe Climate

Dry areas, often bordering deserts, are called steppes. Yearly rainfall in steppe zones averages 10 to 20 inches (25.4 to 50.8 cm).

Steppe vegetation consists of bushes and patches of short grasses without many trees. The world's largest steppe stretches across eastern Europe and western and central Asia. Steppes are also found in North America, South America, Africa, and Australia.

THE WORLD: CLIMATE REGIONS



FOCUS ON GEOGRAPHIC THEMES

1. **Region:** What climate regions are found in Australia?
2. **Location:** Where are tundra climate regions located?
3. **Region:** What climate region is found in the northeastern United States?
4. **Place:** In what climate region is Cairo located?

REGION

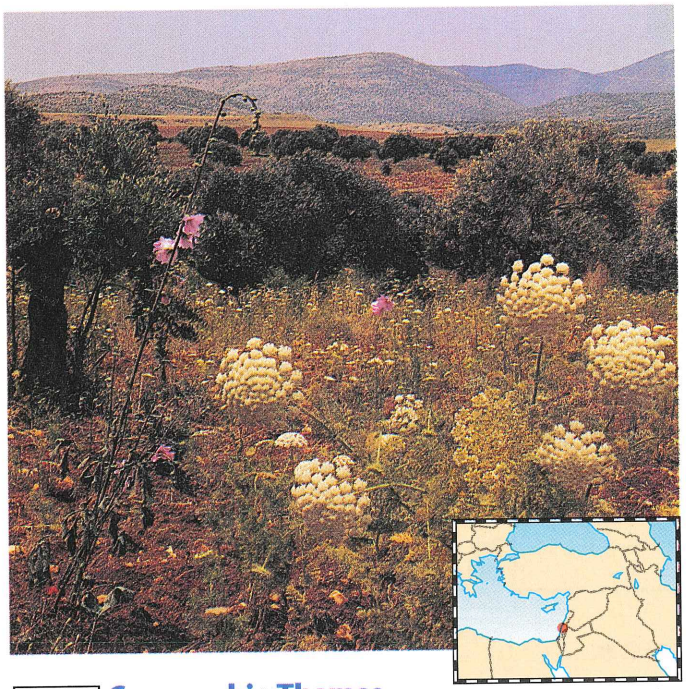
Mid-latitude Climates

The world has four mid-latitude climate regions. They are marine west coast, Mediterranean, humid subtropical, and humid continental.

Marine West Coast Climate

Climate areas generally found along western coastlines between latitudes 30° and 60° north and south are called marine west coast climate regions. Ocean winds produce cool summers and mild but damp winters. Rainfall, quite heavy in places, supports both evergreen and **deciduous** trees.

Deciduous trees lose their leaves in autumn. Most deciduous trees, including oak, maple, and elm, have broad leaves. Evergreens have either needle-shaped or broad leaves. Needle-leaved pine and spruce trees are also called conifers because they have cones.



Geographic Themes

Location: Israel

Mediterranean climate areas, such as that in Israel, have the benefit of mild, wet winters. *Where are the world's Mediterranean climate areas generally located?*

Mixed forests are those with both evergreen and deciduous trees. Marine west coast climate regions cover much of western Europe as well as the Pacific coast of North America. South America, Africa, and Australia also have marine west coast climate regions.

Mediterranean Climate

Areas that have weather patterns and vegetation like those near the Mediterranean Sea are called Mediterranean climate regions. These regions are generally found in coastal lands between latitudes 30° and 40° north and south. They have mild rainy winters and hot, sunny summers.

Vegetation in Mediterranean climate regions includes woody bushes and short trees, such as olive and cork oak, which grow in dense forests. This type of vegetation is called **chaparral.** Southern California has a Mediterranean climate.

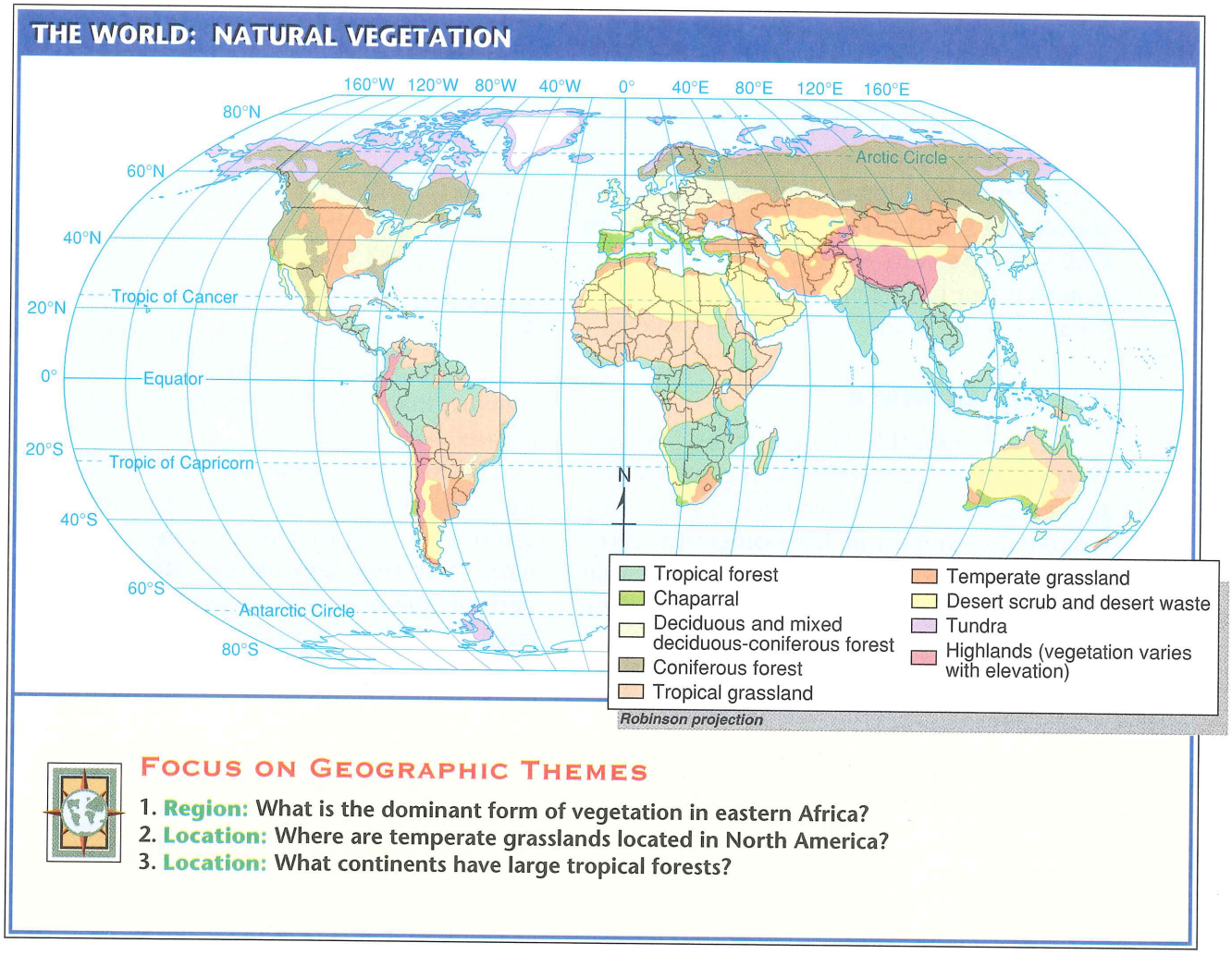
Humid Subtropical Climate

Humid subtropical climate regions are generally found at mid-latitudes in the southeastern parts of continents. Here a pattern of wind and high pressure related to nearby oceans causes high humidity. Rain falls throughout the year but heavy thunderstorms occur in the summer. Winters are generally short and mild.

Vegetation in humid subtropical climate regions includes both grasslands and forests. Grasslands that lie inland are known as **prairie** lands. Forests consist of a mixture of broad-leaved evergreen trees, deciduous trees, and needle-leaved evergreens. The southeastern United States, areas of southeastern South America, and parts of southeastern Asia have humid subtropical climates.

Humid Continental Climate

The fourth type of mid-latitude climate is the humid continental climate. These regions are more influenced by landmasses than by winds, precipitation, or ocean temperatures. The farther north one travels in humid continental climate regions, the longer and more severe are the snowy winters and the shorter



and cooler the summers. These regions are located only in the Northern Hemisphere.

REGION

High Latitude Climates

There are three types of high latitude climates—subarctic, tundra, and ice cap. Just south of the Arctic Circle lie the subarctic climate regions. Temperatures average below freezing for half the year. Winters are bitterly cold, and summers are short and cool. In some places only a thin layer of surface soil thaws. The frozen subsoil is known as **permafrost.** Relatively high temperatures may occur for a few brief summer days. Subarctic climates have the world's greatest range of temperature—as much as 120°F (65°C).

Subarctic Climate

The subarctic's severe conditions limit the variety of plant life. Vegetation consists mainly of needle-leaved evergreen trees. One vast subarctic forest stretches across northern Russia. Geographers often use **taiga,** the Russian word for this forest, to refer to subarctic climate regions in general. Another large subarctic region stretches across Canada.

Tundra Climate

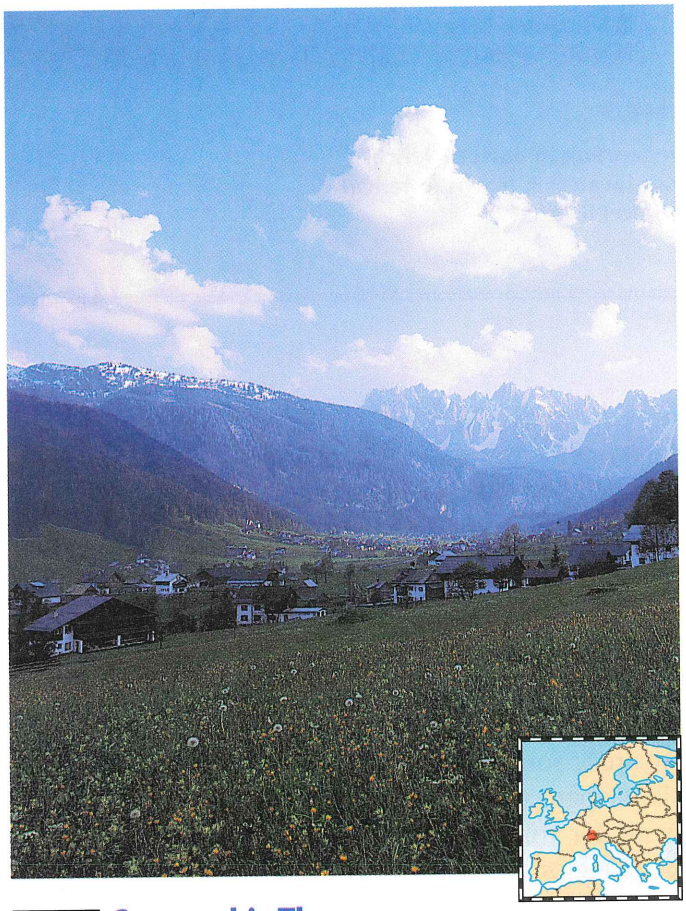
Like the subarctic climate regions, the tundra climate regions have bitterly cold winters

with greatly reduced sunlight. In summer the sun's slanted rays bring constant light but little heat.

The tundra region's thin soil above the permafrost supports certain low plants during the short summers. Mosses, bushes, very short grasses, and lichens—plants that grow on rocks—survive on the treeless plain. The world's major tundra climates lie north of the subarctic zones in the Northern Hemisphere.

Ice Cap Climate

Because monthly temperatures average below freezing, ice cap climate regions support no vegetation. The land surface is constantly covered by snow and ice, sometimes more than 2 miles (3 km) thick. Only plants that can live on rocks grow in ice-cap regions. The earth's greatest polar ice cap spreads over almost all of Antarctica. The interior of Greenland also has an ice-cap climate.



Geographic Themes

Place: The Alps, Austria

This village in Austria is located in the Alps, a mountain chain that stretches across central Europe. *What geographic factor affects the type of highland climate found in mountainous areas?*

REGION

Highland Climates

In mountain areas the climate varies with elevation. The higher the altitude, the cooler the air becomes. Some mountains in South America that lie on the Equator remain snow covered year-round.

Elevation also influences vegetation. Near the bases of mountains, deciduous and evergreen forests grow. Higher up are meadows with small trees and shrubs. Above the **timberline**, the elevation above which it is too cold for trees to grow, are scattered tundra plants.

HUMAN/ENVIRONMENT INTERACTION

Climatic Changes

Climates change gradually over time. During the last 1 to 2 million years, for example, the earth passed through four eras when large areas were covered with glaciers.

Geographers have developed several possible explanations for what caused glacial eras. One explanation is that variations in the sun's output of energy and in the earth's orbit may have caused our world to absorb less solar energy and cool off.

