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The discipline of geography is introduced in the Introduction, as well as the inquiry skills and geographic thinking concepts you will be using throughout the resource. Use the Introduction as a reference that you can turn back to throughout this resource.
UNIT OPENER

There are two units in this book. Each unit has four chapters.

These questions are from the point of view of each geographic thinking concept. You will also see these bubbles throughout each chapter. The colours will always connect to the same thinking concept. Pink means Patterns and Trends, Yellow means Spatial Significance, Green means Interrelationships, and Blue means Geographic Perspective.

The Global Concern case studies take an in-depth look at an issue related to the unit.

This is an introduction to the Unit Challenge, an activity that you will work on throughout the unit.
CHAPTER OPENER

Chapter openers introduce the theme and content covered in the chapter.

The main question that you will explore in the chapter

The skills and ideas that you will cover in the chapter

CHAPTER FEATURES

Questions from the point of view of each geographic thinking concept. Each colour represents a different thinking concept.

Figure references tell you what the photo, graph, map, diagram, or table is about.

These questions ask you to think about a photo in different ways and from your own perspective.

Important words are highlighted and defined directly on the page.
Makings of Pollution

Ocean pollution is thought to be the result of a variety of factors. Pollution is a threat to not only the local environment, but also the global environment. Pollution can be defined as the presence of harmful substances in the oceans, which can affect the health of marine life, and can also affect the health of human beings. Pollution can come from a variety of sources, including human activities such as industry, agriculture, and transportation. Pollution can also come from natural sources, such as volcanic eruptions and wildfires. Pollution can have a variety of effects on the environment, including changes in the pH of the water, reduction of oxygen levels, and the loss of biodiversity. Pollution can also have a variety of effects on human health, including respiratory problems, skin problems, and cancer. Pollution can be a serious problem, and it is important to take steps to prevent it.
Activity pages appear in every chapter to help you read, analyze, and create different kinds of maps and graphs.

In every chapter, you will use Case Studies, including National Geographic Case Studies, to explore different places around the world and look at how people are responding to challenges.
Pass

This activity will help you

Pass

An activity that will help you summarize what you have learned in the chapter.

Sample Material

This spatial journal helps you find the location of each case study in the unit.

Looking Back

At the end of each chapter, you will complete a step in your Unit Challenge.

Instructions for how to complete your Unit Challenge.

These questions and activities help to apply your learning. Each question relates to an inquiry skill or to a geographic thinking concept.

Looking Back: Chapter 2

How Should We Respond to Climate Change?

Learning Goals

1. After reading through this chapter, you had opportunities to:
   a. Describe the factors that influence climate patterns and climate change.
   b. Understand the role of human activities in climate change.
   c. Compare and contrast the impact of climate change on different regions.
   d. Evaluate the effectiveness of current global efforts to mitigate climate change.

2. After completing this chapter, you will have opportunities to:
   a. Create a personal plan of action to address climate change in your community.
   b. Develop an awareness campaign to educate others about climate change.
   c. Participate in a community service project related to climate change.
   d. Engage in a citizen science project to monitor climate change indicators.

Looking Back: Unit 2

Our World’s Natural Resources: Use and Sustainability

Why are Natural Resources Important?

• Natural resources are essential for human survival and well-being.
• Natural resources are finite and non-renewable.
• Natural resources are central to economic development and global trade.
• Natural resources are subject to pressures from population growth and industrialization.

Create a Personal Plan of Action

Here is a chance to make your personal plan of action and share your strategies for how you can make a difference.

• Research the natural resources that are important to you.
• Identify the threats to natural resources in your area.
• Develop strategies to protect and conserve natural resources.
• Share your plan of action with others to inspire change.

Looking Back: Unit 3

Natural Disasters

Understanding Natural Disasters

• Natural disasters are events that occur naturally and cause significant harm.
• Natural disasters can be caused by weather patterns, geological processes, or human activities.
• Natural disasters can have immediate and long-term impacts on human and natural systems.

Learn about natural disasters and what you can do to prepare and respond.

• Create a personal disaster plan.
• Educate others about natural disasters and how to prepare.
• Engage in community service projects related to disaster preparedness.

Looking Back: Unit 4

Ecosystems

Understanding Ecosystems

• Ecosystems are communities of living and non-living things that interact with each other.
• Ecosystems are classified based on physical characteristics such as temperature, moisture, and light.
• Ecosystems provide services such as food, energy, and fresh air.

Explore different ecosystems and their importance.

• Research an ecosystem of interest to you.
• Analyze the interactions within the ecosystem.
• Develop strategies to protect and conserve the ecosystem.
• Share your findings with others to raise awareness.

Looking Back: Unit 5

Human-Environment Interaction

Understanding Human-Environment Interaction

• Human-environment interaction refers to the relationship between human activities and the natural environment.
• Human-environment interaction can lead to positive or negative outcomes.
• Human-environment interaction can be managed through sustainable practices.

Examine the impact of human activities on the environment.

• Identify examples of human-environment interaction in your local community.
• Develop strategies to reduce negative impacts and enhance positive outcomes.
• Share your ideas with others to promote environmental stewardship.

Looking Back: Unit 6

Population and Resources

Understanding Population and Resources

• Population refers to the number of people living in a particular area.
• Resources refer to natural and human-made materials that are used to meet human needs.
• Population and resources are interdependent.

Analyze the relationship between population and resources.

• Research the population and resources in your local area.
• Evaluate the impacts of population growth on resource availability.
• Develop policies to manage population and resources sustainably.
• Share your findings with others to promote informed decision-making.

Looking Back: Unit 7

Economic Development

Understanding Economic Development

• Economic development refers to the process of improving the quality of life for all members of society.
• Economic development can be achieved through various means such as investment, innovation, and education.
• Economic development can have both positive and negative impacts on the environment.

Evaluate the role of economic development in promoting sustainability.

• Assess the economic development strategies in your local area.
• Analyze the environmental and social impacts of economic development.
• Develop policies to ensure that economic development is sustainable.
• Share your insights with others to promote informed decision-making.

Looking Back: Unit 8

Environment and Society

Understanding Environment and Society

• Environment and society refer to the relationship between the natural environment and human societies.
• Environment and society interactions can be positive or negative.
• Environment and society interactions can be managed through sustainable practices.

Explore the relationship between the environment and society.

• Identify examples of environment and society interactions in your local community.
• Analyze the impacts of environment and society interactions on human well-being.
• Develop strategies to manage environment and society interactions sustainably.
• Share your findings with others to promote informed decision-making.

Looking Back: Unit 9

Global Connections

Understanding Global Connections

• Global connections refer to the interconnections between different parts of the world.
• Global connections can be facilitated through trade, travel, and technology.
• Global connections can have both positive and negative impacts on the environment.

Examine the role of global connections in promoting sustainability.

• Assess the global connections strategies in your local area.
• Analyze the environmental and social impacts of global connections.
• Develop policies to ensure that global connections are sustainable.
• Share your insights with others to promote informed decision-making.

Looking Back: Unit 10

Geographical Thinking

Understanding Geographical Thinking

• Geographical thinking refers to the ability to understand and analyze spatial relationships.
• Geographical thinking can be applied to various aspects of life such as geography, history, and economics.
• Geographical thinking can help individuals make informed decisions.

Apply geographical thinking to solve real-world problems.

• Identify a problem that can be solved through geographical thinking.
• Use geographical thinking to analyze the problem and develop a solution.
• Share your solution with others to promote informed decision-making.
•

Using This Resource

Page 58
CHAPTER 3
CHANGING PATTERNS OF NATURAL VEGETATION

WHY CARE THAT EARTH'S NATURAL VEGETATION IS CHANGING?

LEARNING GOALS
As you work through this chapter, you will
• identify patterns in the world's natural vegetation
• describe how nature and humans change natural vegetation patterns
• gain an awareness of the impact we have made on the world's natural vegetation

Grasslands and forests around the world are shrinking. Deserts have always grown and shrunk over time due to changes in climate and periods of drought. But now, more of Earth's surface is turning into desert. For example, the grasslands on the edges of the Gobi Desert, in China, are getting smaller every year. At the same time, the Gobi Desert is growing by 3600 km²—about two-thirds the area of Prince Edward Island—every year.

