CHAPTER 14

Ecosystems and

Getting Ready...

- What is an ecosystem?
- What are biomes?
- What is biodiversity?
- What are the threats to biodiversity in an area?

Science Log

Recall what you know about ecosystems and biomes. Try to answer the questions in Getting Ready. When you finish this chapter, review your answers. Make any changes based on what you learn.

Before Europeans came to Alberta, Aboriginal people obtained everything they needed from the land. Hunting, fishing, and gathering provided food plus materials to make tools, shelter, clothing, and weapons. Aboriginal groups lived in harmony with their environment.

Things changed when the Europeans arrived. Fur traders trapped many fur-bearing animals. Settlers cut down trees to create farmland and homesteads. Loggers cut large forests to supply wood for paper and building materials.

In the prairie grasslands, settlers ploughed the native grasses and planted crops. Millions of bison, pronghorns, and other animals were killed for food and sport. All these activities reduced the number and variety of native plants and animals.

In this chapter, you will learn about Alberta's original ecosystems. You will find that an ecosystem's location determines its climate and type of soil. These, in turn, affect the types of plants and animals that can survive in the ecosystem. You will discover that similar climates around the world have similar ecosystems. You will also realize how humans have affected ecosystems around the world.

Biomes

What You Will Learn

In this chapter you will learn:

- how abiotic factors determine an area's biotic community
- which factors determine the climate of a region
- how climate and vegetation produce large areas of similar ecosystems called biomes
- about the diversity of life in the grassland and northern boreal forest biomes of Alberta
- that the extinction of species may be a natural event
- how human activities can result in the extinction of a species

Why It Is Important

- Do you live in a grassland area, near a forest, or near a mountain lake? If you understand how organisms interact with their physical environment, you can make better decisions on how to take care of the land where you live.

Skills You Will Use

In this chapter you will:

- describe Alberta before and after European settlers arrived
- identify the biotic and abiotic components of a terrestrial ecosystem
- investigate the different particles found in soil
- compare the climates of three areas of Alberta
- explain how human activities have led to the extinction of a species

Starting Point

Yesterday, Today, and Tomorrow

The photographs on this page show that human activities have changed the natural surroundings. In this activity you will compare human activities of 100 years ago with those today.

What to Do

1. Read the Chapter Opener and study the photographs on these two pages.
2. Answer the questions below.

What Did You Discover?

1. Describe the northern forests and the grasslands before European settlers arrived in Alberta.
2. Do you think that logging and farming 100 years ago affected these natural areas?
3. What do you think would happen to the diversity of plants and animals in a forest if all the trees were removed?
4. What do you think would happen to the diversity or variety of plants and animals after natural grasslands were converted to farmland?
5. Do you think we can have a beautiful countryside and still have plenty of lumber for building and enough food for the human population? Explain.

14.1 Ecosystems

If you visit a forest or a grassland area, you will find a variety of organisms. The number and type of living things in an area depend on many factors, such as:

- temperature,
- amount of precipitation, and
- type of soil.

Each of these factors is an example of a part of the non-living, physical environment.

Both the living organisms and the non-living factors in an environment make up an **ecosystem**. Think back to what you learned about biotic and abiotic factors in Chapter 13. Ecologists call all the living components (biotic factors) of an ecosystem the **biotic community**. All the non-living components (abiotic factors) are called the **abiotic environment**.

In any ecosystem, the biotic community interacts with the abiotic environment. Abiotic factors dictate the kinds of organisms that are able to live in the area. These organisms then affect the local environment.

How Large Are Ecosystems?

Ecosystems may be large or small. A pond, a forest, or even the underside of a leaf can be an ecosystem, as long as all of the following interactions occur.

- Living things interact with one another.
- Living things interact with other species.
- Living things interact with the abiotic factors that make up their environment.

READING Check

How does the biotic community differ from the abiotic environment?

Figure 14.1 Each photograph on this page shows an ecosystem. What three interactions occur in each ecosystem?

Find Out ACTIVITY

Build an Ecosystem

An ecosystem is made up of the biotic community and the abiotic factors that affect it. In this activity, you will make a model of a **terrestrial ecosystem** (an ecosystem on land).

SKILL CHECK

- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

Safety Precautions

- Wash your hands thoroughly when you finish setting up your terrestrial ecosystem.

What You Need

thermometer
2 L plastic pop bottle with the top portion removed
scissors
sand
potting soil
gravel or charcoal
10 seeds (radish or lettuce seeds)
2 earthworms
crumbled leaves or tiny pieces of vegetables
water
adhesive tape

What to Do

1. Carefully cut the top from a plastic pop bottle.
2. Place the following materials in the bottom of the bottle.
   - sand, 5 cm deep
   - a thin layer of gravel or charcoal
   - potting soil, 5 cm deep
3. Push 10 seeds just under the surface of the soil. Cover them with soil.
4. Water the seeds.
5. Place the earthworms and a few pieces of dead leaf or pieces of vegetable on top of the soil.
6. Cover the terrarium with the top of the bottle. Use the tape to make a hinged top. Leave the cap off the top to allow air to circulate.
7. Place the terrarium where it will receive sunlight or near a source of artificial light. Water the soil when it feels dry to the touch.
8. Observe your terrarium every day for two weeks. Record your observations.

Check Your Understanding

1. Copy the following list into your Science Log or notebook. Beside each item, state if it is part of the biotic community or abiotic environment. If it is part of the abiotic environment, explain how it affects the biotic community.
   (a) sunlight
   (b) mould growing on a dead leaf
   (c) spider eating a fly
   (d) minerals in the soil
   (e) carbon dioxide
   (f) green plant
2. Explain the statement, "The living things in an ecosystem depend on each other."