Another **hypothesis**, or scientific explanation, suggests that volcanic activity over long periods of time released massive amounts of dust into the atmosphere, which might have had a cooling effect. The volcanic dust reflected sunlight into space, keeping it from warming the earth.

Geographers also believe that human activities today cause changes in the world's climates. Particles in smoke from the burning of fossil fuels may stay in the air for years, scattering the sun's rays. This reduces the sunlight reaching the ground, lowering the temperature.

Another effect of burning fossil fuels is the release of carbon dioxide. This gas allows sunlight to reach the ground but prevents some surface heat from leaving the atmosphere. This causes temperatures near the earth's surface to rise—a greenhouse effect. Also, gases produced by burning fuels mix with water in the air, forming acids. These damaging acids fall in rain and snow.

The exhaust from automobiles helps create **smog**, a haze caused by the sun's ultraviolet radiation. Smog endangers people's health.

People affect climate through water projects, such as dams and river diversions. Dams built for industrial water supplies or for irrigation may cause new areas to become dry.

HUMAN/ENVIRONMENT INTERACTION

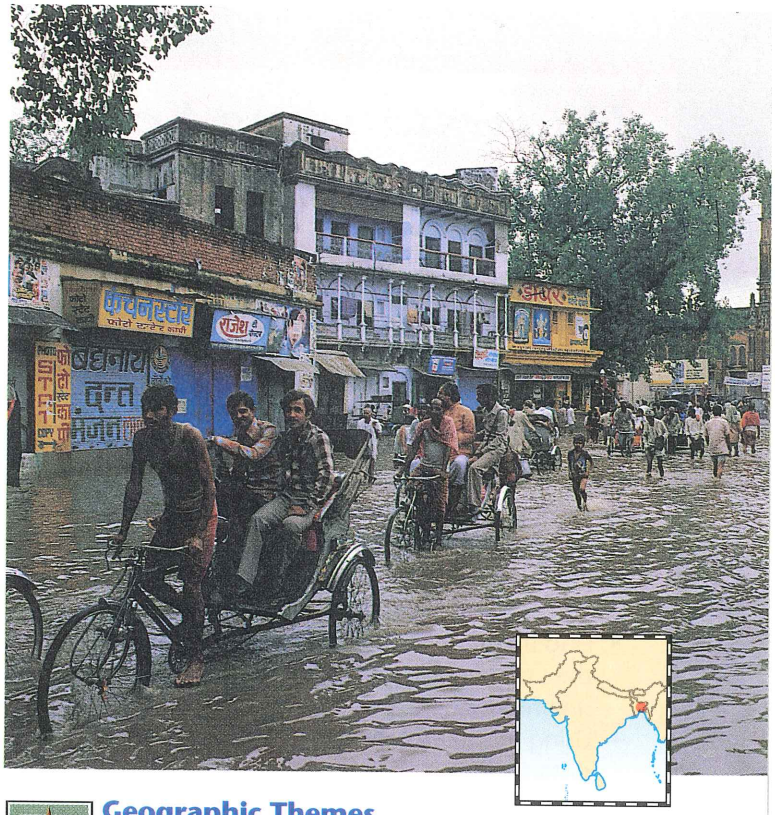
El Niño

A recurring climatic phenomenon, known as El Niño, has an important impact on global weather. El Niño starts in the tropical Pacific Ocean and sets off changes in the atmosphere. Trade winds that blow east to west weaken and sometimes reverse direction. These changes allow a large mass of warm water near Australia to move east toward South America. Along South America's Pacific coast, the warm water mass displaces the cold Peru Current flowing north. Warmer water brings more evaporation, and heavy rains fall over South America.

El Niño also affects other parts of the world by interfering with the flow of high-altitude air currents that shape global weather. In 1998, for example, El Niño caused severe storms in California, tornadoes in Florida, and floods in Virginia. It also contributed to drought in Australia and heavy rains in East Africa.

El Niño used to occur every four to five years but now happens more often. Recent El Niños have caused thousands of deaths and brought billions of dollars in damages around the world.

Scientists are not certain what causes El Niño, but many link it with global warming. Experts believe that El Niño distributes the extra energy produced by global warming.



Geographic Themes

Human/Environment Interaction: South Asia
The monsoons, or seasonal winds, bring practically all the rain that falls on South Asia. Fields and villages can be swept away by flooding. *How do people in various parts of the world respond to climate?*

SECTION 3 ASSESSMENT

Checking for Understanding

1. **Define** natural vegetation, oasis, deciduous, mixed forest, chaparral, prairie, permafrost, taiga, timberline, hypothesis, smog.
2. **Locating Places** What and where are the five main climate regions?
3. **Region** Why do tropical climates have high temperatures year-round?
4. **Human/Environment Interaction** How does El Niño affect weather?

Critical Thinking

5. **Distinguishing Fact from Opinion** In what ways may the earth's climate change due to human and natural processes?

MAP & GRAPH SKILLS

Understanding Scale

Maps are a visual representation of the earth's surface. A map can show an area as small as a backyard or as large as the world. How can cartographers draw something as large as a continent on a piece of paper?

REVIEWING THE SKILL

Cartographers draw maps to **scale**. On each map, a measured distance will represent a fixed distance on the earth. For example, 1 inch on a map may represent 100 miles; however, on another map, 1 inch might represent 1,000 miles. This relationship, or **scale of distance**, often is shown as a **scale bar**—a line with numbers specifying the unit of measurement and the number of miles or kilometers this unit represents. On some maps, scale appears as a fraction.

To use the scale of distance on a map:

- Find the scale bar or scale fraction, and identify the unit of measurement and the distance that unit represents.
- Using this unit of measurement, measure the distance between two points on the map.
- Multiply that number by the number of miles or kilometers represented by each unit.

PRACTICING THE SKILL

Use the maps below to answer the following questions about scale:

1. On each map, what unit measures scale?
2. On Map 1, what is the scale of distance?
3. How far is Orlando from Atlanta?
4. Suppose you are traveling through West Palm Beach on I-95. About how far is it from the intersection of Route 702 to the intersection of Route 98?

For additional practice in understanding scale, see Practicing Skills on page 60 of the Chapter 3 Assessment.

GO TO

The Glencoe Skillbuilder Interactive Workbook, Level 2 provides instruction and practice in key social studies skills.

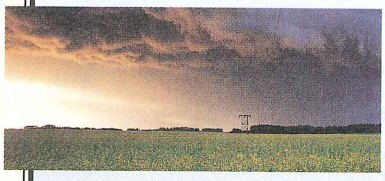
SOUTHEASTERN UNITED STATES (Map 1)

WEST PALM BEACH, FLORIDA (Map 2)

chapter 3

HIGHLIGHTS

SECTION 1 Earth-Sun Relationships



Weather system crossing the Great Plains

KEY TERMS

weather (p. 45)
climate (p. 45)
axis (p. 45)
temperature (p. 45)
revolution (p. 46)
equinox (p. 46)
solstice (p. 47)

SUMMARY

- The relationship between the earth and the sun affects climates around the world.
- The sun provides the earth with heat and light. Different areas of the planet, however, receive different amounts of sunlight at different times.

SECTION 2 Factors Affecting Climate

Monument near Quito, Ecuador, marking the line of the Equator

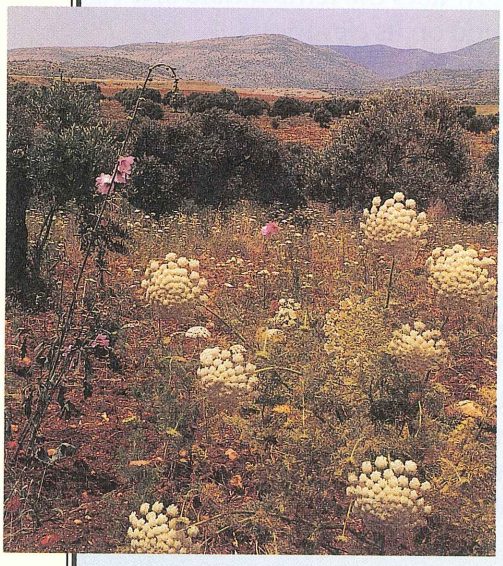
KEY TERMS

prevailing wind (p. 50)
doldrums (p. 50)
current (p. 50)
precipitation (p. 51)
windward (p. 51)
leeward (p. 51)
rain shadow (p. 51)

SUMMARY

- All places on earth are not heated or cooled equally by the sun.
- Latitude, elevation, wind and ocean currents, and landforms also affect climate.

SECTION 3 World Climate Patterns



Mediterranean vegetation in Israel

KEY TERMS

natural vegetation (p. 52)
oasis (p. 53)
deciduous (p. 54)
mixed forest (p. 54)
chaparral (p. 54)
prairie (p. 54)
permafrost (p. 55)
taiga (p. 55)
timberline (p. 56)
hypothesis (p. 57)
smog (p. 57)

SUMMARY

- Geographers often divide the earth into five major climate regions, generally on the basis of latitude.
- These regions are tropical, dry, mid-latitude, high latitude, and highland.
- Major climate regions are further divided into smaller regions based on such factors as plant life, location, landscape, and temperature.
- Climates change over time due to natural and human causes.

chapter 3

ASSESSMENT

Reviewing Key Terms

Choose the vocabulary term that best completes each of the sentences below. Write your answers on a separate sheet of paper.

revolution (p. 46)
equinox (p. 46)
solstice (p. 47)
prevailing wind (p. 50)
leeward (p. 51)
rain shadow (p. 51)
mixed forest (p. 54)
prairie (p. 54)
permafrost (p. 55)
taiga (p. 55)
smog (p. 57)

Section 1

1. The day on which the sun is directly over the Equator and the days and nights are equal in length is called a(n) _____.
2. _____ refers to the earth's trip around the sun.
3. The day on which the direct rays of the sun strike the Tropic of Cancer is called a(n) _____.

Section 2

4. _____ are divided into belts of latitude.
5. A(n) _____ is caused by hot, dry air.
6. _____ refers to the dry side of a mountain.
7. _____ blow in fairly constant patterns.

Section 3

8. _____ refers to forested subarctic climate regions.
9. Grasslands that lie inland are _____ areas.
10. Frozen subsoil is known as _____.
11. The exhaust from automobiles affects climate by causing _____.
12. Areas with both evergreen and deciduous trees are called _____.

Reviewing Facts

Section 1

13. What causes day and night on the earth?
14. What is the greenhouse effect?

Section 2

15. What are the latitudes between the North Pole and the Arctic Circle?
16. What causes ocean currents?

Section 3

17. How much of the earth's land surface is covered by desert areas?
18. What climatic factors are involved in the formation of El Niño?

Critical Thinking

19. **Expressing Problems Clearly** Why is March 21 usually the first day of spring in the Northern Hemisphere?
20. **Making Generalizations** Why do the middle latitudes have a temperate climate?
21. **Analyzing Information** Why do scrubs and cacti grow in desert climates?

Geographic Themes

22. **Movement** How does the earth's tilt affect the temperature of places?
23. **Place** How does the temperature of a place depend on its elevation?
24. **Human/Environment Interaction** Why do people who live in some desert areas wear loose, flowing clothing?

Practicing Skills

Understanding Scale

Refer to the maps on page 58. Suppose you want to travel to the Dreher Park Zoo from City Hall. The most direct route is Route 1. About how many miles would you travel to the zoo? About how many miles would you travel from West Palm Beach to Knoxville, Tennessee?

Projects

Individual Activity

Prepare a chart of climate regions. The first column should describe the climate in reference to temperature and precipitation, the second column should list locations where the climate is found, and the third column should rank the climate according to desirability.

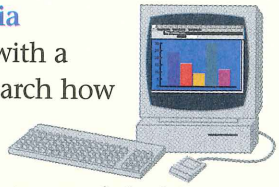
Cooperative Learning Activity

Working in pairs, take climate data from different locations and create a climate graph that shows monthly precipitation and temperature averages. Exchange the climate graphs with other teams of students. Deduce the location of the climate graphs by observing elements such as seasons, precipitation, and temperatures. Let each team prepare clues if help is needed.

Writing About Geography

Cause and Effect Parts of this chapter review the natural and human causes that may affect climate patterns. Using your journal for reference, write a story that takes place in a future in which the climate has changed in your community. Include details about how this change has affected vegetation, economic activities, and human/animal populations.

