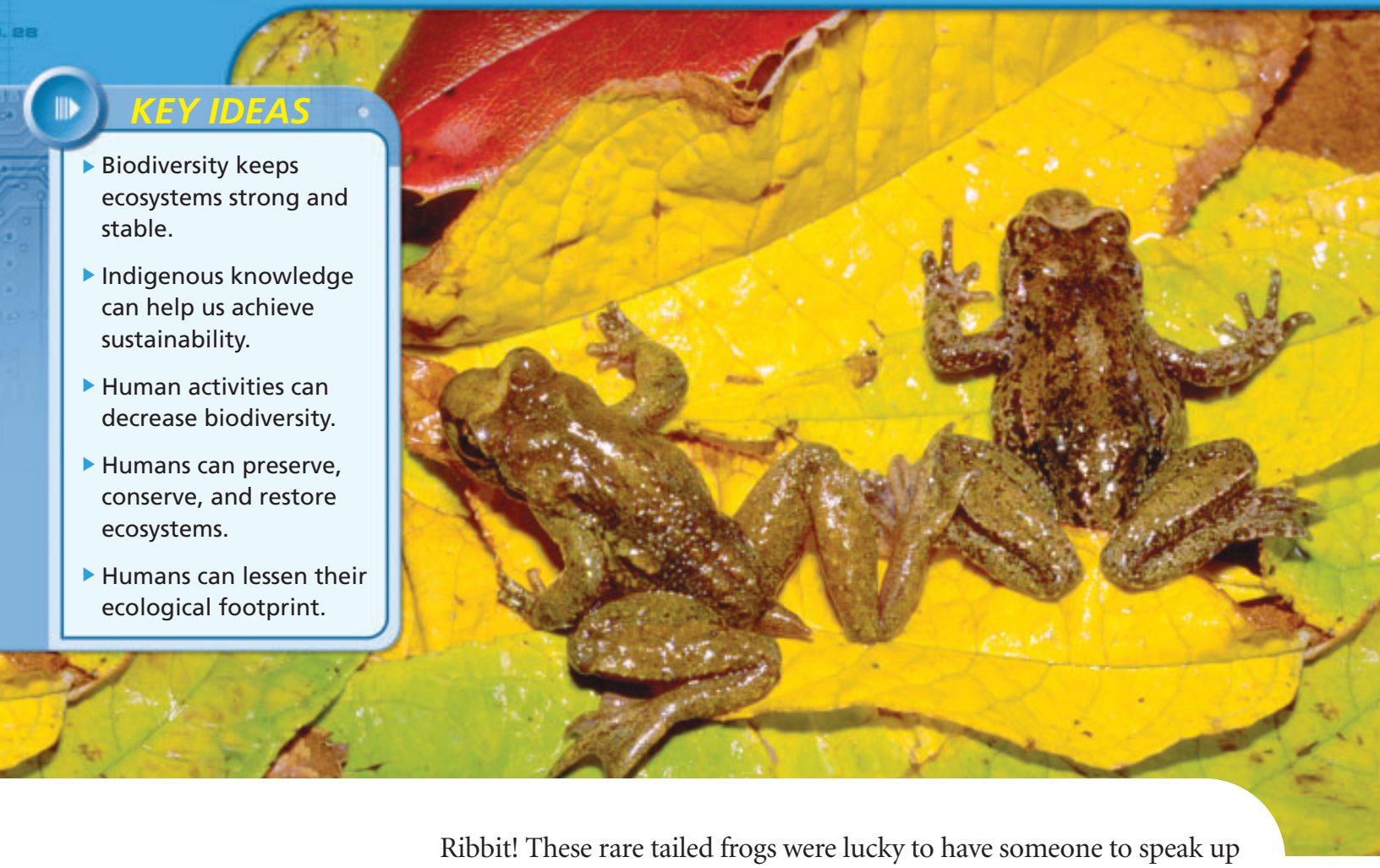
CHAPTER 3

Human survival depends on sustainable ecosystems.