Key Terms

ecosystem
biotic community
abiotic environment
terrestrial ecosystem

14.2 Climate and Land Ecosystems

DidYouKnow?

Did you know that the air temperature drops 2.7°C for every 500 m of elevation that you climb?

Can you explain why palm trees or cactus plants do not grow in northern Alberta? Why do polar bears and caribou not live in tropical regions? The answer is that each species needs a particular type of climate.

The **climate** of an area is its average weather conditions based on long-term records. For each type of climate:

- the temperature is within a certain range in each season, and
- the average annual precipitation is within a certain range.

READING Check

How do latitude, altitude, and topography determine what living things are found in an area?

Climate is important because it affects living things in many ways. For example, it regulates reproductive cycles. Sheep in the Rocky Mountains have their young in spring when there is a lot of food. If they had their babies in winter, many would starve.

Examine the map of Alberta and read the captions to identify the three factors that help to determine the climate where you live. Study Figure 14.3 and read the caption to find out how mountain ranges affect climate.

Figure 14.2

Topography refers to an area's physical features. For example, rivers and lakes provide water. Aquatic plants and animals live in the water. Some other organisms like to live near water. As well, large bodies of water cool a hot climate and warm a cool one.

Latitude refers to how far north or south you are from the equator. The amount of the Sun's energy you receive changes with latitude. The equator is hotter because it receives more direct solar radiation than the poles do. In Alberta, the climate is colder in the north (higher latitude) than it is in the southern part of the province.

Altitude or elevation refers to the height of an area above sea level. This abiotic factor affects the types of plants and animals found in an area. As you travel up a mountain, you see a range of vegetation. The valley floor has deciduous trees, shrubs, and grasses. The side of the mountain is covered with coniferous trees (cone-bearing, evergreen trees) such as pine and fir trees. As you near the top of the mountain, the conditions are similar to those found in the Arctic region — cold and relatively dry. You are at a high altitude!

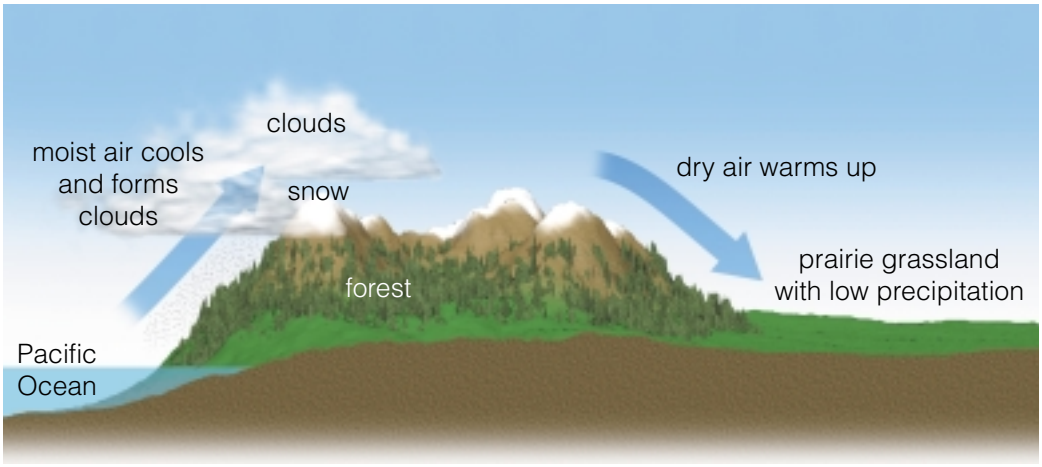


Figure 14.3 Mountain ranges influence climate. Moist air from the Pacific Ocean rises up and over the mountain ranges in British Columbia. There, it drops most of its moisture. The grasslands east of the mountains get little rain. Northeastern Alberta is farther away from the mountains. This area gets enough precipitation for large forests to grow.

Find Out ACTIVITY

Location and Climate

Meteorologists describe the climate of a region by its average monthly temperatures and amounts of precipitation each month. They calculate the averages over many years.

SKILL CHECK

- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

What You Need

calculator

climate data supplied by your teacher

What to Do

1. Using climate data for Alberta, draw three line graphs of the Average Monthly Temperatures for Fort Chipewyan, Manyberries, and Banff. Place the months on the *x*-axis and temperature on the *y*-axis.
2. Plot three bar graphs showing the Total Monthly Precipitation (mm) for each location. Place months on the *x*-axis and precipitation on the *y*-axis.
3. Calculate the total yearly precipitation for Fort Chipewyan, Manyberries, and Banff.

What Did You Discover?

1. Explain what happens to the climate as you move farther north.
2. Banff and Manyberries are close to the same latitude. Compare Banff's climate with those of Manyberries and Fort Chipewyan. What do you notice?
3. Explain why Manyberries receives less precipitation than Banff.

Check Your Understanding

1. Define, in general terms, the climate of an area.
2. Why is it colder near the North and South Poles than near the equator?
3. Read the Did You Know? on page 276. Why is the climate at the top of a mountain similar to the climate in Canada's Arctic region?

Key Terms

climate
topography
altitude
latitude

14.3 Location and Soil

Latitude, altitude, and topography also influence the type of soil in an area. The type of soil, in turn, affects the number and types of plants, which affect the number and types of animals.

Soil is the thin layer of rock fragments that covers the land. Good soils also contain plant nutrients such as nitrogen. In Chapter 12, you learned about the nitrogen cycle and the importance of this nutrient for the growth of healthy plants. Soil also traps water and gives plants a firm base in which to grow.