A major cause of growing deserts today is human activity. We are cutting down trees and grasses to make fields for crops and other human uses. This exposes the soil to the Sun, which dries and cracks it, as shown here in the Namib Desert in south-western Africa. The exposed soil blows away. The ground becomes less fertile, and plants struggle to grow. Also, the ground cannot absorb rainwater, and there is less water in the region. With no vegetation, humans and animals suffer from hunger. What other effects can growing deserts have?
Grasslands and forests around the world are shrinking. What happens to the soil in these regions? How are the wildlife and the people who live in these regions affected?

Your answers to these questions help to explain why Earth’s vegetation is important. Vegetation affects the soil, interactions within the environment known as ecosystems (Figure 3.1), and the climate of a region. It also affects the people who live there, and whether or not they live well or struggle to survive.

Changes in vegetation have both local and global effects. The more we learn about vegetation, the better we will understand how and why we need to protect it.

EARTH’S NATURAL VEGETATION REGIONS

Earth’s natural vegetation consists of the plants that grow freely without help from people, as opposed to those planted by people. There are three major natural vegetation regions around the world: forests, grasslands, and deserts. Each region covers about one-third of Earth’s total land area. Where the regions are located depends mostly on the climate, which includes temperature and precipitation, and the type of soil.

FOREST OF THE WORLD

Trees can grow from areas below sea level to places high in the mountains. They can grow at different latitudes, from the equator and almost up to the Arctic Circle. For example, boreal forests are in northern regions. Tropical forests grow between the Tropic of Cancer (23.5°N latitude) and the Tropic of Capricorn (23.5°S latitude), and subtropical forests are found on the outer edges of these. Some species of trees need large quantities of water to survive; others do not. Trees are either coniferous or deciduous. Coniferous trees have needle-shaped leaves. Deciduous trees lose all their leaves for part of the year. Broadleaf trees have broad, flat leaves. Some are deciduous, such as maple and oak; others, such as mahogany, are evergreen. Evergreen trees have some leaves all year round. They can be both broadleaf or coniferous.

On Figure 3.2, you can locate the six main forest types: tropical broadleaf forests, subtropical broadleaf forests, Mediterranean forests, broadleaf deciduous forests, mixed forests, and needleleaf evergreen or boreal forests.
GRASSLANDS OF THE WORLD

Grasses do not need as much precipitation as trees. They can survive in drier regions. As well as grasses, grasslands include species of wildflowers and other grass-like plants, such as sedges and rushes. They are also home to many animal species. There are two types of grasslands: tropical grassland and mid-latitude grassland.

DESERTS OF THE WORLD

Deserts are extremely dry regions. A region is a desert if it has low precipitation, about 250 mm per year or less. Or it is a desert if it has a very high rate of evaporation compared to the amount of rain it gets. Evaporation is the change of a liquid to vapour or gas. There are three types of deserts: semi-desert scrub, desert, and tundra and high-mountain vegetation. Semi-desert scrub and deserts are usually hot. The tundra and high-mountain vegetation regions, which have low precipitation, are cold regions.

**tundra** vast Arctic region without trees where the soil is frozen year round

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**Global Natural Vegetation Regions**

*FIGURE 3.1* Grasslands’ ecosystems support high numbers of grazing animals, such as giraffes and elephants.

*I wonder what other animal species live in grasslands?*

**FIGURE 3.2** This map shows the natural vegetation regions around the world.
TYPES OF FORESTS

FIGURE 3.3 There are six types of forests: (A) tropical broadleaf forest (Thailand, Asia); (B) subtropical broadleaf forest (Mexico, North America); (C) Mediterranean forest (Italy, Europe); (D) broadleaf deciduous forest (Canada, North America); (E) mixed forest (Japan, Asia); and (F) needleleaf evergreen or boreal forest (Finland, Europe).

A. Tropical broadleaf forest

Climate
- large amounts of precipitation: more than 2000 mm of rainfall per year
- rains every month of the year
- very hot all year; average temperature above 24 °C

Description
- greatest abundance and diversity of plant and animal species
- most trees have broad or wide, flat leaves
- trees do not lose their leaves

B. Subtropical broadleaf forest

Climate
- large amounts of precipitation: as much as 2000 mm of rainfall per year
- several dry months
- hot all year

Description
- trees are deciduous and lose their wide, flat leaves during the dry season
- many species are adapted to use the light that reaches the ground during the dry season when the treetops are bare

C. Mediterranean forest

Climate
- less than 1000 mm of precipitation per year
- hot, dry summers and cool, damp winters
- distinct dry season

Description
- plant species have adapted to survive summer drought conditions
- includes woodlands (mix of smaller trees and shrubs) and shrublands (mainly short, woody plants)
- tree species include olive and cork trees
**Climate**
- from 600 to 1500 mm of precipitation throughout the year
- four distinct seasons, including warm, moist summers and mild winters
- average annual temperature between 7 °C and 17 °C

**Description**
- tree species are mostly deciduous, such as oak, maple, and beech
- leaves falling on the ground every year form a thick, fertile soil

**Climate**
- from 600 to 1500 mm of precipitation throughout the year
- warm, moist summers and mild to cool winters

**Description**
- transition zone between coniferous forests and broadleaf deciduous forests
- mix of coniferous and deciduous tree species

**Climate**
- from 300 to 850 mm of precipitation per year, much of it as snow
- cold temperatures; short growing season

**Description**
- few plant species because of harsh conditions
- tree species are mostly coniferous with narrow, needle-like leaves, such as spruce and pine
- ground cover is slow-growing lichen, mosses, and grasses that are adapted to the cold
TYPES OF GRASSLANDS

FIGURE 3.4 There are two types of grasslands: (A) tropical grassland (Tanzania, Africa); and (B) mid-latitude grassland (Argentina, South America).

A. Tropical grassland

- Climate:
  - from 100 to 1200 mm of precipitation per year
  - most moisture arrives during a short rainy season

- Description:
  - includes many species of tall grasses, and some shrubs and trees
  - supports large herds of grazing animals such as elephants and zebras

B. Mid-latitude grassland

- Climate:
  - from 250 to 750 mm of precipitation per year
  - cold winters and warm summers

- Description:
  - includes tall and short grasses, shrubs, and scattered trees, some of which grow in river valleys
  - growing seasons average 100 to 175 days
  - plant species have adapted to the scarce moisture by creating thick root mats that prevent moisture from soaking into the soil
TYPES OF DESERTS

FIGURE 3.5 There are three types of deserts: (A) semi-desert scrub (Bolivia, South America); (B) desert (Morocco, Africa); and (C) tundra and high-mountain vegetation (United States, North America).

A. Semi-desert scrub

- Climate
  - from 250 to 500 mm of precipitation per year
  - high rates of evaporation

- Description
  - transition zone between desert and grassland
  - includes a mix of vegetation types, such as sagebrush and dwarf shrubs

B. Desert

- Climate
  - less than 250 mm of precipitation per year
  - high rates of evaporation
  - very high daytime temperature and low nighttime temperature
  - average temperature for hot deserts is 22 °C and for cool deserts is 10 °C

- Description
  - includes plants such as short grasses, sagebrush, and cacti
  - plants have very long roots to reach water deep below the surface
  - plants may have no leaves, which reduces evaporation

C. Tundra and high-mountain vegetation

- Climate
  - from 150 to 250 mm of precipitation per year
  - average summer temperatures are below 6 °C
  - most moisture is locked up in ice and snow

- Description
  - soil is frozen solid except for the top few centimetres that thaw each summer
  - vegetation includes mosses, lichen, grasses, and wildflowers
BENEFITS OF VEGETATION

Plants benefit us and the planet in many ways. For example, they prevent soil erosion and maintain the water cycle. They slow climate change by removing carbon dioxide (CO₂) from the air. Here are five other ways that vegetation benefits us and the planet.

OXYGEN

During photosynthesis, plants use energy from the Sun to combine CO₂ from the air with water. This creates carbohydrates and oxygen. Plants use the carbohydrates for growth and reproduction. They release the oxygen back into the atmosphere. Animals, including humans, breathe in oxygen. They need oxygen to survive.