KEY IDEAS

- Biodiversity keeps ecosystems strong and stable.
- Indigenous knowledge can help us achieve sustainability.
- Human activities can decrease biodiversity.
- Humans can preserve, conserve, and restore ecosystems.
- Humans can lessen their ecological footprint.

Ribbit! These rare tailed frogs were lucky to have someone to speak up for them. Some students in West Vancouver found tailed frogs in an area where developers planned to build houses. The students' interest encouraged the property owners to plan for the frogs' survival. The owners supported a five-year study to determine where tailed frogs existed in the area. This is an example of how humans can work together to plan for the future of an ecosystem.

Endangered spaces usually mean endangered species. Is there a species of plant or animal in your community that needs your voice? Is there a space—a stream, a field, or a schoolyard—in your community that needs your voice? You, like the students in West Vancouver, can be a voice for endangered spaces and species.

The Role of Humans in Ecosystems

3.1

What is your place in your ecosystem? Do you visit nature, or do you think of it as your home? Do you worry about your effect on other species, or do you think non-human species are less important than you? Should people control ecosystems, or should people control their use of ecosystems? These are very complicated questions. How people live in ecosystems depends on how they see themselves and their world (**Figure 1**).

LEARNING TIP

Work with a partner and discuss the questions in the first paragraph. Compare your reactions to those of your partner.

The ecosystems of the natural world support the web of life. Energy flows from the Sun, and one species' waste is another species' food. Matter cycles through ecosystems, creating a balance. Like all other living things, humans depend on ecosystems to provide their needs for survival and to recycle wastes.

Figure 1
Do you think you can "conquer" nature?

For most of human history, ecosystems were able to sustain, or bear the weight of, their human populations over thousands and thousands of years. This ability of ecosystems is called **sustainability.** A sustainable ecosystem is able to replace the resources that people remove, and recycle the wastes that people put in.

Humans are a very successful species. As our population continues to grow, so does our need for food, air, water, and shelter. Also, we produce more waste. Today, we often remove resources faster than ecosystems can replace them. We often put wastes into ecosystems faster than the natural cycles can deal with them. As a result, some ecosystems can no longer provide for other species. The other species die or leave.

Each time a species is lost from the web of life, the ecosystem is weakened. A strong ecosystem has a variety of species and complex interactions. The variety of species in an ecosystem is called **biodiversity.**

Scientists know that a loss of biodiversity can threaten the sustainability of our ecosystems. This is such an important problem in our world today that the United Nations has developed a Convention on Biodiversity. It asks all the countries of the world to pay more attention to the knowledge and ways of indigenous peoples, the peoples who originally lived in an area (**Figure 2**).

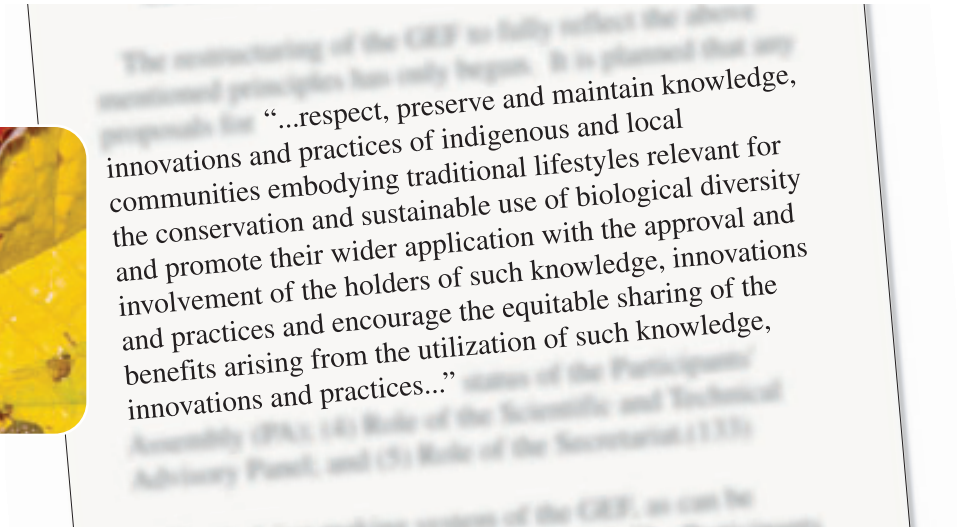

"...respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices..."