Soil is composed of rock particles of different sizes. The smallest particles are called **clay**. The next largest are called **silt**, then **sand**. **Gravel** is the largest particle size found in soil. Not all soils contain every one of these particles.

Humus in Soil

Soil also contains animal wastes and the decaying remains of dead plants and animals. Decomposers that live in the soil consume this matter and help it to decay. Earthworms drag the debris underground. The material gradually becomes **humus**. Humus consists of fibres, soil particles, and a black, sticky liquid that is really the decayed remains of organisms. It also contains living organisms such as bacteria and fungi as well as trapped moisture.

READING Check

What is humus and what role does it play in an ecosystem?

Because humus is sticky, it binds particles of various sizes together to make **soil crumbs**. Soil crumbs are good for several reasons.

- The spaces between the crumbs allow plant roots to grow and spread out.
- The spaces between the crumbs allow air to get into the soil.
- Soil crumbs help keep the soil moist, but the spaces allow excess water to drain away.
- Soil crumbs are less likely to be blown away by wind than small soil particles are.

Humus also helps prevent minerals from being leached out. (**Leaching** is the washing out of soil materials by rain.) Eventually, humus is completely broken down by bacteria, leaving only its valuable minerals behind in the soil.

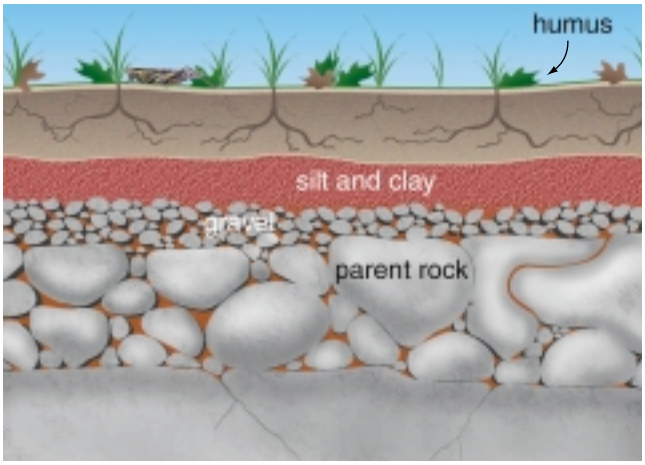


Figure 14.4 Soil includes particles of many different sizes.

INVESTIGATION 14–A

SKILL CHECK
- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

Comparing Soil

Think About It

The characteristics and depth of soil vary from place to place. The climate and vegetation in an area are the main factors that determine the soil's quality and depth.

The figure here shows the soil profiles of three major soil types found in North America. You can see a soil profile if you carefully dig a hole with straight sides. Look at the sides of the hole. The horizontal layers are called **horizons**. The top layer (Horizon A) is called **topsoil**. It consists of rich, dark-coloured soil that contains humus and small rock fragments. The next layer (Horizon B or subsoil) is lighter in colour because it contains very little humus. It contains clay, silt, or sand, plus minerals that have been leached from the top layer. The bottom layer (Horizon C) is most similar to the parent rock below.

What to Do

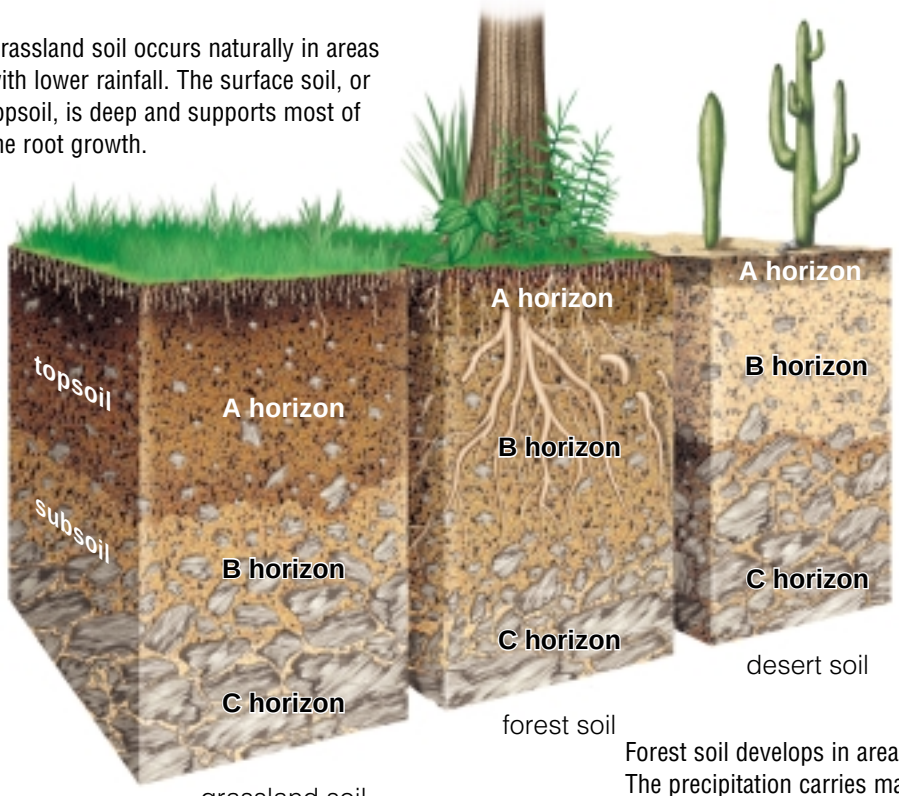
1. Study the diagram of the soil profiles. Notice the different layers found in the soil from each region. Read the description with each profile.
2. Use the diagram and the descriptions to analyze the climate in each area.
3. Refer to these diagrams and to the information on soils found on the previous page to complete the Analyze section of this investigation. Your teacher will give you the Analyze questions.