Technology Activity



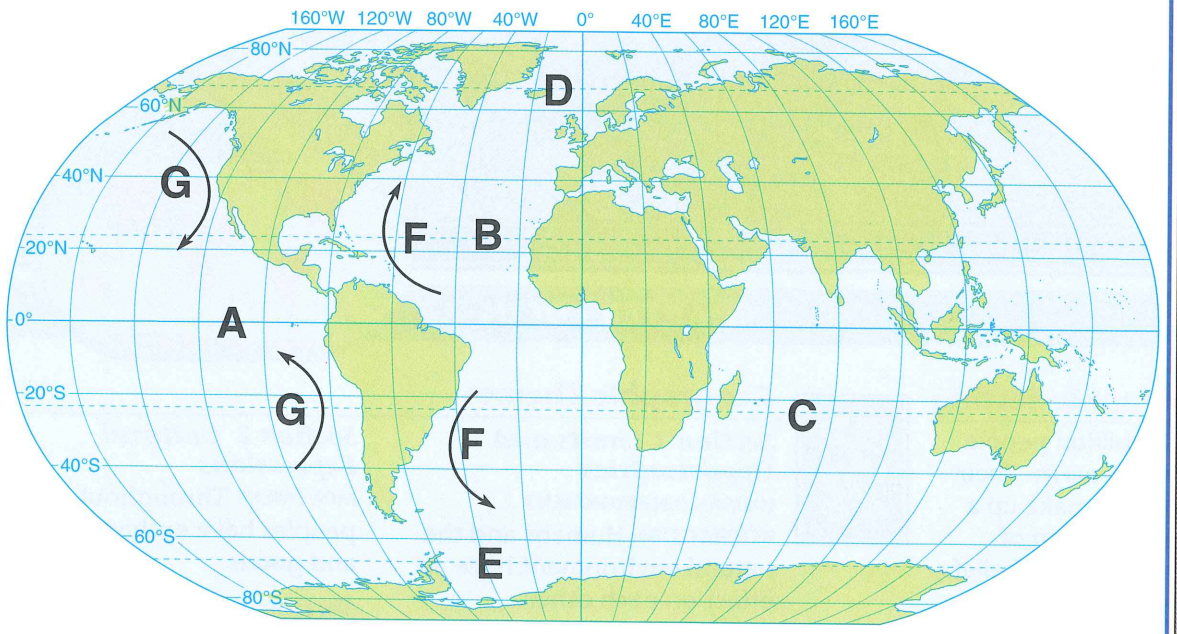
Developing Multimedia Presentations Work with a partner or group to research how your state's climate influences the economy, tourist attractions, types of clothing, and seasonal foods in your state. Use your research, a video camera, and other tools to develop a commercial promoting your state.

Locating Places

THE WORLD: PHYSICAL GEOGRAPHY

Match the letters on the map with the places and physical features of the earth. Write your answers on a separate sheet of paper.

1. Arctic Circle
2. Antarctic Circle
3. Cold Water, Pacific
4. Equator
5. Tropic of Cancer
6. Tropic of Capricorn
7. Warm Water, Atlantic



chapter 4

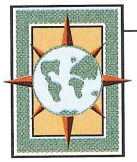
Environments, Peoples, and Cultures

CHAPTER FOCUS

Geographic Setting

About 6 billion people live on the earth. Their ways of life make up a complex pattern of learned customs, beliefs, and actions.

▲ **Photograph:** *Rice field after a harvest, Japan*



Geographic Themes

Section 1 Limits and Opportunities

HUMAN/ENVIRONMENT INTERACTION Humans and the natural environment have an effect on each other.

Section 2 Cultural Expressions

MOVEMENT Throughout history peoples have exchanged ideas and goods.

Section 3 World Culture Regions Today

REGION Geographers divide the world into culture regions.

SECTION 1

Limits and Opportunities

SETTING THE SCENE

Read to Discover . . .
- the differences between developed countries and developing countries.
- the challenges that rapid population growth brings to the planet.
- the impact of environmental hazards on people's lives.

Key Terms
- culture
- subsistence farming
- population distribution
- population density
- tornado
- hurricane
- tsunami
- pollution

Identify and Locate
Canada, Bangladesh, Tornado Alley, Armenia

Culture is the way of life of a group of people with common traditions, interests, and beliefs. A society's culture includes the way in which people meet their needs. The culture of a society also includes its history, government, language, religious beliefs, art, literature, and music.

HUMAN/ENVIRONMENT INTERACTION

Making a Living

Cultures are shaped by the various ways groups of people meet their economic needs. At least 10,000 years ago, agriculture, the earliest form of economic activity, began to develop. Eventually early farmers stopped moving from place to place and began to farm the same land from one season to the next. Successful farmers produced a surplus of food. Because everyone no longer had to raise their own food, some people started to specialize, or do one kind of work, such as weaving or milling grain. They traded their goods and services for the surplus food of farmers. The exchange of goods and services was easier when people gathered in one place. Therefore, villages, towns, and cities often began and grew where trade routes crossed.

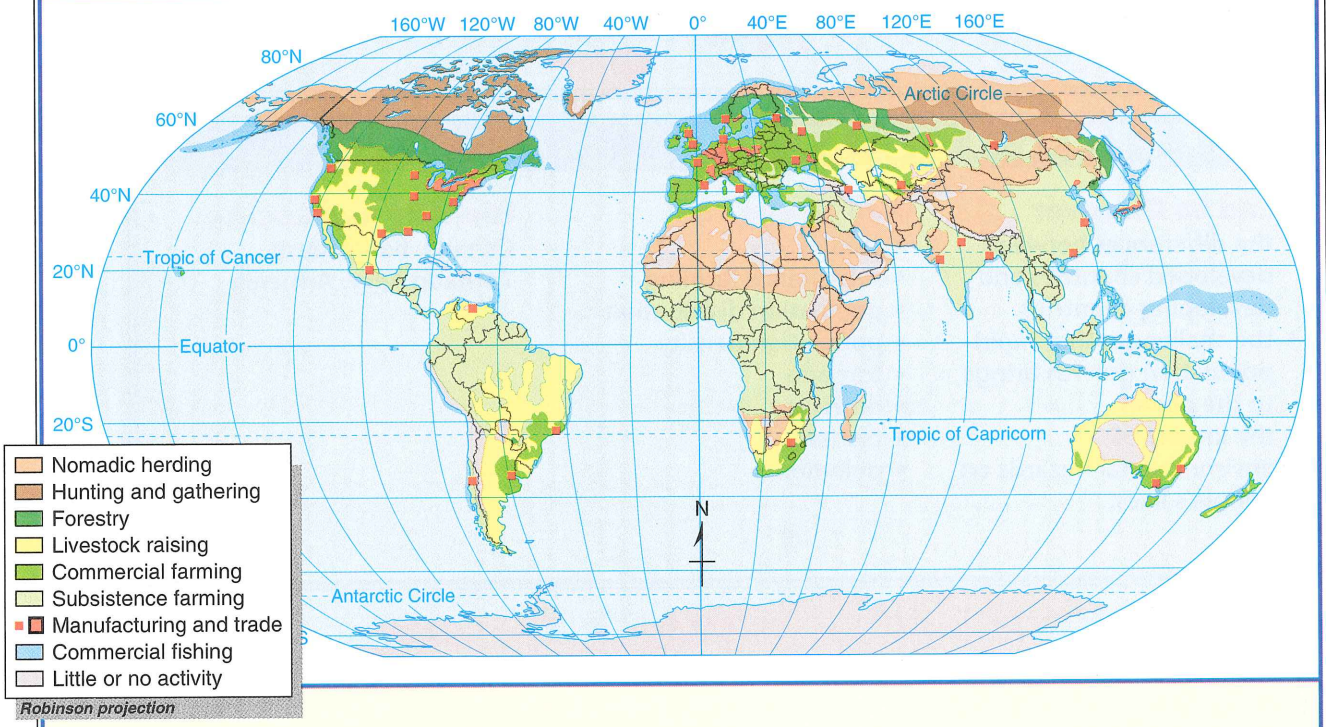
Agriculture

Today about half of the world's people still make their living through agriculture. There are two ways to classify agriculture—traditional and commercial. Traditional agriculture, or **subsistence farming**, depends heavily on human labor, animal power, and basic farm

Geographic Themes

Place: Guatemala, Central America
Farmers gather to sell their produce in an outdoor market in the Central American country of Guatemala. *About how many people in the world make their living through agriculture?*

THE WORLD: ECONOMIC ACTIVITY



FOCUS ON GEOGRAPHIC THEMES

1. **Location:** Where are the world's heavily industrialized areas located?
2. **Region:** What is the principal form of economic activity in Africa?
3. **Region:** What part of Europe is heavily forested?
4. **Place:** What is the principal form of economic activity in central Asia?

tools. Traditional farmers usually grow just enough food for themselves. If they are fortunate enough to have a very good crop or have extra livestock, they may sell or trade it; however, most of their efforts involve growing food to eat, not to sell. Most farmers in the world are traditional farmers.

In commercial agriculture, food crops and animals are produced chiefly for sale. Modern fertilizers, pesticides—chemicals used to control pests—and machinery are used to produce crops. Commercial farmers can farm large areas of land using little human labor.

Industry

A business that produces goods or services is called an industry. The number and kinds of industries vary from country to country. Countries that produce great quantities of goods and services and employ many of their workers in industry are known as developed, or industrialized, countries. People in these countries use science to improve their technology and to build well-developed economies. Developed countries generally have adequate food, clothing, and housing as well as good health care and education for their people.

People in many countries in the world meet their needs in much the same way their ancestors did. These countries, known as developing countries, often do not have modern technology and industries. Most lack the money, resources, and skilled workers needed for economic growth. Although populations in their cities have rapidly increased, developing countries are still mainly rural, and the majority of their workers are traditional farm-

ers. Developing countries often have a poor distribution of income, clothing, and housing. Few people get proper health care or attend school, and life expectancy is relatively short.

REGION

Population Growth and Distribution

The world's population is about 6 billion and growing rapidly. Scientists estimate that by the year 2010 it will be about 7 billion; and by 2025, more than 8.0 billion.

Growth Rates

The world's population, however, is not growing at the same rate in every country. A country's population growth rate is largely based on the relationship between its birthrate and its death rate. The birthrate is the number of births per year for every 1,000 people. The death rate is the number of deaths per year for every 1,000 people. The difference between those two rates is the natural growth rate.

When the two rates are more or less equal, a country has reached what is called zero population growth. This situation exists in some highly industrialized countries today. In less industrialized countries, however, birthrates are still high, while death rates have fallen because of improved health and living conditions. Population in these countries is growing rapidly compared with the overall world growth rate.

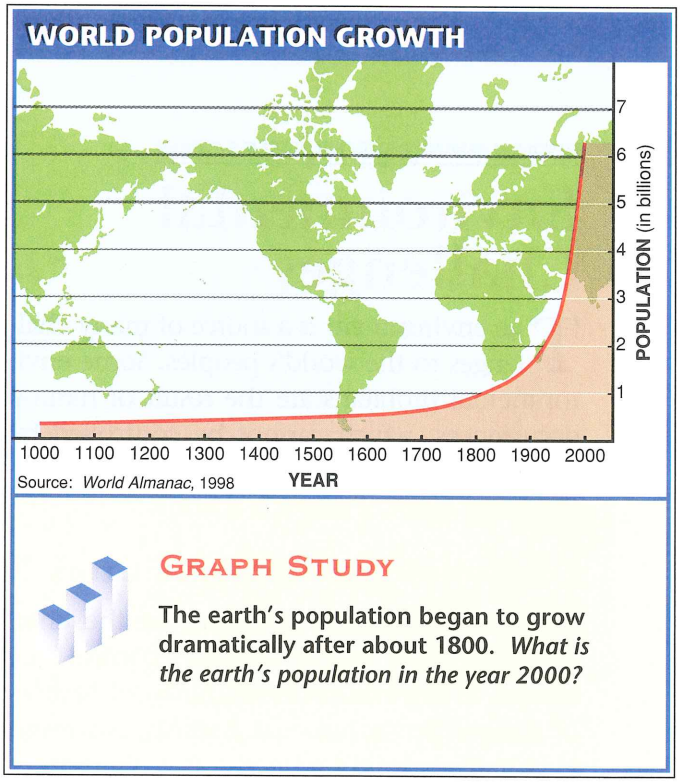
Rapid population growth presents many challenges. As the number of people grows, so does the difficulty of producing enough food to feed them. The birthrates of developing countries are higher than the birthrates of developed countries. Developing countries, however, already have shortages of food, clothing, and housing. Rapidly growing populations in these countries only heighten the problems. Another challenge that faces the world as a result of rapid population growth is the increasing rate at which nonrenewable resources are being used up.