Figure 2
The UN Convention on Biodiversity recognizes the important role of indigenous knowledge.

The longer you observe something, the more you learn about it. Aboriginal peoples have observed local ecosystems for thousands of years. They have passed their knowledge from generation to generation, often in the form of stories (**Figure 3**). Stories are useful models for complex relationships, like those found in nature. Aboriginal stories emphasize the relationships among living things and their non-living environment. As a result, Aboriginal peoples often have a very good understanding of how interconnected all things are, and how important it is for humans to live in harmony with other living things and the environment. The United Nations has decided that this is the type of understanding we need to have to ensure the sustainability of our ecosystems.

LEARNING TIP

Think of other examples in which people use stories to communicate scientific information.

Figure 3
Aboriginal Elders pass on their knowledge through stories.

If you listen to Aboriginal stories, you will notice that nature usually has something to teach people. The stories emphasize that nature is in control, not people. Scientists who study ecosystems have learned the same thing.

CHECK YOUR UNDERSTANDING

1. What do humans remove from ecosystems, and what do they put in? How is this the same as what other species do? How is this different?
2. Would you expect to find greater biodiversity in a natural ecosystem or a human-made ecosystem, such as a farm or a garden? Explain your answer.
3. How can indigenous knowledge help all British Columbians today?

3.2 Pollution of Ecosystems

LEARNING TIP

Look at the headings in this section. What three types of pollution will you be studying? Make a three-column chart using these headings and record examples as you read.

A comedian once said that pollution is a dirty word. Pollution refers to things that are not normally found in the environment, or things that are present in such large amounts they overload the natural cycles in an ecosystem. Do you often get the feeling that others, such as manufacturers, farmers, and people driving to work, are polluting your environment (**Figure 1**)? We all, however, pollute the environment. Think of your food and home, and how you travel each day.

Pollutants in the land, air, or water can enter food webs and end up in the bodies of plants and animals.

Figure 1
Do you see evidence of pollution?

Polluting the Land

Most of the household garbage that you produce ends up in landfill sites (**Figure 2**). A landfill is created by digging a very large hole and, over a period of time, filling it with garbage. The original ecosystem of the field or forest is replaced by the ecosystem of the landfill site. If electronics waste (such as computers and batteries) and poisonous chemicals are put in a landfill, these harmful substances can pollute the soil and water. The environment changes and the plant and animal species that used to live in the ecosystem die or leave.

Figure 2
These seagulls are feeding at the Vancouver Landfill in Delta.

Landfill sites contain many decomposers. As well, they sometimes attract detrivores, such as bears, seagulls, and rats. There is usually less biodiversity, however, than in the original ecosystem. The more garbage people throw out, the more land that is used for landfill sites, and the more biodiversity that is lost. Composting and recycling are two ways to reduce the amount of waste that we put in landfills (**Figure 3**).

Figure 3
How can recycling and composting protect biodiversity in your ecosystem?

Polluting the Air

Have you looked at the labels on your food, clothing, and electronics? If these products were made far from your home, how did they travel? Most of them have likely been on a ship, plane, train, or transport truck and have travelled hundreds or even thousands of kilometres. The leading cause of air pollution is the transportation of goods and people.