Internet CONNECT

www.mcgrawhill.ca/links/science.connect1

Rain forests have a very warm and wet climate. This climate affects the thickness of the topsoil. To learn more about the soil in a rain forest, go to the above web site, then to Internet Connects, Unit D, Chapter 14, and then to Rain Forest Soil. Use the information you find to compare the soil in the tropical rain forest to the soil in an Alberta forest.

Grassland soil occurs naturally in areas with lower rainfall. The surface soil, or topsoil, is deep and supports most of the root growth.



Deserts have limited plant growth due to low levels of precipitation. As a result there is little decomposing plant matter in the soil and a thin layer of topsoil or none at all.

Forest soil develops in areas with more precipitation. The precipitation carries materials deeper beneath the surface of the soil, into the subsoil. In forests, the layer of topsoil is not as thick as in grassland soil.

Soil profiles of grassland, forest, and desert ecosystems.

Find Out ACTIVITY

Soil

Soils are complex. They contain rock fragments, minerals, animal wastes, and living and dead organisms.

SKILL CHECK

- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

Safety Precautions

What You Need

large glass jar with a lid
topsoil
spoon
tweezers
shallow dish (for example, a petri dish) or white paper
water
dissecting microscope and/or magnifying glass

What to Do

1. Obtain a small amount of topsoil from a lawn or garden.
2. Add enough soil to the jar to fill it one quarter full.
3. Almost fill the jar with water.
4. Put the lid on tightly.
5. Shake the contents of the jar and then let it settle while you do Steps 6–8.
6. Take a small spoonful of soil from your original sample. Put it in your dish.
7. Using the tweezers, take the soil apart. Sort the particles by size (as much as you can).
8. Look at the soil using a dissecting microscope or a magnifying glass. Draw some of the particles you see.
9. Clean up the lab and wash your hands thoroughly when you have finished.

What Did You Discover?

1. In your Science Log or notebook, draw a picture of the layers you see in your jar.
2. Which particles are the heaviest? the lightest? Why?
3. Record what you found when you picked apart your soil sample. How do the particles differ?
4. Estimate how much of the soil in your dish is rock fragments, how much is humus, and how much is living organisms. Draw a pie graph showing your estimations.

Key Terms

soil
clay
silt
sand
gravel
humus
soil crumbs
leaching
horizon
topsoil

Check Your Understanding

1. List four reasons why soil is important.
2. What is humus and why is it so valuable to plants?
3. Explain how the amount of precipitation in an area helps to determine the type of soil that forms there.

14.4 Biomes

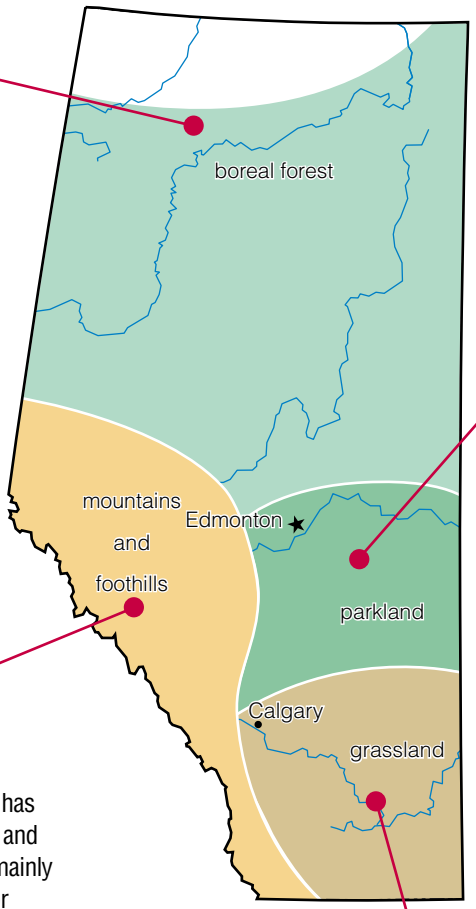
The photographs at the beginning of this chapter (on pages 272 and 273) show two large ecosystems in Alberta — the northern boreal forest and the grasslands.

As you have discovered, the types and number of plants and animals found in a region are determined by the region's climate and soil. Ecologists have divided Alberta into four main climatic and soil zones, each with different communities of plants and animals. A large geographic area with distinct plants and animals is called a **biome**.

READING Check

What is a biome?

The **boreal forest** region receives more precipitation than the grassland. Winters are long and cold. Summers are cool, but the days are long. Mixed forests of aspen, spruce, and pine trees are the main vegetation. Moose, mosquitoes, and caribou are common in this biome.



The **parklands** have more precipitation than the grasslands. The summers are cooler and the winters are colder. Animals found in the parkland include deer, Baird's sparrows, and red-tailed hawks. The main plants are aspen trees and fescue grasses.

The **mountain and foothill** biome has extreme variations in temperature and amounts of precipitation. This is mainly due to the differences in altitude or elevation over short distances. At higher elevations, the climate is colder in both winter and summer. As a result, these elevations have a short growing season. Forests of coniferous trees grow on the sides of the mountains from the valley floor to the tree line. Elk, moose, and black bears live in the mountains.

The **grasslands** have the lowest precipitation of any area in the province. Summers are hot and winters are cold. Mixed grasses grow in clumps in undisturbed areas. Animals such as burrowing owls, swift fox, and pronghorns live in this biome.