Population Distribution

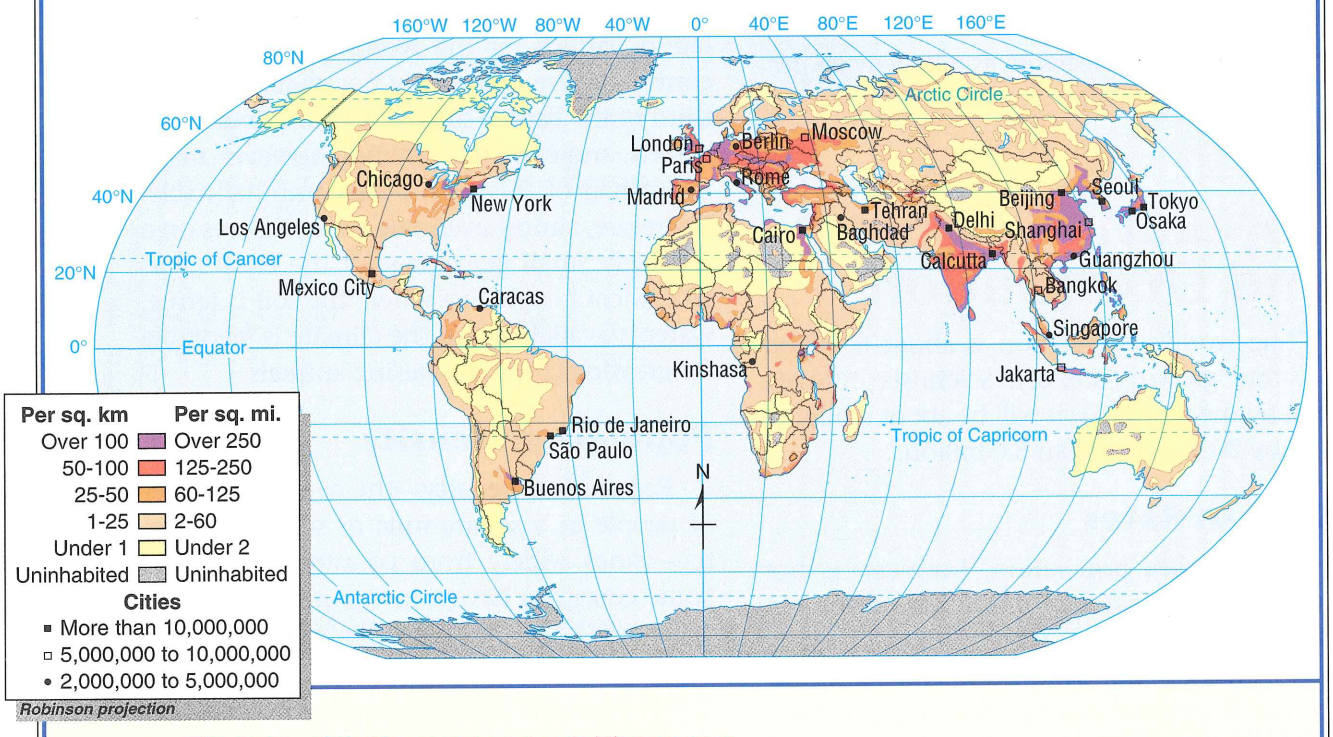
The **population distribution**, or the population pattern, of the world shows that the continents are not evenly populated. About a third of the earth's surface is land. Mountains, deserts, and climatic extremes, however, make about half of this land nearly uninhabitable. Therefore, almost everyone on earth lives on a relatively small percentage of the earth's surface. Most people live where the soil is fertile, water is available, and the climate is favorable for growing crops and raising animals.

Population Density

Population density—the average number of people in a square mile or square kilometer—varies widely from country to country. Some countries have a low population density; others have many people crowded into a relatively small area. For example, Canada has about 9 people per square mile (4 people per sq. km), while the country of Bangladesh has about 2,454 people per square mile (948 people per sq. km).



THE WORLD: POPULATION DENSITY



Per sq. km	Per sq. mi.
Over 100	Over 250
50-100	125-250
25-50	60-125
1-25	2-60
Under 1	Under 2
Uninhabited	Uninhabited

Cities

- ▪ More than 10,000,000
- ▫ 5,000,000 to 10,000,000
- • 2,000,000 to 5,000,000

Robinson projection

FOCUS ON GEOGRAPHIC THEMES

1. **Region:** What areas of the Northern Hemisphere are densely populated?
2. **Region:** What areas of the Southern Hemisphere are sparsely populated?
3. **Place:** What cities in East Asia have more than 10 million people?
4. **Place:** What city in the United States has more than 10 million people?

HUMAN/ENVIRONMENT INTERACTION

Environmental Challenges

The environment is a source of many challenges to the world's peoples. Some environmental problems are the result of natural occurrences, which cannot be controlled by people. Other environmental problems are the direct result of people's actions.

Environmental Uncertainties

Occurrences and conditions in the environment that people cannot control are known as environmental hazards, or sources of danger. Environmental hazards can result in damage or loss of property, as well as loss of life.

Weather is often the cause of environmental hazards. One type of weather-related hazard is a **tornado**, a powerful, whirling windstorm. The tornado is the most violent of all storms. It may last several hours or just a few minutes and can measure up to 1.5 miles (2.4 km) in diameter. The winds of a tornado, rotating at up to 300 miles (483 km) per hour, destroy almost everything in their path. Only the strongest buildings made of steel and concrete can escape great damage. In the United States, an area of land about 460 miles (740 km) long and 400 miles (644 km) wide extending from northern Texas through Oklahoma, Kansas, and Missouri is known as Tornado Alley. More tornadoes occur annually here than in any other place on the earth.

Another kind of weather-related hazard is a **hurricane**, a powerful, whirling storm that

forms over oceans. Unlike a tornado, a hurricane measures several hundred miles (or km) in diameter. The winds and rain of a hurricane combine with the forces of the sea to produce huge waves, called storm surges. The environmental importance of hurricanes lies in the extent of destruction that they can bring to islands and coastal areas.

Earthquakes are another kind of environmental hazard. Most earthquakes are mild and occur beneath the sea. Earthquakes that occur near large cities, however, can result in much damage and loss of life. A disastrous earthquake in Armenia in 1988 resulted in more than 50,000 deaths and 130,000 injuries. Earthquakes occurring primarily under the ocean can result in **tsunami**, or huge ocean waves. These waves can cause additional damage where they sweep up onto land.

Eruptions of volcanoes and lava flows are severe environmental hazards. Volcanic eruptions have resulted in loss of life and the destruction of towns and cities.

Pollution

A serious environmental problem today is **pollution**—unclean or impure elements in the environment. Pollution affects the air, the water, and the land.

Most air pollution is caused by burning fossil fuels. Burning fuel gives off poisonous gases and tiny particles of solid or liquid matter. Homes, industries, and motor vehicles that burn such fuels are the major sources of air pollution. The burning of garbage and trash also contributes to air pollution.

The most harmful result of air pollution is its effect on people's health. The gases and particles in the air burn people's eyes and irritate their lungs. Air pollution can worsen some respiratory diseases, such as bronchitis and asthma, and cause other diseases, such as cancer. Air pollution can also destroy plants and animals and erode the surfaces of buildings.

There are several causes of water pollution. Tankers and offshore drilling accidents sometimes cause oil spills that pollute the water. Industries dump large amounts of waste products, which include chemicals, into bodies of water. Untreated sewage, which is made up of people's wastes and garbage, is another major source of water pollution.

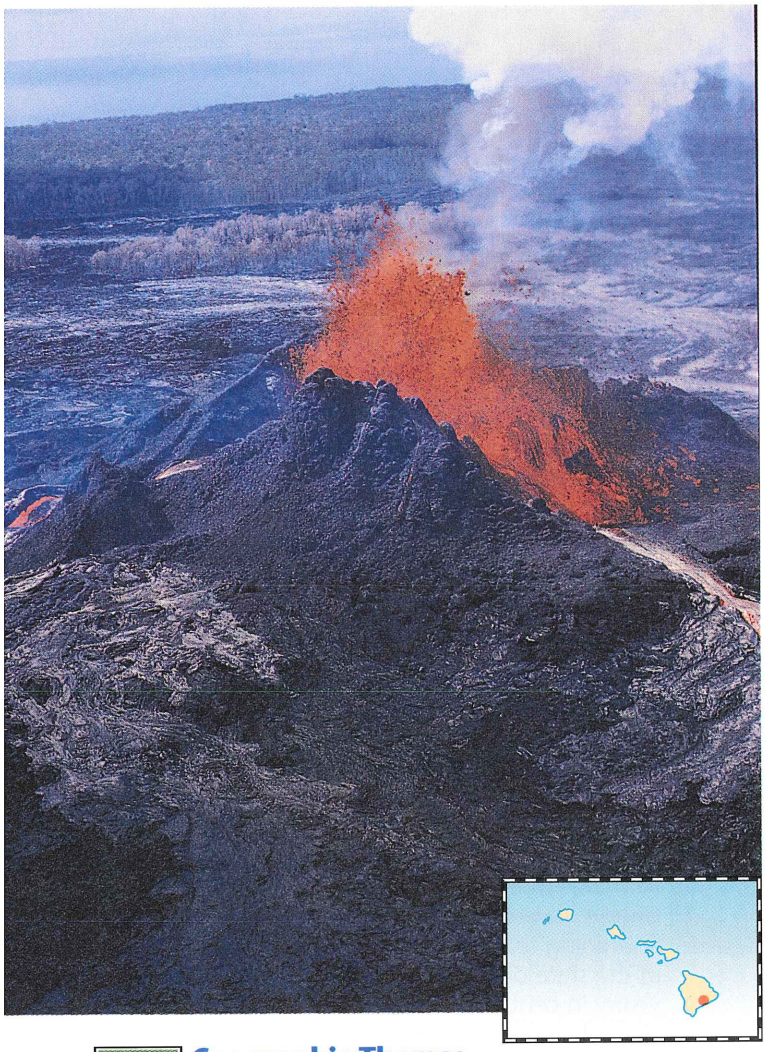
Water pollution harms all living things. Plants and animals cannot live in polluted waters. Polluted water is also very harmful to people's health. Higher-level living organisms often store up pollutants obtained by eating lower-level organisms. The pollutants are passed upward in the food chain. Eventually the food eaten by humans may be poisoned to a dangerous level.

Soil pollution involves damage to the thin layer of fertile soil that covers a large portion of the earth's land. Fertilizers and pesticides are the main causes of soil pollution. Soil pollution can damage and contaminate fertile soils that are necessary for growing the world's food.

Geographic Themes

Human/Environment Interaction: Kansas, United States

A whirling tornado sweeps across Sumner County in the state of Kansas. Many tornadoes occur yearly in central parts of the United States. *What effect do tornadoes have on an area?*



Geographic Themes

Place: Hawaiian Islands

Volcanoes formed the Hawaiian Islands. Hawaii, the largest Hawaiian island, has active volcanoes, including Mount Kilauea. *How do volcanoes, such as Mount Kilauea, pose an environmental hazard?*

Solid wastes are a major form of land pollution. People throw out billions of tons of solid wastes each year. Examples of solid wastes are used tires, cans, plastics, and scrap metal. Some of this waste ends up littering roadsides and floating in streams. Many solid wastes end up in open dumps. These dumps provide areas for disease-carrying animals, such as rats, to breed.

Many industrial processes create toxic or hazardous wastes. Nuclear power plants, for example, create radioactive wastes that must be stored properly if they are not to become a threat to society. Poisonous chemical wastes, all too often dumped in streams and ditches, have caused people to get sick and have led to birth defects. They also have contributed to the rise in cancer and other life-shortening diseases.

Attempts at Cleanup

People have developed different ways to control pollution. One way is to use fuels that cause less air pollution. Other ways include removing chemicals from the wastes dumped into water, and improving water treatment facilities. The use of organic farming instead of fertilizers and pesticides helps control soil pollution. Recycling is another step that has been taken to lessen pollution.

Attempts at Regulation

National and local governments in many countries have taken steps to control pollution. Laws have been passed that limit the harmful materials that automobiles and industries can put into the environment. Funds have been established to conduct research into ways of controlling pollution.

SECTION 1 ASSESSMENT

Checking for Understanding

1. **Define** culture, subsistence farming, population distribution, population density, tornado, hurricane, tsunami, pollution.
2. **Locating Places** Where is Tornado Alley located?
3. **Region** Why is industry more important in developed countries than it is in developing countries?
4. **Human/Environment Interaction** What factors have contributed to the pollution of air and water?

Critical Thinking

5. **Making Comparisons** How does traditional agriculture compare with commercial farming?

SECTION 2

Cultural Expressions

SETTING THE SCENE

Read to Discover . . .
- how the first civilizations developed.
- the ways in which the movement of people, goods, and ideas has caused cultural change.
- the factors that have contributed to cultural contact and cultural barriers.

Key Terms
- civilization
- history
- prehistory
- culture hearth
- cultural diffusion

Identify and Locate
Egypt, Iraq, Pakistan, China, Greece

A society expresses its culture through such things as language, religion, and the arts. From the beginning of time, people developed different ways of expressing their cultures.

REGION

Cultural Origins

Over the centuries, many cultures have built cities, developed writing systems, and achieved varying kinds of development in the arts, sciences, government, and business. These cultures are often called **civilizations.**

Learning From the Past

Before the rise of civilizations, people focused their attention on meeting basic needs and did not leave many written records. Some of the records they did leave were written in a form that is not understood by people today. Studying the written information about a people's past to learn what, how, and why things happened is called **history.** The time in a people's past before written records were kept is known as **prehistory.**

Geographers have learned about the prehistory of different groups of people with the help of other scientists called archaeologists. Archaeologists study the sites where people once lived, looking for evidence left by these people. Such evidence includes things like buildings and ruins of buildings, bones, and artifacts. Artifacts are objects that were made or used by people, such as weapons, tools, and pottery. Sometimes only bits and pieces of artifacts are found. Archaeologists use artifacts to look for hints about the way people lived before written history. These hints show how cultures developed at certain locations and times.