NATURAL HABITATS

Natural vegetation provides animals with habitats. Habitats give animals food, water, shelter, opportunities for mating, and some protection from predators.

RESOURCES

For thousands of years, people have used materials from plants, such as trees, to build shelters, furniture, and modes of transportation. We have used plant materials, such as bark, cotton, or vines, to make clothing, tools, and weapons. We have used wood to keep us warm and to provide heat for cooking. Thousands of medicines come from plants. At least three-quarters of the world’s population uses plants or parts of plants for medicine.

Over the centuries, farmers domesticated, or adapted, some wild plants, such as the ancestors of today’s wheat and corn. Over time, the plants adapted and changed, becoming easier to grow. We eat food made from grasses (grains) and trees (nuts), drink beverages (tea and coffee) made from shrubs, and make clothes from plant fibres such as cotton. Plant materials can be used to make various products, including car parts (Figure 3.6).

FIGURE 3.6 The exterior of this hybrid concept car contains seaweed (inset).
RECREATION
Around the world, natural environments are important places for recreation and relaxation. People enjoy camping in forests, hiking or skiing on mountain trails, and boating or swimming in rivers and lakes. These connections have encouraged ecotourism, tourism with low environmental impact, as more people choose vacations to enjoy nature in many places, such as the tropical rainforests of Costa Rica. In addition, many countries have developed national parks to preserve wilderness areas for people to enjoy, as well as to protect land and wildlife. There are also many urban parks around the world where city dwellers go to relax and reconnect with the natural world.

SPIRITUAL CONNECTION
Many people find spiritual value in the natural world. For example, Indigenous peoples all around the world are strongly connected to the land. The land holds a key importance in their belief systems. Australian Aboriginals' values are based on a deep respect for the land. They use plants for medicine and for ceremonial purposes. In North America, many First Nations people also use specific types of vegetation, such as sweetgrass, sage, and cedar, for similar purposes (Figure 3.7).

FIGURE 3.7 Sage is burned in this Munce-Delaware First Nations smudging ceremony for spiritual cleansing.

CHECK-IN
1. **PATTERNS AND TRENDS** Create an organizer to compare the characteristics of the tropical broadleaf forest to two other vegetation types. Suggest reasons why there are differences in the characteristics.
2. **INTERRELATIONSHIPS** Why is natural vegetation important? Write a short paragraph or create an oral presentation to explain your ideas.
3. **INTERPRET AND ANALYZE** Use the natural vegetation regions tables (pages 78 to 81) to identify the type of natural vegetation in your community. Discuss with a classmate whether more of the vegetation in your community is human-influenced or natural, and identify some reasons why.
4. **INTERRELATIONSHIPS** With a partner, make a list of ten items you use that come from vegetation. Create a poster to demonstrate how your life would change without them.
How do natural factors and vegetation interact?

Natural factors such as moisture, temperature, and soil affect vegetation. In turn, vegetation affects these natural factors. They interact.

Why should you care about this? As you read in Chapters 1 and 2, Earth is a place of change. Its climate and landforms change over time. Natural vegetation changes too. Earth’s systems are interconnected. A change in one system can lead to changes in the others.

When we learn about how plants grow, how they interact with the environment around them, and how they affect us and the planet, we gain a better overall understanding of Earth and our place on it.

First, let’s look at how three natural factors affect vegetation. Two main factors are moisture and temperature, which are part of the climate system. The third main factor is soil.

Moisture

Plants need moisture to survive (Figure 3.8). The moisture in a region depends on the amount of precipitation and evaporation that occurs there.

Precipitation

The amount of precipitation, moisture that falls to the ground, such as rain or snow, differs from region to region. Plants adapt to the amount of precipitation in their region. Grasses can survive with low amounts of precipitation. Trees need more water than grasses do. This is why grasslands are more common than forests in hotter, drier areas. This is also why forests grow best where moisture is available year round, especially during the growing season.
A thematic map shows one topic or theme within a geographic area, such as the Global Natural Vegetation Regions map on page 77 (Figure 3.2). The topic or theme is identified in the legend. Thematic maps use symbols and colours to help users “see” patterns and find important geographic relationships. The purpose of these symbols or colours is identified in the legend. Often thematic maps include some location information, such as lines of latitude and longitude. On some maps, water bodies and places may have name labels, depending on the theme. Thematic maps will also include a scale and north arrow.

Figure 3.9 is one example of a thematic map. It uses colours to represent the different values shown on the map. Precipitation rates vary from place to place. By using a thematic map to show the annual rates of precipitation across an area, we are able to quickly see any patterns or interrelationships.

**FIGURE 3.9** This map shows total yearly precipitation, measured in millimetres.

**HOW TO READ A THEMATIC MAP**

**STEP 1**
Review Figure 3.9. Read the title. What is the theme or topic? What is the location? Explain the meaning of the topic to another person.

**STEP 2**
Look for patterns you can see on the map. What factors might explain the patterns?

**STEP 3**
Identify how precipitation rates might affect patterns of natural vegetation around the world.

**STEP 4**
Read the legend. Identify the colours on the map. How does the legend show the colours? What units of measurement are used in the legend?

**STEP 5**
Make connections. What other natural systems might show similar patterns?
EVAPORATION
Plants are affected by the amount of moisture that evaporates from the ground. Places with high temperatures have high evaporation rates. The moisture leaves the soil more quickly in these regions than in regions with lower temperatures. Plants in hot regions will not grow as well as plants in places with less extreme temperatures.

TEMPERATURE
Plants are affected by the amount of solar energy or heat in a region. During photosynthesis they use sunlight for energy. Also, the amount of heat that plants receive depends on their location and the temperatures there.

PHOTOSYNTHESIS
Plants use energy from the Sun during photosynthesis. The photosynthesis of a plant increases as the temperature rises. Plants do not usually start growing until the daytime temperature reaches 6 °C. Plants usually grow well at temperatures of around 20 °C. At very high temperatures, photosynthesis slows down, and plants do not grow as well.

LATITUDE AND ELEVATION
Temperatures are higher near the equator and lower near the poles. As a result, vegetation changes as the latitude changes.

As you learned in Chapter 2, air is colder at higher elevations. This affects the natural vegetation, such as trees, that grows on mountainsides. The treeline is the transition zone where a forest ends because the climate has become too cold or too dry (Figure 3.10).
Soil is an anchor for a plant. As the plant grows, its roots grip the soil. Soil plays a key role in the health of most plants. Plants need nutrients to grow, and they absorb these from the soil. In agriculture, if the soil does not have enough nutrients for crops to grow, farmers may use fertilizers, which add nutrients to the soil.

**HOW VEGETATION AND CLIMATE INTERACT**

You have read about the ways in which the climate, including moisture and temperatures, and soil affect natural vegetation. Natural vegetation has an effect on the climate, too. In fact, natural vegetation and the climate affect each other. Here are two examples:

- **It rains in a mid-latitude grassland.** Plants take in the water through their roots. They use some of it for photosynthesis to grow and reproduce. They return what they do not use to the air. As the plants continue to grow larger, they use more and more of the moisture and return less to the air. This makes the overall climate in that particular region drier over time.

- **Leaves absorb sunlight, which is energy from the Sun, to use in photosynthesis.** This cools the air. When the air is cool, less moisture is evaporated, and more moisture is available for plants, which helps them live and reproduce.

Look at **Figure 3.11.** What types of trees can grow where it is colder? How are they different from other types of trees? The answers give clues about how trees adapt to colder temperatures.

**FIGURE 3.11** This figure shows how types of vegetation adapt to ranges of temperature and precipitation levels.
HOW VEGETATION, CLIMATE, AND SOIL INTERACT

Vegetation, climate (moisture and temperature), and soil interact with one another, too. Here are three examples:

- Plants and animals decay on the surface of the ground and become **humus** (Figure 3.12). Humus is full of nutrients. Rainfall carries the nutrients down into the top layer of the soil. Here, they are available to the roots of living plants. Warm temperatures encourage plant growth. Eventually these plants die and decompose. As a result, warm, moist places, such as a broadleaf deciduous forest vegetation region, generally have excellent soils for plants.