Figure 14.5 Biomes of Alberta

The Northern Boreal Forest Biome

READING Check

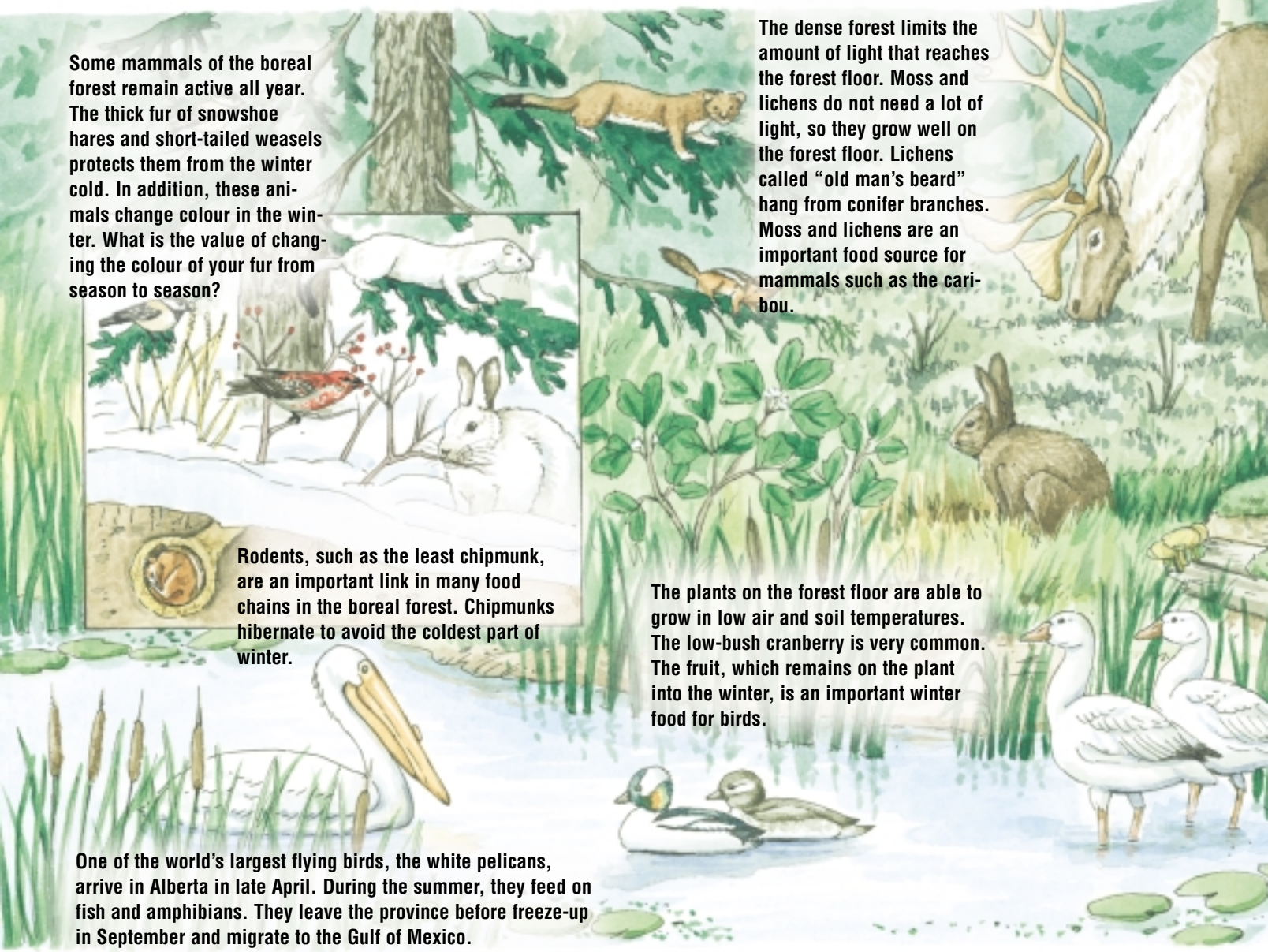
What is meant by the phrase "diversity of living things"?

A very large biome, called the northern boreal forest, lies in northern latitudes around the world. This type of forest stretches across Canada, northern Europe, and Asia. Although its climate is colder than the grassland biome, this biome receives enough precipitation to support trees.

Despite the cold, the soil thaws completely during the spring and summer. Some summer days are surprisingly hot.

Because it is cold and wet and the soil is acidic, earthworms are rare. The action of bacteria is slowed down. As a result, the needles of coniferous trees and dead organisms decompose slowly.

Figure 14.6 shows a part of the boreal forest in northern Alberta. How do you think the climate determines the diversity of organisms in this region? **Diversity** or **biodiversity** are synonyms used to describe the number and variety of living things in an area.



Some mammals of the boreal forest remain active all year. The thick fur of snowshoe hares and short-tailed weasels protects them from the winter cold. In addition, these animals change colour in the winter. What is the value of changing the colour of your fur from season to season?

The dense forest limits the amount of light that reaches the forest floor. Moss and lichens do not need a lot of light, so they grow well on the forest floor. Lichens called "old man's beard" hang from conifer branches. Moss and lichens are an important food source for mammals such as the caribou.

Rodents, such as the least chipmunk, are an important link in many food chains in the boreal forest. Chipmunks hibernate to avoid the coldest part of winter.

The plants on the forest floor are able to grow in low air and soil temperatures. The low-bush cranberry is very common. The fruit, which remains on the plant into the winter, is an important winter food for birds.

One of the world's largest flying birds, the white pelicans, arrive in Alberta in late April. During the summer, they feed on fish and amphibians. They leave the province before freeze-up in September and migrate to the Gulf of Mexico.