Culture Hearths

Four ancient civilizations made special contributions to world cultures. These civilizations developed in areas of the world known today as Egypt, Iraq, Pakistan, and China. These areas are known as **culture hearths,** or places where civilizations began.

These culture hearths had certain common geographic features that were helpful for the beginning of early agriculture. Each location was characterized by a mild climate and fertile lands. Each civilization was near a major river. The people discovered ways to make use of these good conditions. For example, they dug canals and ditches in order to use the rivers to

irrigate the land. In this way, people were able to grow surplus crops.

MOVEMENT

Cultural Change

Cultures often are changed by both internal and outside influences. Within a specific culture, discoveries and inventions can promote change. Outside influences come through **cultural diffusion**, or the spread of people, ideas, practices, and goods from one culture to another.

Cultural Contacts

Travel and trade are two age-old activities that have encouraged cultural contacts among different groups of people. As a culture developed better ways of moving over land and water, its trade increased. Inventions like the magnetic compass improved navigation and led to the exploration of new lands. Consequently, contacts were made among many cultures.

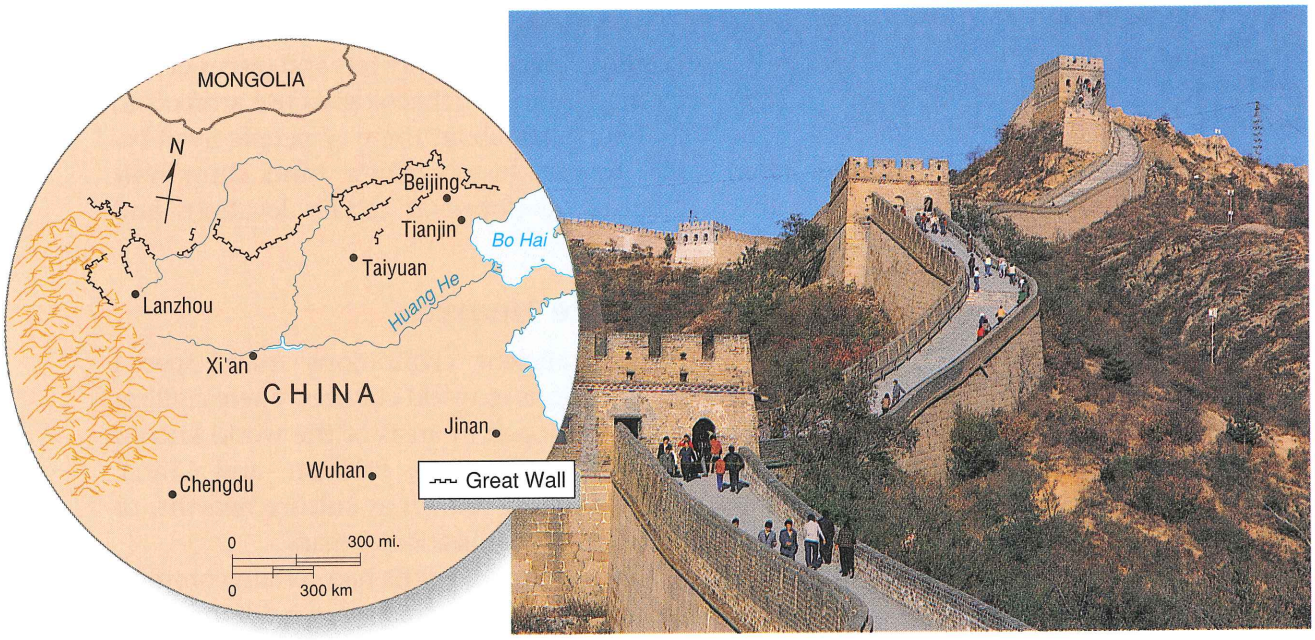
Many times people migrated, or made a permanent move to live in another place. Throughout history, migrations have generally occurred as a reaction to natural or political conditions. The Ice Age, for example, caused people to move to warmer climates. People have also migrated to avoid harsh governments, wars, religious persecutions, and famines.

When people migrate, they carry their culture with them. In their new homelands their ideas and ways of doing things generally become mixed with the ideas and ways of the people already living there.

Cultural Barriers

While some factors have encouraged cultural contact, others have created barriers to it. Natural barriers, such as huge deserts, high mountains, dense rain forests, and unknown ocean waters, have sometimes restricted the movement of goods and ideas between cultures.

People have also created cultural barriers. Such barriers generally come about because of

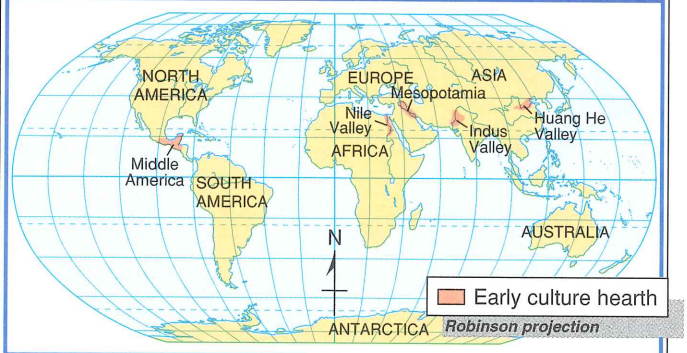


Geographic Themes

Movement: Northern China

The early Chinese built the Great Wall in the northern part of their country to keep out foreign invaders. *What impact did the Great Wall have on Chinese relations with the outside world?*

CULTURE HEARTHS



FOCUS ON GEOGRAPHIC THEMES

1. **Region:** What culture hearths emerged in Asia?
2. **Region:** On what continent did the Nile Valley culture hearth develop?

people's beliefs. One culture might not understand or accept another culture's activities or viewpoints. This lack of understanding leads to fear or mistrust. Such feelings encouraged the ancient Chinese to build their Great Wall to keep others from crossing their boundaries.

Today the barriers posed by distance and natural features are gradually disappearing. Technology enables people to speak to others almost anywhere in the world. Satellites broadcast television signals around the globe. As modern communications systems spread more information, cultural exchange will increase.

Far-reaching Changes

Peoples and their cultures change and evolve through time. Historians have labeled periods of time when change has taken place on a large scale and created a great impact. The time when European countries were exploring the world, for example, is called the Age of Discovery. The mobility of this period encouraged cultural diffusion.

The Industrial Revolution was another time of great change. Power-driven machinery and mass production were introduced at a rapid pace. This led to great changes in the economies of many countries, since goods could be produced quickly and cheaply. The Industrial Revolution also led to social changes. Many people moved to large cities in order to get jobs in factories.

Historians also have labeled periods when great ideas are stressed. One such period is known as the Age of Classical Greece. This period is known for its democratic ideas of government and for its great achievements in art. The Renaissance (REN•uh•SAHNTS), meaning rebirth, is the name given to a period that took place hundreds of years after the time of classical Greece. During the Renaissance, many ideas of early civilizations were reintroduced, and there was a great search for knowledge that led to many changes in the arts, the sciences, and education.

At certain times in history, ideas about government have been rethought. People often wanted more freedom from their rulers. Sometimes, the desire for freedom led to revolutions, or complete changes in government in short periods of time. An age of nationalism also developed. Nationalism involves loyalty and devotion to country. Before the development of nationalism, people generally expressed their loyalty to individual rulers. Nationalism includes a people's pride in their heritage, or those things handed on to people from their ancestors. A people's history and culture are a part of their heritage.

SECTION 2 ASSESSMENT

Checking for Understanding

1. **Define** civilization, history, prehistory, culture hearth, cultural diffusion.
2. **Locating Places** Where did the earliest civilizations develop?
3. **Movement** What factors have affected contact between cultures?
4. **Movement** How have cultural changes had far-reaching effects?

Critical Thinking

5. **Identifying Central Issues** Why do people create cultural barriers?

OUT OF OZONE

Though the news keeps breaking, good and bad, the Montreal Protocol is a real achievement. For once, nations worked together to prevent an environmental catastrophe instead of trying haplessly to repair one that has already happened.

The Global Citizen, 1991

In March 1985, British scientists announced that they had recorded a steady loss of ozone in the upper atmosphere during the previous 10 years. NASA confirmed the British report. Later in the year, American scientists added alarming figures of their own: ozone above Antarctica was depleted 40 to 60 percent.

Discovery of the "ozone hole," as the media dubbed it, shocked the world. Scientific teams around the globe began a burst of research and environmental and diplomatic activities to push national governments into action.

In September of 1987, representatives from 46 countries met in Montreal, Canada, to consider the proposal. From this meeting came the Montreal Protocol, the first multinational treaty to curb a global air pollutant.

THE ISSUE

The Montreal Protocol called on the world's nations to cut in half their use of chemicals proven devastating to the ozone layer. Developed nations, accounting for 97 percent of such use, supported the treaty. Many had already begun to search for substitute chemicals.

Developing nations, however, protested the treaty. They pointed out that the chemicals in question were so widely used in their growing industries that to cut their use would stop economic progress in their countries. In addition, they said, their governments could not afford the costs of finding substitutes.

THE BACKGROUND

The ozone layer is a "buffer zone" of pale blue gas between 14 and 15 miles up in the atmosphere. It protects the earth from the sun's deadly ultraviolet rays.

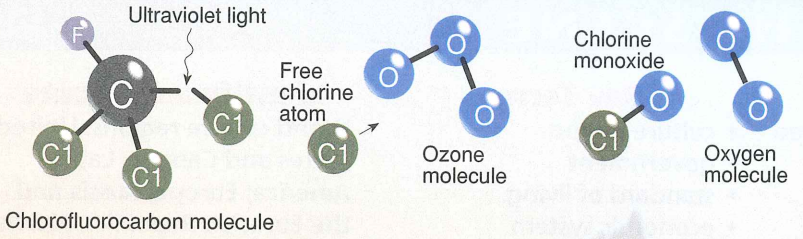
The same studies that exposed the ozone hole also exposed the factor destroying it: *chlorofluorocarbons* (CFCs). CFCs are "wonder" gases that do not rust, explode, burn, or pose immediate dangers to users. They are found in refrigerators, air conditioners, fire extinguishers, plastic foams, aerosol sprays, and many other products. CFCs, however, are very hard to contain. Millions are produced every year, and most find their way to the upper atmosphere. There they devour highly unstable ozone molecules.

Most scientists agree, however, that ozone-damaging CFCs will remain in the atmosphere for 75 years.

THE POINTS OF VIEW

Developing nations, led by China, India, and Brazil, protested that cutting CFC use would considerably hurt their economic progress. In China, for example, refrigerator production is the fastest growing sector of their economy. Besides, developing nations used only a small percentage of CFCs: China, India, and Brazil—the 3 largest—account

HOW CFCs DESTROY OZONE

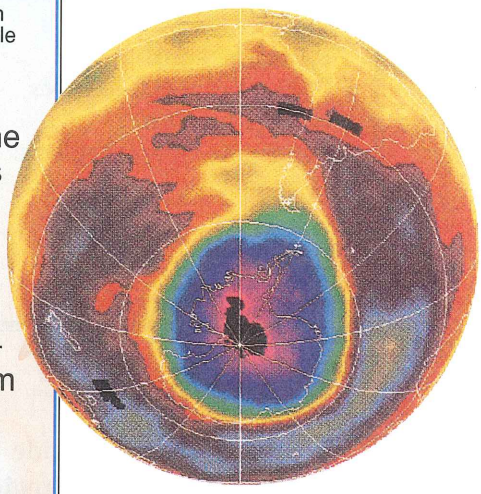


Carbon, fluorine, and chlorine atoms make up CFC molecules. Ultraviolet rays break chlorine atoms free.

A free chlorine atom "steals" an oxygen atom from an ozone molecule.

Oxygen and the chlorine atoms then form a molecule of chlorine monoxide. The two remaining oxygen atoms form an oxygen molecule.

The chlorine monoxide molecule can break up again and again to "eat" more ozone molecules. A single atom of chlorine can devour 100,000 molecules of ozone!



A computer-generated image shows the "hole" that has appeared in the ozone layer above Antarctica.

for 2 percent of the world's CFC use. A Chinese environmental official stated, "Developed countries are responsible for most of the damage to the ozone layer so they should do the most to clean up the problem."

Without that buffer, more of the sun's ultraviolet rays would reach the earth. Such rays cause skin cancer and eye cataracts, weaken the body's immune system, and harm plants, wildlife, and marine food chains.

THE ISSUE TODAY

By the end of 1989, continuing reports that the ozone layer was disappearing more rapidly than first thought caused another UN-sponsored meeting. In Helsinki, Finland, delegates from 80 nations revised the Montreal Protocol to completely ban CFC use in industrialized nations by the year 2000, and in developing nations by 2010. Developed countries agreed to establish a global fund to help developing nations find substitute chemicals.