- When rain washes away the top nutritious layer of the soil, the soil loses fertility, making it more difficult for plants to grow. If there are plants growing in the soil, however, they can help prevent this. The roots of the plants anchor the soil. The plants’ leaves stop raindrops from hitting the ground hard enough to wash away the soil particles.

- A growing amount of evidence suggests that the Sahara Desert was created over time by interactions between the climate, the natural vegetation, and the soil. Read the timeline, **Figure 3.13**, to find out more about how grasslands changed to desert.
1. **INTERRELATIONSHIPS** Create an ideas web that shows some of the interactions between vegetation, climate, and soil.

2. **INTERRELATIONSHIPS** In some parts of Canada, such as in the mixed forest regions of Ontario, the soil is deep and fertile. In other places, such as the tundra regions, soil is thin and poor. What factors help to create soils? What role does natural vegetation play in creating soils? Create a diagram or a chart to show your ideas.

3. **SPATIAL SIGNIFICANCE** Use Figure 3.2 (page 77) and a political map of the world to locate a community in two of these types of vegetation regions:
   - mixed forest
   - tundra and high-mountain vegetation
   - tropical grassland

**FIGURE 3.13** This timeline describes how the Sahara Desert, in the northern part of Africa, may have been created by climate and vegetation interactions. Note that BCE means *before the Common Era.*

Grasslands cover what is now the Sahara Desert. People live in the area with grazing animals. As the grasses die, more soil is exposed to sunlight. The soil dries and starts to crack. A severe desert environment is created.

The climate becomes hotter and drier due to natural causes. With less moisture available, grasses do not grow well.
At the beginning of this chapter, you read how people are playing a part in changing areas of grassland and forest into deserts. People have also made huge changes to other natural vegetation regions. In fact, scientists estimate that humans have changed more than half of Earth’s surface to some extent.

**CHANGING VEGETATION PATTERNS**

As you read in Chapter 2, human activities are contributing to climate change. Changes in climate are causing changes in vegetation patterns around the world. For example, rising temperatures are causing many plant species to migrate. Some plants are growing in places that used to be too cold for them, such as closer to the poles and higher on mountains (Figure 3.14). They can survive in these locations now because average temperatures there have increased. What happens to the species that are already there? They have more competition for their living space and for the resources needed to live. Some lose out and die. Others may die off if they cannot adapt to warmer temperatures.

**FIGURE 3.14** Studies show that some plants on Austrian mountaintops are being replaced by plants that used to live lower down the mountain.

I wonder what other species are affected by this change in plants?
CREATING MORE DESERT

The change from fertile land into desert is called desertification. Desertification can be caused by changes in climate. It can also be caused by poor farming methods, such as grazing and overuse of the soil. About 1 billion people live in areas affected by desertification. Many of them can no longer grow crops, and they face hunger if they remain in the area. Desertification also changes plant and animal habitats. Species must adapt or migrate out of the area, or they will die off.

REDUCING NATURAL VEGETATION

Starting thousands of years ago, people removed natural vegetation, such as grasses and trees, to create flat, open areas for farmland. They domesticated some species of plants for their crops. Today, about one-third of Earth’s land surface is farmland instead of natural vegetation. That is larger than the area of North America and South America combined.

LOSING FORESTS

In the last 5000 years, about 18 million km² of Earth’s forests, an area about the size of South America, has been lost. The removal of forests is called deforestation. Forests have been cut down to create space for cities, roads, and farmland. In the past, farmers cut down trees by hand and burned them, which was known as slash-and-burn (Figure 3.15). Today, the slash-and-burn method is widespread. Also, large machines remove trees very rapidly. Forests are being lost at a rate where they cannot regrow in our lifetime. These changes are dramatically changing the natural vegetation of these ecosystems and the lives of the species that live in them.
HEROES IN ACTION

FELIX FINKBEINER: PLANT-FOR-THE-PLANET

In 2007, in Germany, a nine-year-old student named Felix Finkbeiner (Figure 3.16) read about Wangari Maathai. She was an activist from Kenya whose goal was to plant 30 million trees across Africa. Why? To stop soil erosion and capture greenhouse gases.

Inspired, Finkbeiner came up with his own goal: to plant a million trees in every country on the planet. This would fight global climate change and improve the world’s vegetation. He and his classmates created an organization called Plant-for-the-Planet. They planted the first tree outside their school in March 2007.

In one year, Finkbeiner led students in planting 50,000 trees in Germany. In 2008, he was elected to the United Nations Environment Programme (UNEP) children’s board.

It is made up of young people from around the world who are committed to improving the environment. Finkbeiner spoke to UNEP’s youth conference in South Korea in 2009. He inspired other participants to start tree-planting programs in their own countries (Figure 3.17). In 2011, there were activities in 131 countries. More than a million trees had been planted. Many were planted by children in countries already suffering from the impacts of climate change.

To the members of Plant-for-the-Planet, the trees that they plant are symbols of climate justice. Not only do they reduce the harmful effects of climate change, but they also show that every child can make a difference in the world.

In 2011, UNEP turned over its “Billion Trees Program” to Plant-for-the-Planet. This gave the organization access to more funds and to more people who could help out. By 2014, Plant-for-the-Planet has planted close to 13 billion trees across 193 countries. Now the organization’s goal is to plant 1000 billion trees until 2020.

A CALL TO ACTION

1. With a partner, discuss why Felix Finkbeiner chose trees as the focus for his environmental actions.

2. In a small group, discuss, and agree on, what you would choose as the focus for your own environmental actions. Take the first step toward making this happen.

3. How would you organize a tree-planting campaign in your community?
BURNING GRASSLANDS
For tens of thousands of years, people have lived on grasslands. They moved from place to place, grazing their livestock where grass grew naturally. Herders often set fire to grasslands to encourage new growth for their animals to eat. Sheep and goats destroyed many native plants by pulling out their roots. Over time, burning has altered entire ecosystems. Now, grasslands are one of the most threatened habitats worldwide.

PRESERVING THROUGH ECOTOURISM
While some people change or remove natural vegetation, others living in a similar environment preserve the natural vegetation through ecotourism. The goal of ecotourism is for tourists to learn about and explore the natural environment without interfering with it. Costa Rica, with its protected and undisturbed rainforests, is a well-known ecotourism destination (Figure 3.18). Some countries with tropical grasslands, such as South Africa and Australia, encourage ecotourism. Ecotourism creates jobs for the people who live there. They might work as tour guides, or own or work in local restaurants or hotels.

CHECK-IN

1. **Patterns and Trends** In which parts of the world have people had the greatest impact on natural vegetation patterns? In which parts of the world have people had the least impact on natural vegetation patterns? Explain your choices to a partner and explain why such a pattern might exist.

2. **Evaluate and Draw Conclusions** List some ways that people have adapted to live in tropical grasslands. How have they responded to its challenges and opportunities? Explain whether or not their ways of life are sustainable.
In most cases, changes to vegetation regions have been made on purpose. Often people have made these changes as a way to improve their own lives. But sometimes the changes and effects have been unintentional. In some cases, we do not yet know what the effects will be. In other cases, we know that the changes are harmful to people, wildlife, and the local environment (Figure 3.19). Some even harm the global environment, which means we are all affected.

On the following pages are some examples of how changes we have made to vegetation patterns affect plant and wildlife species specifically.
LOSS OF BIODIVERSITY

The vegetation regions on Earth are made up of ecosystems. An ecosystem is made up of the plants and animals in a location interacting with their environment and depending on one another to survive. All the different species of plants and animals in these ecosystems create Earth’s biodiversity. Some of the countries with the highest biodiversity are Brazil, Indonesia, Mexico, Ecuador, and Australia. Changes in natural vegetation patterns are threatening this biodiversity.

It is important that we preserve Earth’s biodiversity. An ecosystem that includes a great variety of animals and plants is better able to respond to changing conditions. Imagine, for example, that one plant species becomes extinct, or dies out. An animal that feeds on it must adapt by eating other species of plants. Otherwise, it will also become extinct.