Figure 14.6 The boreal forest biome

DidYouKnow?

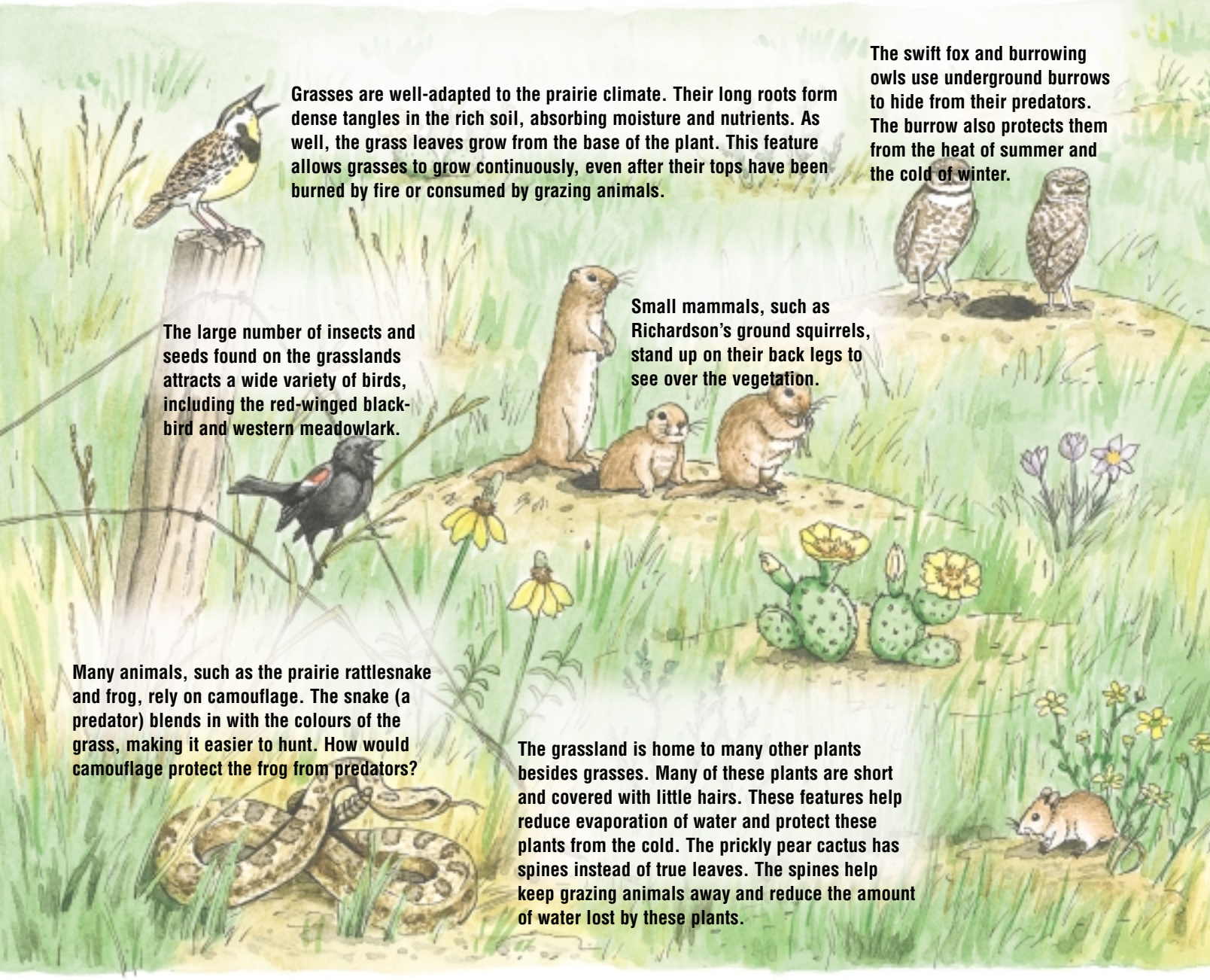
Just before winter, the spruce budworm larva spins a shelter of silk in a crevice in the bark. It stays in this shelter until spring.

The Grassland Biome

Alberta's grassland biome is an extension of the great western plains in the United States. Few trees grow in this biome because of the:

- low precipitation,
- drying winds,
- extremely cold winters,
- fierce snowstorms in late spring, and
- drought in summer.

Before settlers ploughed the grassland, this biome had a large biodiversity. The grasslands were covered with mixed grasses plus communities of animals, plants, fungi, and decomposers. Study Figure 14.7. How do you think the climate of the grassland influences the diversity of life found in this biome?