In 1992 western European countries and the United States announced that their industries would work to stop the use of CFCs. Most scientists agree, however, that ozone-damaging CFCs will remain in the atmosphere for 75 years. The ozone layer may not return to its full strength until at least 2100.

Reviewing the Case

1. What was the final main provision of the Montreal Protocol?
2. Why did developing nations object to the treaty's demands?
3. **Human/Environment Interaction** What concerns does the Montreal Protocol address?

SECTION 3

World Culture Regions Today

SETTING THE SCENE

Read to Discover . . .

- what factors are considered to determine the earth's culture regions.
- how other social sciences help geographers determine culture regions.

Key Terms

- culture region
- government
- standard of living
- economic system
- per capita income
- free enterprise
- capitalism
- socialism
- language family
- religion

Identify and Locate

World culture regions: United States and Canada; Latin America; Europe; Russia and the Eurasian Republics; North Africa and Southwest Asia; Africa South of the Sahara; South Asia; East Asia; Southeast Asia; Australia, Oceania, and Antarctica

Geographers often divide the planet into areas called **culture regions**. These culture regions may not have clear boundaries. For this reason geographers with varying viewpoints may use different ways to decide the number of culture regions and the countries included in each. The authors of this book have divided the world into the 10 culture regions shown on the map. Geographers, as well as political scientists, economists, sociologists, and anthropologists, might divide the world into different culture regions based on government, social groups, economic systems, languages, or religions.

REGION

Governments

People who study **governments**, or groups' political systems, are political scientists. The kind of government a society has reflects the values of a culture. Democracy—a form of government in which the people of a country vote for their leaders—shows that the people value individual freedom.

Among some cultures, the power of the government is more important than individual freedom. These governments are called authoritarian governments. A government in which one leader has full power over a country is a dictatorship. Iraq and North Korea are dictatorships.

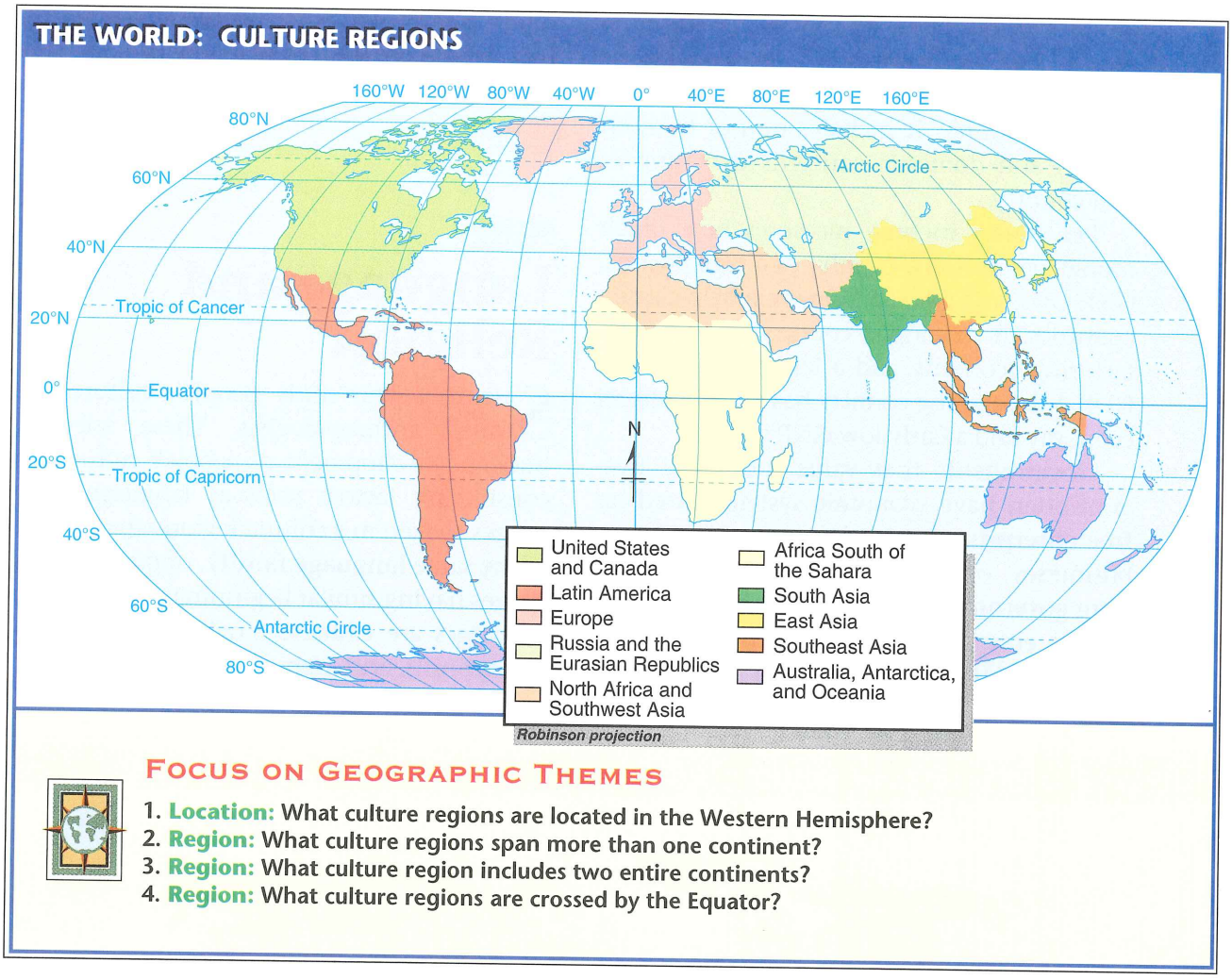
Some countries combine elements. For example, some countries that have monarchs—kings or queens—also have elected a lawmaking group. This type of government is called a constitutional monarchy.

REGION

Social Groups

Those who study people's relationships to one another in groups are called sociologists. Sociologists study the structure of a society, people's social institutions, and the quality of life in a society.

Sociologists use certain measures to determine how well a society meets its needs. For example, the infant survival rate—the number of babies that live to be 1 year old out of the number of babies born—is often used. This figure and a group's life expectancy, or the average number of years a person can expect to live, show the level of health care. The number of people in a group who can read and write is the literacy rate. This figure shows how



FOCUS ON GEOGRAPHIC THEMES

1. **Location:** What culture regions are located in the Western Hemisphere?
2. **Region:** What culture regions span more than one continent?
3. **Region:** What culture region includes two entire continents?
4. **Region:** What culture regions are crossed by the Equator?

widely people are educated. The **standard of living** measures the quality of life based on available material goods.

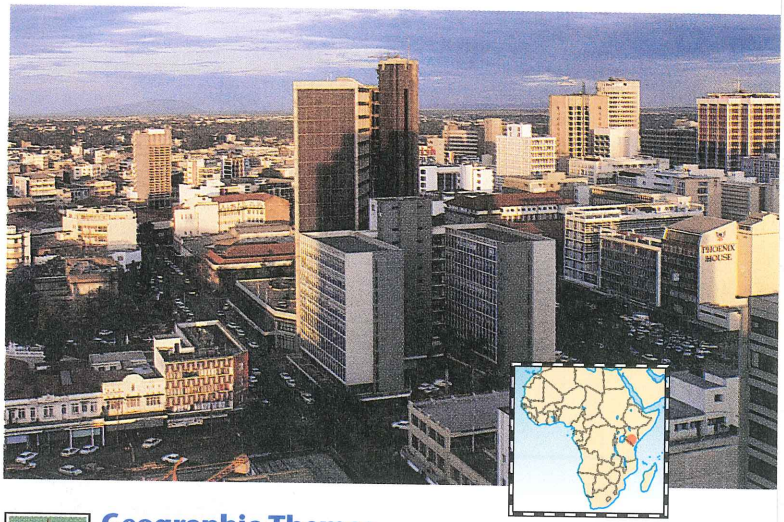
Sometimes quality of life is affected by urbanization—the growth of large cities. Rapid growth can be a problem if the city cannot provide such things as food and housing.

REGION

Economic Systems

A country's **economic system** is the way in which the people of the country produce, get, and use goods and services. Economists are people who study and describe how economic systems work.

The value of all goods and services produced annually by the citizens, working inside or outside the country, is the gross national



Geographic Themes

Place: Nairobi, Kenya

The African country of Kenya—along with its modern capital, Nairobi—has prospered under a free enterprise economy. *What is the relationship between government and business in a free enterprise economy?*

product (GNP). Many nations prefer the more precise measure of gross domestic product (GDP). GDP covers all annual production *within* a country. It includes output by both foreign and domestic concerns operating in that country.

Per capita income measures how much money per person a country or a region earns. GNP, GDP, and per capita income help classify countries. A developed country has a manufacturing economy and a fairly high GNP or GDP. A developing country has an agricultural economy and a fairly low GNP or GDP.

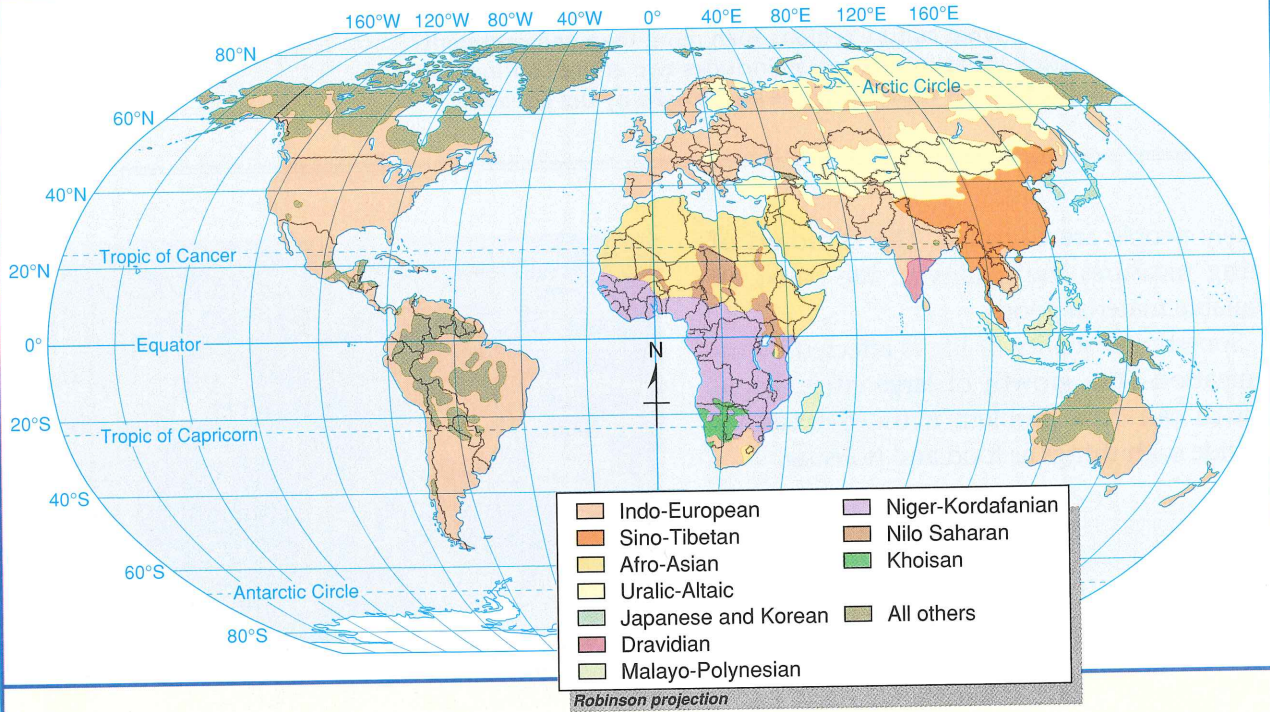
Governments that value individual freedom often have economic systems based on **free enterprise.** Under free enterprise private businesses operate with little interference from government. An economic system based on free enterprise, as in the United States, is called **capitalism**. Authoritarian governments often use an economic system called **socialism**, in which the government decides how resources will be used and how businesses will be run.

REGION

Language and Religion

Scientists who study people's cultures are called anthropologists. These scientists trace the development of people's cultures by considering factors such as language. Languages spoken in a culture region often belong to the same **language family**, or group of languages having similar beginnings. Some major languages are Chinese, English, Hindi, Russian, Spanish, and Arabic.