All living things benefit if there is greater diversity on Earth. Tragically, many of Earth’s animal and plant species are extinct or endangered, close to becoming extinct. Earth’s biodiversity is shrinking, and so is our ability to survive as a living planet.

LOSS OF HABITAT

Forests, grasslands, and even deserts are home to plant and animal species. Changes in natural vegetation patterns caused by factors such as growing cities (Figure 3.20), the destruction of forests and grasslands, and desertification are causing the loss of many animal habitats. Habitat loss, or loss of where a species lives, is one of the leading causes of biodiversity loss. It can result in smaller numbers of many species and even the extinction of some species.
Spatial significance relates specifically to where places are located on the planet. Every location has certain features or characteristics that make it unique. The term that geographers use to describe the specific characteristics of a place is site. Spatial significance also looks at the importance of a place and the things around it.

We determine the spatial significance of a place by asking questions such as the following:

**Where?**
- What are the absolute and relative locations of the place?

**Why there?**
- What physical conditions or characteristics make this place important?
- What human conditions or characteristics make this place important?

**Why care?**
- How does its location make the place important to people? to animals? to plants?

**WHAT CHARACTERISTICS MAKE A PLACE SIGNIFICANT?**

A place might be significant for various reasons. It might be significant because of its physical characteristics, such as its landforms, climate, or natural vegetation. It might be important because of human activities, such as manufacturing. Often the significance of a place comes from a combination of these characteristics.

We can also think about spatial significance for plants and animals. The places that have the greatest spatial significance for plants and animals are those that best meet their needs for food and shelter. These places will have quite different characteristics than places that people find significant.

**MADAGASCAR**

The island of Madagascar is located off the east coast of Africa (Figure 3.21). It was separated from other land masses by tectonic plate movement about 160 million years ago. The plant and animal species on Madagascar evolved on their own. Today, 95 percent of the reptiles, 92 percent of the mammals, and 89 percent of the plants on Madagascar exist nowhere else on Earth. It is considered one of the planet’s biodiversity hot spots. The biodiversity of Madagascar is under threat for several reasons:
- deforestation is taking place as a growing human population clears the forests for fuel and for farming
- valuable timber is being harvested illegally because of the income it creates
- many species are being captured by wildlife traders who sell the animals illegally to pet stores and collectors
- climate change is altering the natural patterns on the island

**FIGURE 3.21 Map of Madagascar**

**TRY IT**

1. **Where?** Locate Madagascar on a world map. What is its absolute location? What is its relative location?

2. **Why there?** What are the unique characteristics of Madagascar?

3. **Why care?** How is its location important to the people, plants, and animals that live there?

Use the Internet and other sources of information to develop your answers.
LOSS OF SPECIES
Any large change in natural vegetation patterns also leads to the extinction of plant and animal species. Because of this, and sometimes other factors such as poaching, the illegal taking or killing of wildlife, species are now becoming extinct at a faster rate than ever before. Since 1970, many animal species have become extinct. This includes the West African black rhinoceros, the Dutch Alcon Blue butterfly, and the Labrador duck. Many plant species, including Kingman’s prickly pear, have also become extinct. There are an estimated 16,000 plant and animal species currently on the edge of extinction, including the tiger (Figure 3.22). In the last 100 years, we have lost 97 percent of wild tigers. Studies predict that climate change will cause more loss of species than habitat loss. One-quarter of all plant and animal species on land may be threatened with extinction by 2050.

RISE IN NON–NATIVE PLANT SPECIES
Native species are plant or animal species that naturally live in a place. Non-native species are species that have moved into, or been introduced into, a new environment. Australia now has more non-native plant species than native species.

Sometimes this change happens accidentally. Sometimes people have brought in new plants on purpose. For example, in the 1930s, Australia introduced the athel pine to provide shade and to help prevent soil erosion. When non-native plant species are in a new environment, they compete with the species already there for space and nutrients. Sometimes the new species are fast-growing, produce many seeds, and are hardy. They can take over the habitat of the native species, such as the athel pine has done. These are known as invasive species. Invasive species can cause the native species to become extinct.

CHECK-IN
1. **GEOGRAPHIC PERSPECTIVE** Should Canadians be concerned about global patterns of natural vegetation loss? Debate the question with a classmate.

2. **INTERPRET AND ANALYZE** Create a graphic organizer to outline the causes of changes in natural vegetation and the consequences arising from the changes. Sum up your thinking in a 15-second soundbite.
A unique rainforest lies along the east coast of South America, mainly in Brazil. Known as the Atlantic Forest, it is one of the top five biodiversity hot spots on the planet. This means it is a place with great biological diversity but it is under high risk of destruction.

WHERE IS THE FOREST?
The Atlantic Forest is very narrow, squeezed between the Atlantic Ocean on the east and the Serra do Mar mountains on the west. The forest extends up the east side of the mountains to about 1800 metres. Above that, the climate is too cool for tropical plants to grow.

Far to the north-west, on the other side of the mountains, is a completely different rainforest, the Amazon Rainforest. The higher elevations separate the two rainforests. Each one has different species of plants and animals.

WHY IS THE FOREST SPECIAL?
The Atlantic Forest is a tropical broadleaf forest. It is amazingly diverse, with unique vegetation and climate characteristics. It has about 20 000 species of plants. About 40 percent of them are found nowhere else on Earth.

The Atlantic Forest contains many ecosystems. This gives the forest a great diversity of animal and bird species, second only to the much larger Amazon Rainforest. The Atlantic Forest is home to an estimated 2200 species of wildlife. It has 200 bird species that are found nowhere else in the world. It also has 250 types of mammals, such as the puma and the ocelot. Of the 26 primates found in the Atlantic Forest, 21 do not exist anywhere else in the world.
WHAT IS DESTROYING THE FOREST?

Five hundred years ago, the Atlantic Forest covered an area larger than the size of Ontario. Today, less than 12 percent of the original forest remains (Figure 3.23).

Over the years, people cut down much of the Atlantic Forest to make room for grazing livestock, growing crops, and commercial logging. Also, trees were cleared to make room for mining and drilling operations, and for building roads and railways. Part of the forest destruction can also be blamed on human population growth. This small area of Brazil is home to 70 percent of the country’s population, and it includes Brazil’s largest cities, Rio de Janeiro and São Paulo.

WHAT NOW?

The remaining forest has been reduced to small patches of trees (Figure 3.24). Many of these forest patches are damaged. It is very difficult for wildlife species to survive and find suitable habitats. Many species are endangered, such as jaguars and golden lion tamarins (Figure 3.25). The human population in the region continues to grow, creating more air and water pollution.

However, there are efforts to save the forest. Environmentalists are trying to protect the forest patches that remain, as well as create a corridor system to link them. This would allow species to move safely from one forest patch to another, enlarging their habitats. Other actions include: buying farmland and returning it to a more natural state; developing other forms of economic activities; pressuring governments to create protected parks.

EXPLORE THE ISSUE

1. Research to find out more about efforts to preserve the Atlantic Forest and its wildlife.

2. People have cut down much of the Atlantic Forest. Research other ways people in Brazil are responding to the challenges and opportunities offered by this forest.
As you learned in Chapter 3, Earth’s natural vegetation is changing. Think back to the question that started the chapter: Why care that Earth’s natural vegetation is changing? Hopefully you now know many different ways to answer this question.

Summarize Your Learning
Reflect on what you have read and discussed throughout Chapter 3. Then select one of the following tasks to summarize your learning about natural vegetation patterns:

- Write a short story about a character who is taking action to prevent some type of harm to the environment, or to a species, caused by a change to a natural vegetation region. Include facts to create a realistic scenario.
- Write a proposal to your principal suggesting that a large mural on the theme of habitat preservation be placed on one of the hallway or cafeteria walls. Your proposal should persuade your principal that the mural will both teach your fellow students and inspire them to take action.
APPLY YOUR LEARNING

1. **INTERRELATIONSHIPS** Think about all the different types of natural vegetation around the world. Which ones do you think would have the greatest impact on people—both good and bad? How did you decide? Choose two or three, and list some of their impacts on people.

2. **INTERRELATIONSHIPS** What are some ways that people cope with the challenges of living in a particular type of natural vegetation region, such as a semi-desert scrub or a mixed forest? Choose one type and create an annotated photo montage or annotated drawings describing the region and ways that people cope with it.