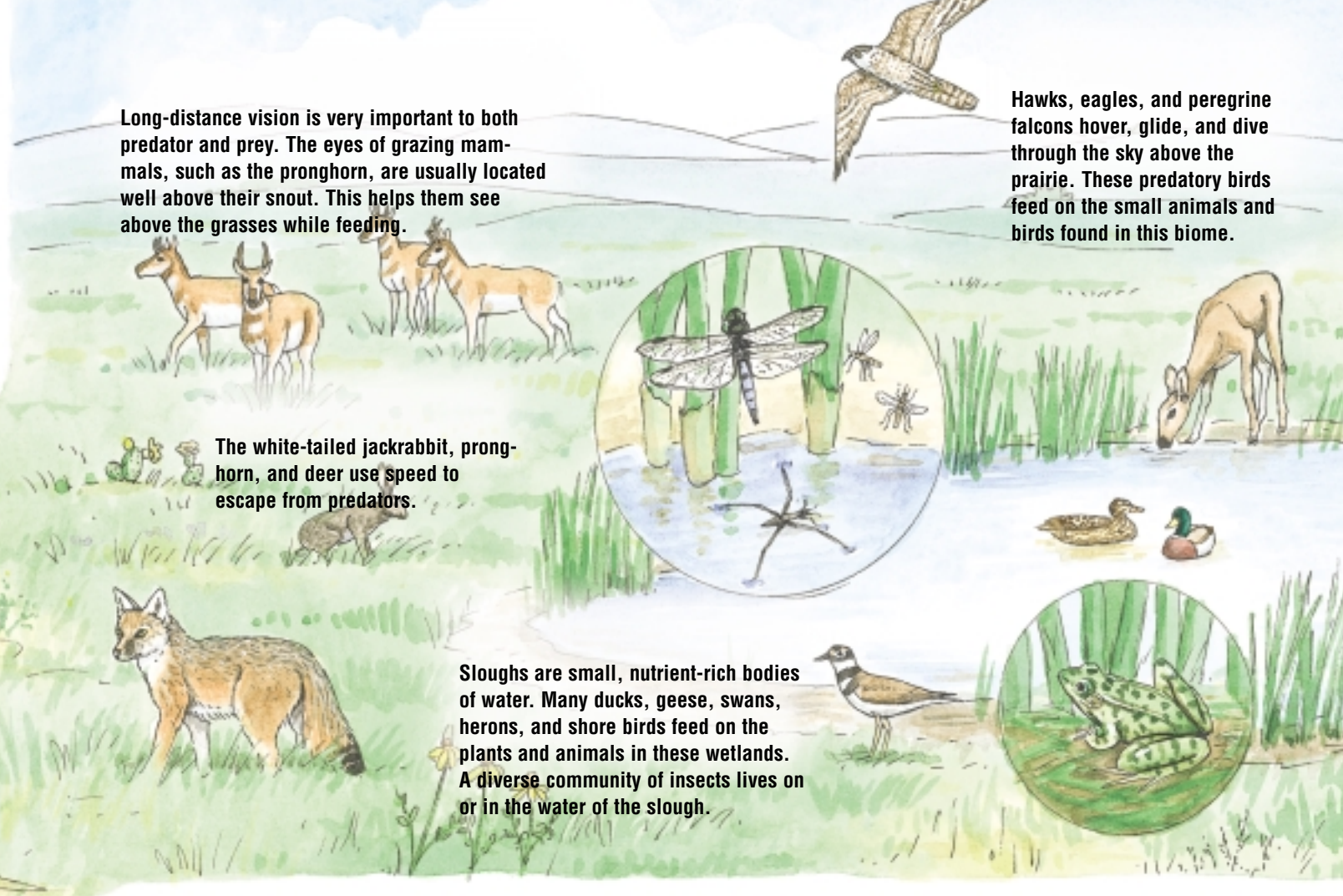


Figure 14.7 The grassland biome

Check Your Understanding

1. Which biome do you live in? In your own words, describe some biotic and abiotic features in your region of Alberta.

2. **(a)** How are coniferous trees adapted for the climatic conditions in the northern boreal forest?
   (b) Why are other producers, such as the low-bush cranberry, important to birds that spend the winter in this biome?

3. **(a)** How are prairie grasses adapted to the climate of the grassland biome?
   (b) How are other producers adapted to surviving in this region?

4. Read the text at the top of pages 282 and 284. Also, study the pictures and read the text with Figures 14.6 and 14.7. Use what you learn to make a chart comparing the northern boreal forest and grassland biomes. Use the following headings: climate, plant life, plant adaptations, animal life, animal adaptations.

Key Terms

biome
boreal forest
mountain and foothill
parkland
grassland
diversity
biodiversity

14.5 What Threatens Biodiversity?

Figure 14.8 These large snails became extinct long before humans roamed Earth.

Today, only small parts of Alberta are true grasslands or northern boreal forests. The animals and plants you saw on pages 282–285 now have only those small areas to live in. And some of the organisms that lived here 100 years ago are now extinct.

Extinction is the elimination of a species from Earth. Sometimes, extinction is a normal process of the natural world. Sometimes, species cannot adapt to a natural climate change. Many became extinct during the ice ages — for example, the woolly mammoth.

Catastrophic events, such as a volcanic eruption or a flood, may also cause extinction. About 250 million years ago, two thirds of all marine species and nearly half of all land plants and animals on Earth died out very suddenly. About 65 million years ago, most species of dinosaurs and many other organisms became extinct, possibly because a large meteorite crashed into Earth.

SCIENCE Myths

Numerous filmmakers show humans interacting with dinosaurs such as *Tyrannosaurus rex*. Dinosaurs were extinct about 60 million years before the first humans appeared on Earth!

Human Impact on Biodiversity

Over the last 100 years, human activities have increased the rate of extinction. The main reason is habitat loss. (An organism's **habitat** includes its shelter and food.) People fill in wetlands. Loggers clear-cut forests. Farmers plough grasslands and put up fences. We dam or divert fast-flowing rivers to slow them down. All these activities destroy habitats for animals and plants.

The term **species at risk** refers to plants and animals that are close to becoming extinct. Some of these species are common in some areas, but rare or missing from others. (See Figures 14.10 and 14.11.)

Figure 14.10 The black-footed ferret is a species at risk. It no longer lives in the wild in Canada. A few individuals live in the United States.

READING Check

What is extinction of a species?

Figure 14.9 Millions of passenger pigeons were shot for sport. They are now extinct; the last one died in a zoo in 1914.