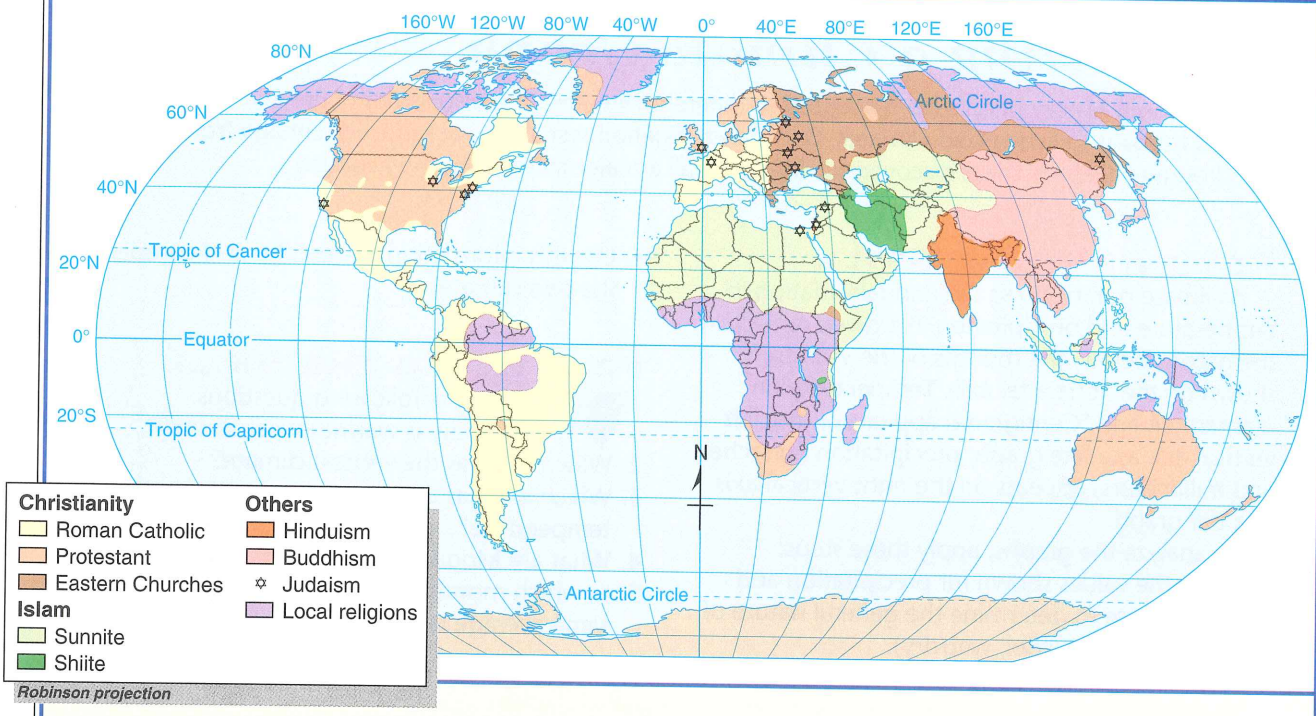
THE WORLD: LANGUAGE FAMILIES



FOCUS ON GEOGRAPHIC THEMES

1. **Region:** Where are Sino-Tibetan languages spoken?
2. **Place:** What is the leading language family in southern India?
3. **Place:** What is the major language family in North America?
4. **Region:** Where are Malayo-Polynesian languages spoken?

THE WORLD: RELIGIONS



Focus on Geographic Themes

1. **Location:** In what continents of the world is Islam a leading religion?
2. **Region:** What is the principal religion of South America?
3. **Place:** Where is Hinduism a major religion?

Language is a powerful tool of communication. It offers a way for people to share information and experiences. Language also permits people to preserve their past and present experiences through history and literature. Through the written word, the people of one generation can pass their knowledge and skills to later generations.

Anthropologists also consider people's **religion** when studying their cultures. Religion is an organized way of worshiping a spiritual being or thinking about life. Anthropologists study which religions are practiced in different parts of the world. Some of the major religions in the world today are Judaism, Christianity, Buddhism, Islam, Hinduism, and Confucianism. Religion and language are part of a society's traditions, or the practices and beliefs passed on to people throughout the ages.

Section 3 Assessment

Checking for Understanding

1. **Define** culture region, government, standard of living, economic system, per capita income, free enterprise, capitalism, socialism, language family, religion.
2. **Locating Places** In what parts of the world do each of the world's major religions predominate?
3. **Region** What factors are considered when describing different culture regions?

Critical Thinking

4. **Analyzing Information** Why do scientists use such measures as GNP, GDP, and literacy rate in studying groups of people?

Interpreting a Climate Graph

Throughout history people have adapted to different climates. The discoveries of fire and clothing allowed humans to live in cold climates. Dams and irrigation systems have reduced damage from floods and droughts. Despite these discoveries, climate is still a major factor in human culture.

REVIEWING THE SKILL

A climate graph shows the annual variation in temperature and precipitation in a given region. In the graphs below, the months of the year are shown on the horizontal axis. Temperature (in °Fahrenheit and °Centigrade) appears on the left vertical axis as a line graph; precipitation (in inches and millimeters) appears on the right vertical axis as a bar graph.

To analyze the graphs, apply these steps:

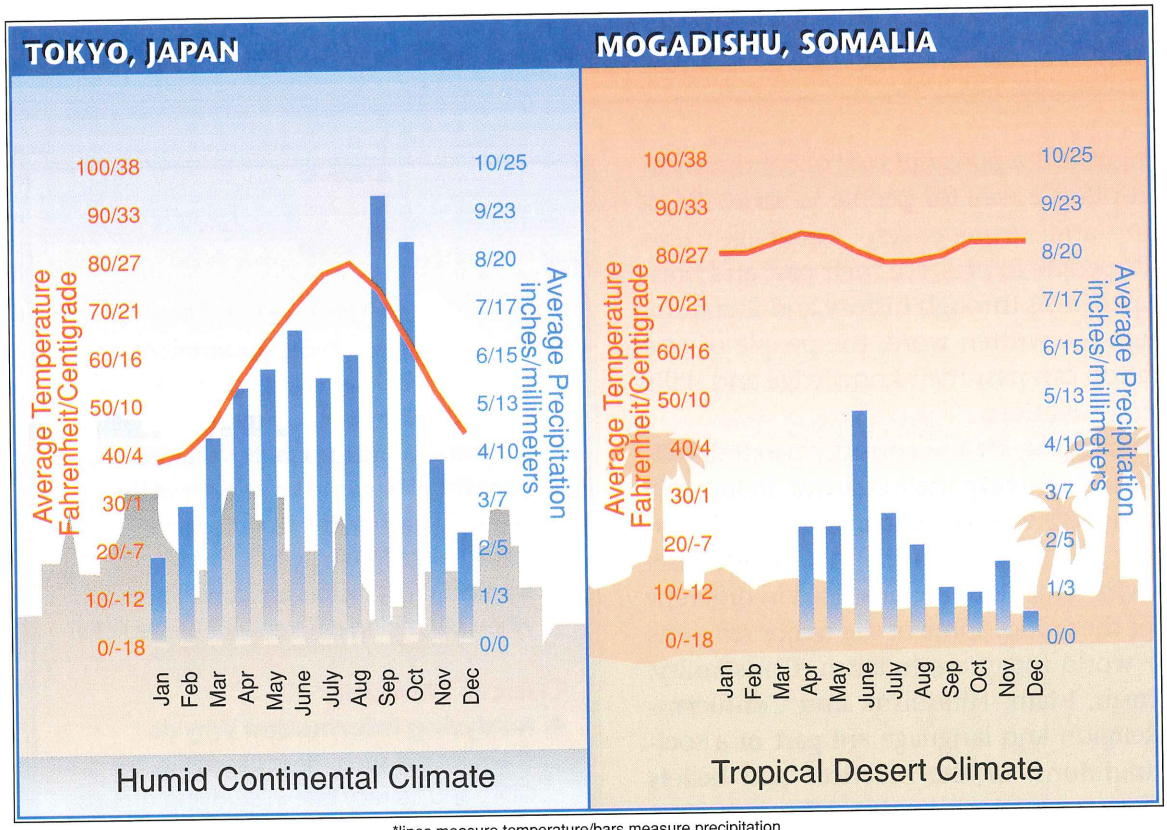
- Study the values shown for precipitation and temperature to determine the general nature of the climate (hot/cool, wet/dry).
- Determine annual temperature variation by identifying highest and lowest temperatures.
- Determine annual precipitation variation.
- Identify the months with the most extreme temperatures and precipitation.
- Use this information to describe and compare the two climates.

PRACTICING THE SKILL

Answer the following questions:

1. Which city is warmest year-round?
2. Which city has the wettest climate?
3. Which city has the greatest annual variation in temperature?
4. What are Mogadishu's driest months?
5. In which months do both cities have about the same average temperature?

GO TO The Glencoe Skillbuilder Interactive Workbook, Level 2 provides instruction and practice in key social studies Skills.



Source: *World Weather Guide*, 1990

*lines measure temperature/bars measure precipitation

chapter 4

HIGHLIGHTS

SECTION 1 Limits and Opportunities

Market scene in Guatemala

KEY TERMS

culture (p. 63)
subsistence farming (p. 63)
population distribution (p. 65)
population density (p. 65)
tornado (p. 66)
hurricane (p. 66)
tsunami (p. 67)
pollution (p. 67)

SUMMARY

- Nations can be classified as either developed or developing. Developed countries are highly industrialized, while developing countries are largely agricultural.
- The rapidly growing population of the world is creating many challenges, including meeting food needs and conserving resources.
- Environmental hazards include weather-related phenomena and pollution.

SECTION 2 Cultural Expressions

Archaeological dig

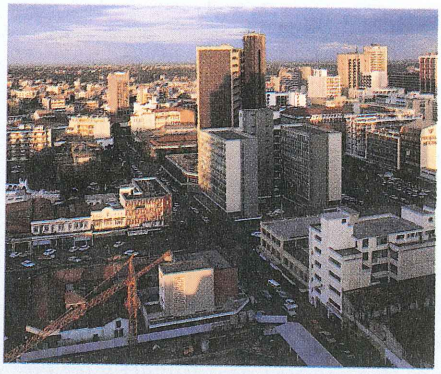
KEY TERMS

civilization (p. 69)
history (p. 69)
prehistory (p. 69)
culture hearth (p. 69)
cultural diffusion (p. 70)

SUMMARY

- Cultures express themselves in different ways. Some important cultural expressions are language, religion, and the arts.
- Early civilizations developed near major rivers in areas where the climate was mild and the lands were fertile.
- As cultures developed better modes of transportation, trade increased and cultural contacts were made.

SECTION 3 World Culture Regions Today



Nairobi, Kenya

KEY TERMS

culture region (p. 74)
government (p. 74)
standard of living (p. 75)
economic system (p. 75)
per capita income (p. 76)
free enterprise (p. 76)
capitalism (p. 76)
socialism (p. 76)
language family (p. 76)
religion (p. 77)

SUMMARY

- To help them describe people and cultures, geographers divide the world into culture regions.
- Different factors are used to determine world culture regions. Among the factors considered are environment, history, language, religion, government, social structure, and economy.

chapter 4

ASSESSMENT

Reviewing Key Terms

Choose the vocabulary term that best completes each of the sentences below. Write your answers on a separate sheet of paper.

culture (p. 63)
subsistence farming (p. 63)
tornado (p. 66)
tsunami (p. 67)
civilization (p. 69)
cultural diffusion (p. 70)
capitalism (p. 76)
free enterprise (p. 76)
socialism (p. 76)

Section 1

1. A ____ is a powerful, whirling storm that ranks as the most violent of all storms.
2. ____ is the way of life of a group of people having common traditions, interests, and beliefs.
3. Earthquakes under the ocean can result in ____, or huge ocean waves.
4. Many people in developing countries engage in ____.

Section 2

5. The spread of ideas and practices from one part of the world to another is called ____.
6. A culture with a high level of development in the arts and sciences is called a ____.

Section 3

7. ____ is an economic system based on free enterprise.
8. The American economy is based on the principles of ____.
9. Under ____, a government decides how resources will be used and how businesses will be run.

Reviewing Facts

Section 1

10. What challenges does the world's rapidly growing population present?

Section 2

11. What is prehistory? History?

Section 3

12. What are some major languages of the world today?

Critical Thinking

13. **Making Comparisons** How do developed and developing countries differ?
14. **Identifying Central Issues** What steps have governments taken to solve environmental problems?
15. **Analyzing Information** Why are countries increasingly preferring gross domestic product (GDP) over gross national product (GNP) as a measure of economic well-being?

Geographic Themes

16. **Human/Environment Interaction** What is the most harmful result of air pollution?
17. **Region** What geographic features did culture hearths have in common?
18. **Movement** Why have cultures changed over the years?

Practicing Skills

Interpreting a Climate Graph

Refer to the climate graph on page 78.

19. Referring to the climate graph for Mogadishu, how would you describe a desert climate?
20. Referring to the climate graph for Tokyo, how would you describe a humid continental climate?
21. What is the total annual precipitation for each city?
22. What are the highest and lowest average monthly temperatures for each city?

Projects

Individual Activity

Make a list of objects that you own or use. Note where each item was manufactured. Locate these places on a world map. What culture regions of the world have contributed most to your way of life?

Cooperative Learning Activity

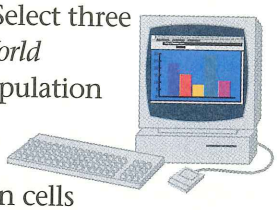
Working with a partner, use a world almanac and other sources to create an economic data chart. Pick 10 countries from different culture regions. For each country, find information that provides evidence of its level of economic development. Rank the countries by level of development.