3. **INTERPRET AND ANALYZE** Deforestation is viewed as one of the major threats facing natural vegetation, especially tropical forests. Find a pair of “before” and “after” photos that show the impacts of deforestation. Write a caption for each photo. As always, remember that photos are someone’s intellectual property, so make sure you are allowed to use them and that you attribute the owner in your work.

4. **EVALUATE AND DRAW CONCLUSIONS** Write a letter for a politician to read in Parliament (this should take no more than two minutes to read) that explains the interactions between soils and natural vegetation and then emphasize why we should protect natural vegetation cover.

5. **FORMULATE QUESTIONS** What questions do you have about human activities in the tundra and high-mountain vegetation environments? Research an answer to one of them.

6. **COMMUNICATE** The Chapter Big Question is “Why care that Earth’s natural vegetation is changing?” Create a blog, vlog, or podcast to answer the question. Use details from this chapter.

7. **SPATIAL SIGNIFICANCE** A housing developer wants to build new homes in a forested area near your community. Using point-form notes, record the spatial significance of the forest for different groups in your community. Include town officials, environmentalists, construction workers, people wanting to buy new homes, any other group you think should be included.

UNIT 1 CHALLENGE CHECK-IN

1. Review the Focus On: Spatial Significance on page 96. What are the characteristics of your selected community that make it important?
2. Review what you learned about natural vegetation in Chapter 3. Research to see how vegetation can be used to prevent or mitigate your natural disaster. What are the pros and cons to including this vegetation? Think about how the vegetation might impact the recovery from the disaster. Use a t-chart to help organize your thinking.
3. Investigate your chosen community to see what they are already doing to prevent or mitigate a natural disaster.
4. Review the Unit Challenge on page 15 and the information you have collected so far. Look over your research questions. Do you need to make any changes based on what you learned about vegetation in Chapter 3?
NELSON GEO 7

TEACHER’S RESOURCE
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CHAPTER 3
CHANGING PATTERNS OF NATURAL VEGETATION

Student Book pages 74–75

LAUNCHING THE CHAPTER

- Ask students: What is vegetation? (plants) What is natural vegetation? (plants that are natural to an area and grow freely there)

- Point out the Chapter Big Question as well as the Unit Big Question. Discuss with students how this chapter links to the Unit Big Question, Why care about changes in Earth’s physical environment? (plants are an important part of Earth’s physical environment; plants are affected by physical elements and also causes changes). Ask them how the Chapter 3 Big Question also connects to the Chapter 1 Big Question, Why are landforms important? (landforms help to shape natural vegetation) and the Chapter 2 Big Question, How should we respond to climate change? (vegetation responds to changes in the climate).

- After students read the three learning goals for this chapter, ask: What are the key words in the Learning Goals? Which of these learning goals interests you most, and why?

- Use a K-W-L Chart to assess what students already know about the topic of natural vegetation. Have students complete the first two columns of BLM 0.26 K-W-L Chart indicating what they already Know and what they Want to know. (At the end of the chapter, they will record what they Learned.)

WHAT IS WHERE? WHY THERE? WHY CARE?

Highlight the where aspect of geography by pointing out that the Namib Desert is located primarily along the western edge of Namibia in southern Africa (24.75°S, 15.28°E). Rainfall in this desert rarely exceeds 200 mm annually. Although this desert is located right on the Atlantic coast, prevailing wind patterns mean that little moisture finds its way inland (why there). Human use of the land is minimal, with only a few herding groups across the whole region (why care). Most of the species that do exist in this inhospitable environment, such as the camel thorn tree, the black-backed jackal, and the Namib desert beetle, are found nowhere else in the world.

Have students discuss what they see in the chapter opener photo on pages 74–75. Then display Figure 3.26, an online version of the photo. Provide students with these labels (numbers here provide the answers): (1) prevailing wind direction; (2) sand dune; (3) sparse plants growing in sand; (4) isolated trees; (5) dense grassland; (6) sparse grasses; (7) dried cracked soil. Point out the foreground, middle ground, and background in the photo. Have students describe what they see in each part of the photo, matching the labels to the numbered lines. Have them explain what possible factors created the conditions that they see (wind, lack of rain), and suggest some implications of these conditions. As they do so, they will make connections between climate and vegetation.

Note that that the term desertification is defined on Student Book page 91 and that the chapter opener photo and narrative exemplify desertification. Desertification refers to the changing conditions of formerly productive land that causes it to become more desert-like. Where appropriate while reading the chapter, have students consider questions such as What natural causes make deserts expand? What human actions create deserts? How is this a good example of the geographic concept of changing patterns? How is this a good example of the geographic concept of interrelationships between humans and natural environments?
**WHY IS VEGETATION IMPORTANT?**

*Student Book pages 76–83*

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**LESSON SUMMARY**

**EXPECTATIONS**
A3.9

**CRITERIA FOR SUCCESS**
Students can
- identify the major natural vegetation regions and describe the role that climate and soil has in shaping these regions
- describe the importance of vegetation to humans and the planet

**SUGGESTED ASSESSMENT STRATEGIES**
- Think-Pair-Share
- No Hands
- 3-2-1

**CROSS-CURRICULAR CONNECTIONS**
- Grade 7 Math: Patterning and Algebra: represent linear growing patterns, using a variety of tools and strategies
- Grade 7 Math: Data Management and Probability: make inferences and convincing arguments that are based on the analysis of charts, tables, and graphs

**MAP, GLOBE, AND GRAPHING SKILLS**
- extracts information from and analyzes photographs of unfamiliar places and sites

---

**GEOGRAPHY BACKGROUND**
There are various acceptable ways of categorizing natural vegetation. The 11 vegetation types referred to in this chapter are commonly used at this grade level. However, if students are using other sources of information, they will find different categories and names for the vegetation types. For example, one source from the University of California has 37 different zones across the world. Prompt students to consider why categorization approaches vary; for example, approaches may depend on the purpose and level of analysis. Some, for instance, are designed for gardeners, who need to understand subtle differences in growing conditions. There are no right or wrong approaches, just ones for different purposes.

---

**POSSIBLE MISCONCEPTIONS**
In Canada, there has been a tendency to describe trees as deciduous (lose all their leaves for part of the year; often have broad, flat leaves) or coniferous (have needle-like leaves). This can be confusing; some species, such as the tamarack (also called larch), are coniferous and do lose their needles. You will encourage better understanding by referring to trees as either deciduous or evergreen (the latter lose some leaves, but have leaves all year round), and point out that many coniferous trees in Canada (such as pine and fir) are evergreen trees. In tropical areas, evergreens include mangrove, teak, rosewood, and palm.
TEACHING NOTES

MINDS ON

- Ask students: *What is, or was, the natural vegetation of our own area?* (deciduous trees, evergreen trees, grasses, forests) Have them describe examples of species or types of natural vegetation that they have seen in the media or when travelling to other parts of the world (palm trees, rainforests, scrub).

- Use a **Think-Pair-Share** to observe students’ conversations and check their understanding of the importance of natural vegetation. Ask students to think about the statement: *The world is better off if natural vegetation is left natural.* Have them pair up to discuss their response. Provide another prompt, such as *We would all be better off without cities.* Have a whole class discussion in which students share their responses around each statement. Check that students are considering all living things as part of “the world,” not just humans.

ACTION

- Help students extend their thinking about the role of natural vegetation in ecosystems by discussing the interrelationships question on Student Book page 76. For example, after listing examples of animals that live in grasslands but not in deserts, such as lions, giraffes, bison, and kangaroos, they may note that the habitats of wildlife species change as natural vegetation is altered.

- Students will also make connections between wildlife and vegetation when they consider the photo question for Figure 3.1. From past experience, they may be able to identify other grazing species such as gazelles, or predators such as lions.

- After introducing the forests, grasslands, and deserts of the world, have students identify the geographic distribution of the different natural vegetation types on the world map in Figure 3.2, noting the vegetation types found in our part of North America.