Figure 14.11 There are no cryptanthe in Alberta. It does still grow in the western United States. This is a species at risk.

DESIGN & DO

INVESTIGATION 14–B

SKILL CHECK

- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

Design a Web Site about Species at Risk

Your design team works for a company that designs web pages. Your client wants a web site that describes how the use of an area by humans may cause the extinction of a species of plant or animal in that area. Your client would like an interactive web site, with a variety of text and pictures linked together in an imaginative way.

You and your team will make a presentation to your client. This will show what you will include in the web site and how it will work.

Challenge

Design a web site illustrating that the way humans use the land in a region can put some plant and animal species at risk.

Materials

paper

web editing software (if available)

Design Criteria

A. Your web site must be interactive and not simply display text and graphics.

B. You may present your web site design as a flowchart or a storyboard. You may illustrate your design with pictures.

C. Your web site must show a species at risk.

D. Use your library and/or electronic resources to find information.

E. Do not simply copy text from a web page or encyclopedia. That is called "plagiarism." You must give credit to the book or web site where you found any text or photos you used. If possible, give the name of the writer or photographer. When crediting a web site, provide the date on which you visited it.

Plan and Construct

1. Decide on the role of each member of your team. Some could research the species at risk; others could learn how human land use in the area contributed to putting the species at risk.
2. As a team, decide how to present the material on the web site. What types of links, pictures, and type fonts will you use?
3. Be prepared to show an outline and storyboard of your plan.

Check Your Understanding

1. Using examples, explain why extinction is sometimes a normal process on Earth.
2. Define what we mean by "extinct" and "species at risk." Give an example of an organism in each group.
3. How do you think each of the following land uses could affect the biodiversity in an area?
   - **(a)** ploughing native grasslands and planting thousands of hectares of wheat
   - **(b)** clearcutting the trees
   - **(c)** dumping piles of rock over the side of a mountain in a mining operation
   - **(d)** building a large shopping mall and parking lot in a wooded area

Key Terms

extinction
habitat
species at risk

CHAPTER

14 Review

Key Terms

ecosystem
biotic community
abiotic environment
terrestrial ecosystem
climate
topography
altitude
latitude
soil
clay
silt
sand
gravel
humus
soil crumbs
leaching
horizon
topsoil
biome
boreal forest
mountain and foothill
parkland
grassland
diversity
biodiversity
extinction
habitat
species at risk

Reviewing Key Terms

If you need to review, the section numbers show you where these terms were introduced.

1. In your Science Log or notebook, match each description in Column A with the term in Column B.

A	B
(a) the organisms in an ecosystem are called	i. climate (14.2)
(b) the non-living environment is called	ii. altitude (14.2)
(c) term for the long-term precipitation and temperature in a region	iii. biome (14.4)
(d) temperature decreases the higher you go in _____	iv. biotic community (14.1)
(e) name for the decaying plant and animal matter in soil	v. extinction (14.5)
(f) term for rainwater removing nutrients from the soil	vi. humus (14.3)
(g) name for a large area with similar climate and ecosystems	vii. grassland (14.4)
(h) term used to describe a species that no longer exists because all members are dead	viii. leaching (14.3)
(i) type of biome on the prairies of southern Alberta	ix. abiotic environment (14.1)

Understanding Key Ideas

Section numbers are provided if you need to review.

2. List the page number in your text where each main idea is found. Then, explain each main idea.
(a) the two components of an ecosystem (14.1)
(b) the role latitude plays in determining the biomes in an area (14.2)
(c) the importance of soil (14.3)
(d) the climate of the grasslands (14.4)
(e) the climate of the northern boreal forest (14.4)
(f) biodiversity (14.4)

3. Explain how soil crumbs are formed. List four reasons why they are important for plants. (14.3)

4. On a map of Alberta, locate, name, and describe the climates of the four Alberta biomes. (14.4)

5. Explain how each of the following is an adaptation for survival in the northern boreal forest. (14.4)

(a) lichens growing on the forest floor
(b) fur of the snowshoe hare changing from brown to white in winter
(c) least chipmunks hibernating during the winter
(d) hooked beaks and sharp talons of hawks and eagles
(e) white pelicans migrating to the Gulf of Mexico in September

6. Explain how each of the following is an adaptation to life in the grasslands. (14.4)
   (a) Richardson's ground squirrels standing on their hind legs
   (b) colour pattern of the prairie rattlesnake
   (c) growth of the leaves of native grasses from their base
   (d) speed of deer and jackrabbits
   (e) swift foxes living in a burrow

7. Using an example, describe how each of the following helps to determine the climate of an area. (14.2)
   (a) latitude
   (b) altitude
   (c) topography

8. Scientists think they know what caused dinosaurs to become extinct. What is their theory? (14.5)

9. How has human activity contributed to putting species at risk in Alberta? Give an example. (14.5)

Problem Solving/Applying

10. In Chapter 13, you learned about exotic species (see page 268). Exotics are organisms introduced into habitats where they are not normally found. As a result, these organisms have few predators, parasites, diseases, and competition. Their populations often grow quickly. Should exotic species be allowed in Alberta? (14.2)

Critical Thinking

11. Explain the following statements. (14.1)
   (a) The biotic community in an ecosystem depends on abiotic factors for survival.
   (b) The living things in an ecosystem depend on each other.

Pause & Reflect

1. Look back at the pictures and read the text in the Chapter Opener on pages 272 and 273. Suggest at least four reasons why the biodiversity of Alberta decreased after the European settlers arrived.
2. Check your original answers to the Getting Ready questions on page 272. How has your thinking changed? How would you answer these questions now that you have investigated the topics in this chapter?