Writing About Geography

Narration Pick a current international event that is significant and write a geographic analysis of the story. Apply the observations recorded in your journal as well as the ideas and cultural characteristics that you have learned in this chapter to discuss the event in geographic terms.

Technology Activity

Using a Spreadsheet Select three countries and use the *World Almanac* to find their population data in 10-year increments. Use your data to create a spreadsheet. In cells A2, A3, and A4, type in the names of your selected countries. In cells B2 through F2, type in *1960, 1970, 1980, 1990, 2000*. In cells B2 through F2, type in the data for the three countries. Click on "Chart Wizard" and follow the prompts to create a bar graph showing population changes over a 40-year period.

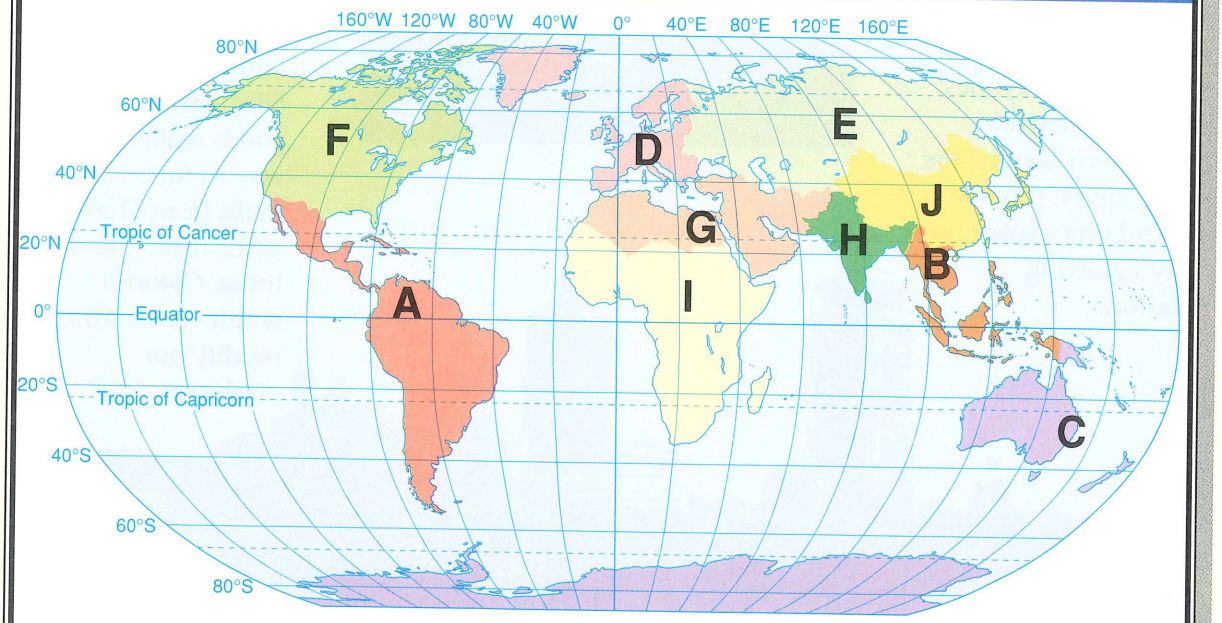


Locating Places

THE WORLD: CULTURE REGIONS

Match the letters on the map with the culture regions of the world. Write your answers on a separate sheet of paper.

1. The United States and Canada
2. Latin America
3. Europe
4. Russia and the Eurasian Republics
5. North Africa and Southwest Asia
6. Africa South of the Sahara
7. South Asia
8. East Asia
9. Southeast Asia
10. Australia, Oceania, and Antarctica

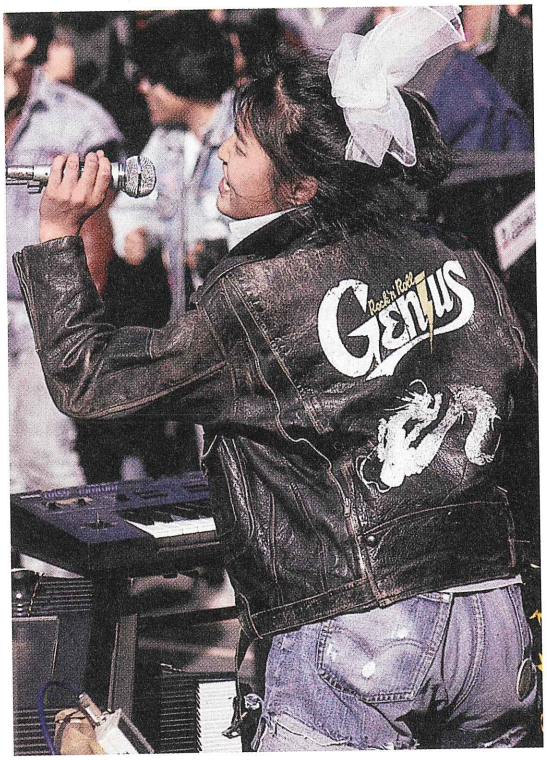


GEOGRAPHY CONNECTION

The World and the United States

THE GLOBAL CULTURE

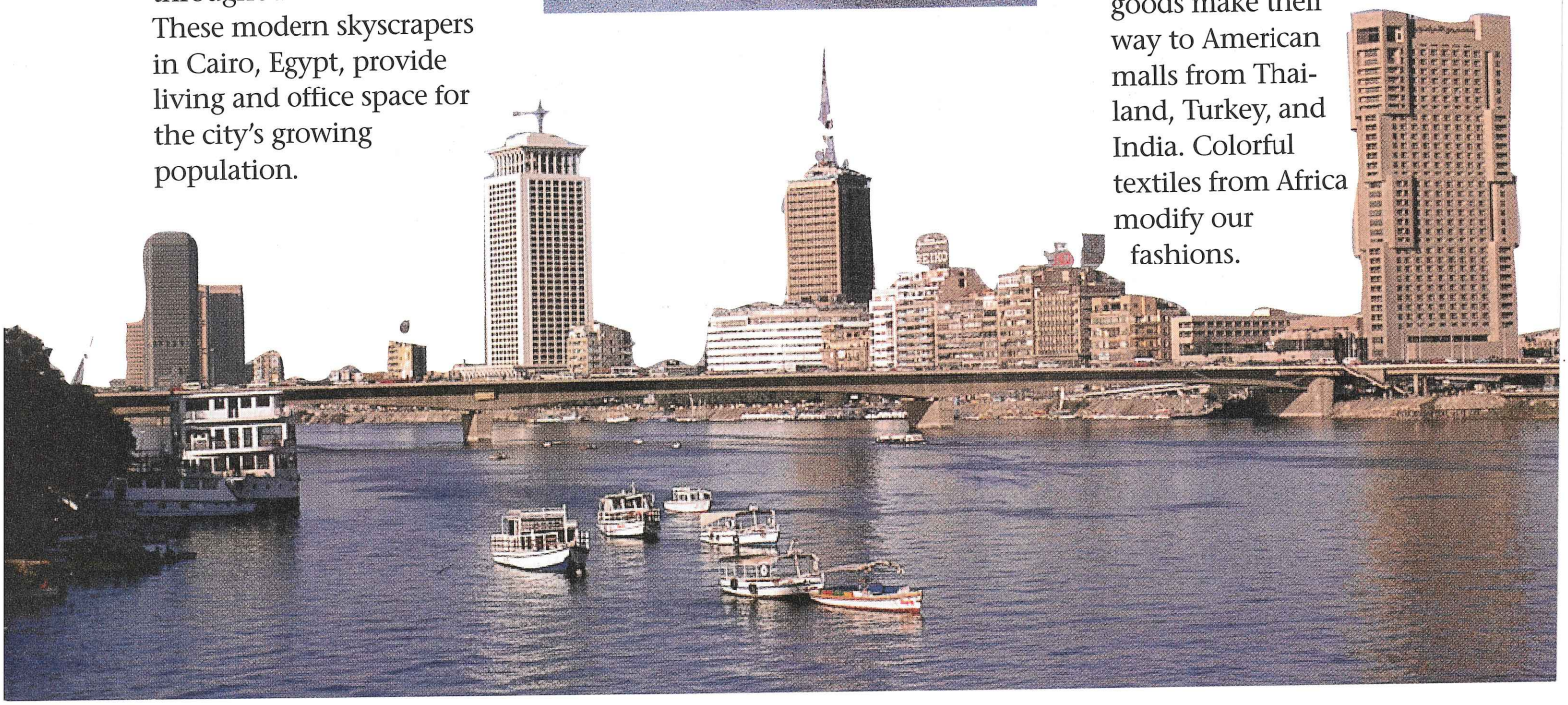
Since the end of World War II, the fads and fashions of the United States have spread across the globe. American television, American businesses and industries, and American products have greatly influenced today's global culture.

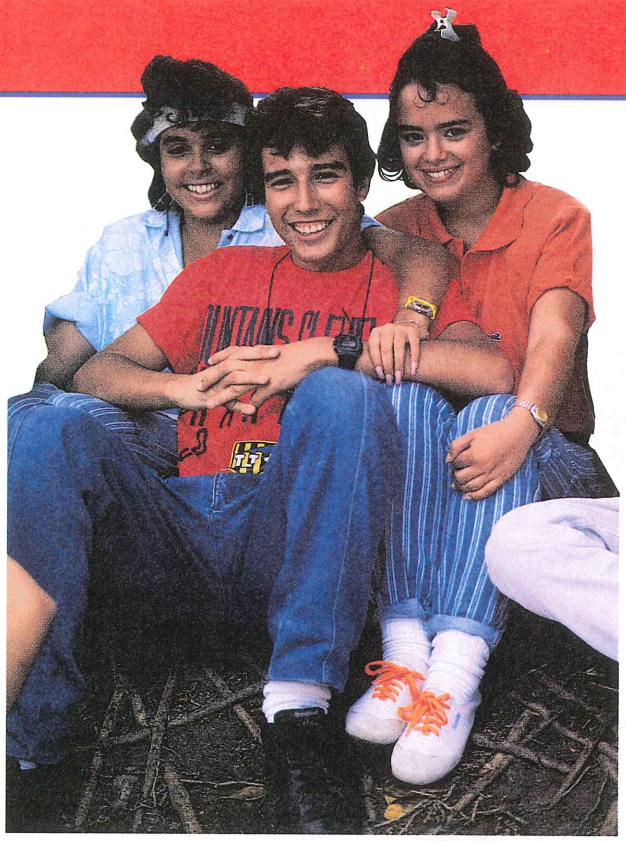


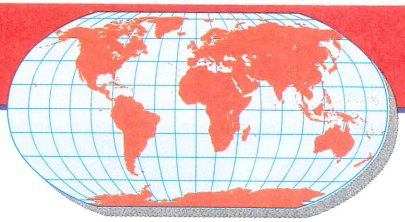
ROCK AS WELL AS COUNTRY AND WESTERN MUSIC ▶ are popular from Mozambique to Japan. Rock began as rock 'n roll, getting its start in the 1950s with American musicians Chuck Berry and Elvis Presley. Country and western developed from early American folk tunes. During the mid-1980s, country music began to gain in worldwide popularity. This Japanese teenager is part of a rock band performing before an outdoor audience.

▼ **SKYSCRAPERS** are found in many countries of the world. These structures first reached skyward in Chicago and New York. Steel-and-concrete buildings now define skylines throughout the world. These modern skyscrapers in Cairo, Egypt, provide living and office space for the city's growing population.

◀ **PRODUCTS FROM OTHER NATIONS,** such as this German sports car, influence American culture. From Japanese assembly lines come automobiles and electronic products. Silk, batik, and bamboo goods make their way to American malls from Thailand, Turkey, and India. Colorful textiles from Africa modify our fashions.







▲ **JEANS AND SNEAKERS,** worn by these students in Latin America, are two of the most popular products from the United States ever to reach global markets. Developed in the 1860s by Levi Strauss, jeans took off globally in the 1950s, when jeans-wearing American movie stars Marlon Brando and James Dean roared onto movie screens. United States Rubber introduced rubber-soled Keds in 1917. As other brands of rubber-soled footwear appeared, they became known as sneakers because wearers could "sneak" around almost soundlessly on the rubber soles.

▲ **MASS PRODUCTION AND MOVING ASSEMBLY LINES** characterize manufacturing in most of the world's nations. The American automobile industry developed assembly lines during the early 1900s. Mass production is now an indispensable part of manufacturing worldwide. These South African workers are assembling transistor radios.

AMERICAN FAST FOODS ▶ are as much a part of global culture as they are of American culture. Shoppers in Moscow and Milan enjoy Kentucky Fried Chicken. Coca-Cola fills glasses in Budapest, Beijing, and Bogotá. This customer is buying a McDonald's hamburger in Tokyo.

Checking for Understanding

1. What are the main features of the global culture?
2. **Movement** In what ways are you a global citizen?