- Have students use online or classroom atlases to locate on Figure 3.2 the countries where each of the photos in Figures 3.3 to 3.5 were taken. Introduce the natural vegetation region tables (types of forests, types of grasslands, and types of deserts), shown on pages 78 to 81. Each type is described, along with the climate conditions that surround it.

- Point out that the great diversity of vegetation makes it difficult to see patterns in natural vegetation characteristics. Explain that using graphic organizers can help us identify those patterns, for example, by making comparisons and noting similarities and differences among the various vegetation regions. Have students use BLM 3.1 **Looking for Patterns in Natural Vegetation** to correlate variables (amount of vegetation and latitude) along two general scales, creating four quadrants. Ask them to write the names of the natural vegetation regions in the appropriate quadrants or on the lines, using the information in the Student Book to make their decisions. Then, have students describe patterns in natural
vegetation around the world (all tropical forests are near the equator; the tundra is far from the equator). Use a No Hands strategy with a whole class discussion to assess students’ understanding of these connections.

- Have students create a new graphic organizer with four quadrants and the same two general scales they used in BLM 3.1 but identifying a different set of variables (temperature and amount of plant diversity; and location of plants and height of plants). Students can make the graphic organizers individually in their notebooks, or in small or large groups with electronic whiteboards. For a more hands-on approach, prepare labels of the natural vegetation regions and have students add them to graphic organizers enlarged as posters.

- Have students read the definition of domesticated on page 82. Discuss how domesticating plants has helped people, and brainstorm a list of possible negative consequences.

- Ask students to list the benefits of vegetation to people (providing food, medicines, beverages, clothing, oxygen; cleaning water; protecting soil from erosion; offering spiritual comfort). Once students have compared their lists, have them discuss their conclusions.

- The spatial significance question on Student Book page 83 invites students to connect the natural vegetation in Costa Rica (tropical and subtropical broadleaf forests) and human uses of it. Ecotourism uses vegetation in ways that generally help to protect it from harmful human-induced changes. Have students look at photos of Costa Rican forests and point out the vegetation characteristics that they believe would encourage ecotourism (unique wildlife and plants, beautiful landforms, bodies of water).

- In their answer to the photo question for Figure 3.7, students might suggest that some vegetation grows in certain regions but not in others; some vegetation is better for some uses than others—for example, in certain ceremonies, the herbal properties of sage may be preferred, or other aromatic plants, such as sweetgrass, may be preferable to plants with a stronger scent, such as cedar.

**CONSOLIDATION**

- To do a quick assessment of students’ understanding of natural vegetation, use a 3–2–1 strategy. Students should note 3 things they learned about patterns in natural vegetation, 2 things they learned about the benefits of natural vegetation, and 1 thing they learned about why natural vegetation is important.
1. **Patterns and Trends** Graphic organizers for this question could include comparison charts or ideas webs. The characteristics they could compare include type of vegetation (forest/grassland/desert), location, climate conditions, elevation, plant characteristics, and so on. Reasons for differences will vary but will mainly be made up of climate and landform characteristics. For example, if tropical broadleaf forests are compared to deserts, reasons for differences could include global wind patterns, the direction of prevailing winds, and proximity to large bodies of water. If tropical broadleaf forests are compared to tundra and high-mountain vegetation, reasons for differences could include latitude and effects of high elevations. (Knowledge and Understanding)

2. **Interrelationships** Student Book pages 82 and 83 identify the following as reasons why natural vegetation is important for humans: oxygen, natural habitats, resources, recreation, and spiritual connection. Students should give specific examples to explain how many of these benefits are important to us and to all living things. (Communication)

3. **Interpret and Analyze** Answers will vary by location of communities. Students should distinguish generally natural areas from places where the vegetation is largely influenced by human activity. Areas differ depending on use; for example, vegetation is more likely to remain natural in a protected park or an inaccessible wilderness area than in a human settlement. Reasons why the areas differ could range from being a place where people live to being a place inaccessible to people or to being a protected park area. (Application)

4. **Interrelationships** Ask students to think about the different aspects of their lives as they make their lists of uses of plants (food, clothing, housing, recreation, spiritual connection). Their posters may show a local, community, or global view of life without the resources that come from plants. Alternatively, students may choose to create an infographic. (Thinking)
## Lesson Summary

### Expectations

A3.10, A3.11

### Criteria for Success

Students can

- describe how moisture, temperature, and soil affect natural vegetation
- read and analyze a thematic map
- describe how different factors of the environment (natural vegetation, climate, and soil) interact with one another in different regions of the world

### Suggested Assessment Strategies

- Frayer Model
- Compare/Contrast Matrix

### Cross-Curricular Connections

- Grade 7 Math: Data Management and Probability: collect data by conducting a survey or an experiment to do with themselves, their environment, issues in their school or community, or content from another subject and record observations or measurements; read, interpret, and draw conclusions from primary data and from secondary data presented in charts, tables, and graphs
- Grade 7 Math: Number Sense and Numeration: represent and order integers, using a variety of tools

### Map, Globe, and Graphing Skills

- extracts information from, analyzes, and creates increasingly complex thematic maps, including physical
- extracts information from and analyzes photographs of unfamiliar places and sites

### Geography Background

We can make some general statements about the relationship between natural vegetation and soils. For example, we can say that soil under needleleaf forests tends to be thin and acidic, and soil under deciduous forests tends to be thick and fertile. However, the interrelationships between natural vegetation and soil are complex, and more detailed explanations are beyond the scope of the Student Book.

### Possible Misconceptions

Clarify for students that tropical broadleaf forests are also known as rainforests. Students might think that the massive trees in these forests indicate that the soil there must be fertile. In fact, nutrients that make it to the soil from decaying plant material are quickly washed away by the precipitation, which is typically heavy in these regions. Soils under rainforests are notoriously infertile. The soils in temperate rainforests, such as those found on Canada’s West Coast, typically contain more nutrients than tropical rainforests.
TEACHING NOTES

MINDS ON

• Ask students: *What is the most important factor shaping the vegetation of our area?* Tell them to consider what they have already learned about vegetation, such as factors that affect vegetation, and then think about what those factors are like in their local area, what type of vegetation is in their local area, and how local factors influence the plants. Point out that soil is also a key factor.

ACTION

• Have students note the three headings in the Student Book, which name three key natural factors that affect natural vegetation—moisture, temperature, and soil. Have students use information from pages 84, 86, and 87 to record ideas and facts about how each factor helps to shape natural vegetation on BLM 3.2 *What Three Main Factors Affect Our Natural Vegetation?* (Students will complete BLM 3.2 as they work through this section of the chapter.)

• Have students respond to the interrelationships question on Student Book page 84. From past experience, they may be able to explain that precipitation is essential for vegetation growth and that plant species have adapted to the amount of moisture that is available to them.

• In their answers to the photo question for Figure 3.8, students should mention that forests need more moisture than grasslands. Have them support their responses using the geographic terms they have studied in the chapter.

READING THEMATIC MAPS

*Student Book page 85*

• Refer to the chart below to familiarize yourself with a variety of common thematic maps. Then describe them to students and refer them to the examples found in the Student Book.

<table>
<thead>
<tr>
<th>MAP TYPE</th>
<th>DESCRIPTION</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>choropleth</td>
<td>shades of colour show differences in variables</td>
<td>Figure 2.11, Student Book pages 56-57</td>
</tr>
<tr>
<td>elevation</td>
<td>colours represent heights</td>
<td>Figure 1.6, Student Book page 23</td>
</tr>
<tr>
<td>flow</td>
<td>direction of movement indicated</td>
<td>Figure 2.15, Student Book page 61</td>
</tr>
<tr>
<td>isopleth</td>
<td>lines connect places of equal value</td>
<td>Figure 1.5, Student Book page 22</td>
</tr>
<tr>
<td>proportional symbols</td>
<td>size of symbol represents volume</td>
<td>Figure 1.12, Student Book page 29</td>
</tr>
</tbody>
</table>

• Consider adding these terms to a word wall or creating a display of these types of maps.

• It is important that students develop a procedure for reading maps. Review with them the steps on page 85. Then have students work in small groups to answer the questions in the steps about the map in Figure 3.9.

(continued)
Step 1: The theme is annual precipitation rates and the location is North America.
Step 2: The 11 colours in the legend represent precipitation amounts measured in millimetres. Students should recognize that each category represents a range of rainfall and these ranges vary from 100 mm in the category at the top of the legend (0–100) to 2250 mm in the bottom category (4000–6250).
Step 3: The pattern shows more precipitation on the edges of the continent and less in the interior and the northern parts.
Step 4: Climate systems, which students read about in Chapter 2, might show similar patterns. To make connections, students can use what they learned about climate factors, such as the effect of elevation and proximity to large bodies of water.
Step 5: Students should use their understandings about natural vegetation factors, particularly the role of temperature and precipitation, to draw their conclusions. Sample response: North America has a wide range of precipitation conditions, and this could lead to a great diversity of natural vegetation.

- Have students complete **BLM 0.11 Thematic Map Checklist**. Ask them to locate these maps in sources other than the Student Book, such as on the Internet or in books, magazines, or brochures.
- **ASSESSMENT**: To check student understanding, use a **Frayer Model**. Distribute **BLM 0.24 Frayer Model**. Have students write the term **Thematic Maps** in the centre. Tell them the four categories are definition, some characteristics, examples, and non-examples. An example can include the map of global natural vegetation regions in Figure 3.2, and a “non-example” can include the topographic map of Lake Louise, Alberta, in Figure 1.5.

- Ask students: **What is a treeline**? (an area beyond which trees do not grow) **Why do trees not grow above a certain elevation or a certain latitude**? Explain that there are lower temperatures at higher elevations. With lower temperatures, less photosynthesis takes place, to the point where there is not enough for adequate tree growth. Tell students that often there is less precipitation at higher latitudes, such as in tundra conditions. Point out that the graph in Figure 3.11 connects the two variables of temperature and precipitation. Ask students: **What information is on the x axis**? (increasing precipitation) **On the y axis**? (decreasing temperatures) Explain to students that biologists have discovered that the different types of vegetation grow only where the conditions are right for them. So, for example, Mediterranean forests grow where there is between 1400 and 2700 mm of rainfall annually and temperatures are higher than about 22 °C. Have students use the graph to identify the temperature and precipitation conditions in which the natural vegetation in your area grows.

- Before reading about how vegetation and climate interact, on pages 87 and 88, have students list simple examples of ways that vegetation and moisture or temperature might interact, using observations of plants and climate in your local area (when it rains, the grass grows; when it starts to get cold and there is less daylight, the leaves begin to drop off the trees).
• Have students apply the factors on BLM 3.2 (which they started earlier) by working in small groups to compare the three factors and rank them in importance for your location. For example, they might gather data that describes the amount of precipitation in the local area and the annual temperatures; they might consider the quality of soil to some degree by considering the vegetation in the local area (gardens and crops could mean soil is fertile; desert vegetation could mean soil is less fertile).

Assign one or several students the role of advocate of each of the factors. They may organize the evidence for their factor and attempt to convince the rest of the group that it is the most important one. The group should then consider all the evidence and attempt to reach an agreement about the rankings. Assist students by providing information pages containing details about the moisture, heat, and soil conditions for your local area. They can summarize their thinking in the bottom chart on BLM 3.2. Note that there is no correct answer; the conversations that take place using ideas about factors is the goal of this activity.

CONsolidation

• Have students forecast how the following changes would likely affect the natural vegetation in your area:
  – the average temperature goes up by 3 degrees Celsius
  – annual precipitation drops by 20 percent
  – the soil dries out and winds blow it away

Students can share their forecasts in a variety of ways, such as by making a comic strip, writing a story, making a model, or preparing a photo essay.

• Ask students to locate the Sahara Desert on a world map (23.01°N, 11.61°E) and refer to Figure 3.2 to see its natural vegetation region. Have them read the timeline in Figure 3.13 showing the changes in the Sahara Desert. Give out copies of BLM 0.23 Compare/Contrast Matrix. Have students work in pairs to examine each of the photos. Have them make a list of characteristics of natural vegetation regions, which might include vegetation conditions, soil conditions, and ability to produce crops. Then tell them to compare and contrast the natural vegetation region shown in the top (7000 BCE) photo to the natural vegetation region shown in the bottom (3800 BCE) photo, recording their ideas on BLM 0.23. To help them think about the changes they see, ask: What vegetation factors have changed? How do the patterns show interrelationships? Read their written work and listen to their answers to assess their understanding of how natural factors and vegetation interact.
1. **INTERRELATIONSHIPS** Ideas webs can vary considerably, but check to see that students’ work includes interactions between vegetation and soils (decaying plants add nutrients to soil), vegetation and climate (trees will not grow where it is too cold), and climate and soils (rain can wash nutrients out of the soil). *(Knowledge and Understanding)*

2. **INTERRELATIONSHIPS** In their diagrams or charts, students should include the following factors that help to create soil:
   - worms, insects, and other decomposers live in the soil and affect its fertility
   - inorganic material (eroded rock material) is contained in the soil
   - soil needs air to support decomposition of the organic matter

   They should include the following information about the role natural vegetation plays in creating soil:
   - the amount of humus in the soil is directly linked to the amount of vegetation in the area (the more vegetation there is, the more humus there is)
   - roots of natural vegetation help to anchor the soil and prevent erosion, so soil can continue to increase in thickness and develop greater fertility *(Thinking)*

3. **SPATIAL SIGNIFICANCE** The places that students choose will vary. Ensure that they are finding places within two of the three natural vegetation regions mentioned in the Student Book. *(Application)*
Print the names of vegetation types on the organizer in the appropriate places. “Tropical broadleaf forest” and “tundra and high-mountain vegetation” have been done for you. Use the information on Student Book pages 76 to 81 to help you.

<table>
<thead>
<tr>
<th>tropical broadleaf forest</th>
<th>much vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>near the equator</td>
<td>far from the equator</td>
</tr>
<tr>
<td>little vegetation</td>
<td></td>
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</tbody>
</table>

*tundra and high-mountain*

Describe three patterns in natural vegetation around the world.

1. Describe a pattern for deserts.

   _____________________________________________________________

2. Describe a pattern for forests.

   _____________________________________________________________

3. Describe a pattern for grasslands.

   _____________________________________________________________
**WHAT THREE MAIN FACTORS AFFECT OUR NATURAL VEGETATION?**

1. Use information about natural vegetation on Student Book pages 84 to 89 to complete this t-chart.

<table>
<thead>
<tr>
<th>Natural Vegetation Factor</th>
<th>How Each Factor Shapes Natural Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>moisture (precipitation)</td>
<td></td>
</tr>
<tr>
<td>temperature (heat)</td>
<td></td>
</tr>
<tr>
<td>soil</td>
<td></td>
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</tbody>
</table>

2. Record information about each of the natural vegetation factors for our local area.

<table>
<thead>
<tr>
<th>Natural Vegetation Factor</th>
<th>Evidence for Our Local Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>moisture</td>
<td></td>
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<td>temperature</td>
<td></td>
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<td>soil</td>
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# Thematic Map Checklist

<table>
<thead>
<tr>
<th>The map has ...</th>
<th>Yes</th>
<th>No</th>
<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>• a title</td>
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<tr>
<td>• a legend that shows all the symbols used</td>
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<tr>
<td>• countries shaded neatly and correctly using the data</td>
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<td>• country names labelled correctly</td>
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<tr>
<td>• a north arrow or compass rose</td>
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<tr>
<td>• a scale</td>
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<td></td>
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<tr>
<td>• evidence that care was taken to do a good job</td>
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Assessment done by: Self_________ Peer_________ Teacher_________

Additional comments: ____________________________________________
3-2-1

3 things that I already know about this topic are ...

•

•

•

2 questions about the topic that I would like to answer are ...

•

•

1 other topic that I think connects to this topic is ...

•
## COMPARE/CONTRAST MATRIX

Title: __________________________________

<table>
<thead>
<tr>
<th>(Categories)</th>
<th>(Item 1)</th>
<th>(Item 2)</th>
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FRAYE R MODEL

Use this graphic organizer to help you understand key words and concepts. In the middle oval, place the key word or concept. Add a heading to each of the boxes around the oval, and fill in the relevant details.