Air pollution can cause health problems for humans, other animals, and even plants. It can also cause acid rain. Acid rain can harm the soil that plants need to survive. Acid rain can also increase the acidity in lakes. This reduces biodiversity, since most plants and animals cannot survive in acidic lakes.

Air pollution can even change the climate. A certain amount of carbon dioxide in the atmosphere is needed for photosynthesis. It helps to trap the Sun's heat energy, just like greenhouse glass traps the Sun's heat energy, warming the greenhouse. Scientists call this the greenhouse effect. Without the greenhouse effect, Earth would be too cold for life as we know it. The burning of coal, oil, and natural gas changes the balance in the carbon cycle so that there is more carbon dioxide in the atmosphere. Scientists hypothesize that the extra carbon dioxide is causing global warming. Even a slight increase in the average temperature can affect climates worldwide, changing the water levels in oceans and creating extreme weather patterns of heat and cold, and droughts and floods (**Figure 4**). What effects might these changes have on people, crops, and animals?

Figure 4
Sachs Harbour is located on Banks Island in Canada's Western Arctic. Warmer temperatures are melting the permafrost, causing the ground to sink and shift. This can be clearly seen at the edge of this lake near the coast of Banks Island.

Polluting the Water

When you flush your toilet or drain your sink, the wastewater has to go somewhere. It may go to a sewage treatment plant on its way to a river and eventually to the ocean. Every year, billions of litres (L) of untreated sewage from cities and communities pour into waterways and then into the oceans worldwide. About 80% of ocean pollution is caused by human activities on land. Agriculture and industry also contribute to water pollution during the processes that produce the food you eat and the products you buy. Water pollution kills many plants and animals, reducing the biodiversity in our lakes, rivers, and oceans (**Figure 5**).

Figure 5
How do you think the garbage in this photo is affecting the water?

CHECK YOUR UNDERSTANDING

1. Which types of pollution affect you personally? Explain how you have been affected by each.
2. Explain how your household garbage can reduce biodiversity.
3. Explain how your shopping habits could contribute to air pollution.
4. Estuaries are important ecosystems for migratory birds. Explain how pollution in your community could affect an estuary ecosystem hundreds of kilometres away.
5. Which types of pollution mentioned in this section do you think are occurring in your community?

3.3 Conduct an Investigation

SKILLS MENU

○ Questioning	● Observing
○ Predicting	● Measuring
● Hypothesizing	○ Classifying
○ Designing Experiments	○ Inferring
● Controlling Variables	● Interpreting Data
○ Creating Models	● Communicating

Polluted Waters

When streams and lakes are polluted, the organisms that live in the water are affected. Can you think of some ways that a plant or animal may be affected by a change in its watery home? Can some organisms still live in polluted water?

Earlier in this unit, you learned that yeast (a living thing) lives best in warm, sugary water. In this investigation, you will observe how yeast is affected when a pollutant is added to its non-living environment. The pollutant you will add is lemon juice, an acid.

Question

How will different amounts of a pollutant affect the growth of an organism that lives in water?

Hypothesis

Write a hypothesis that answers the question above. Use the following form for your hypothesis: "If … then …."

Materials

- 10 250-mL clear glass jars or beakers
- masking tape
- pen or marker
- apron
- safety goggles
- measuring spoons
- measuring cup
- 5 mL of sugar for each small container
- graduated cylinder
- very warm (not hot) water for each small container
- lemon juice at room temperature
- 2 soup spoons
- 1 large jar (500 mL)
- 100 mL of very warm (not hot) water for larger jar
- 25 mL of instant rise baker's yeast
- clock or watch

Wear safety goggles for this investigation.

Procedure

1 In your notebook, make a table like the one below.

Effects of Lemon Juice on Yeast Growth

	3 min	5 min	7 min	9 min	11 min	13 min	15 min
none							
5 mL							

2 Working with a partner, set up your containers in a line. Label the first container "none." Then, label the rest by fives: 5 mL, 10 mL, 15 mL, and so on until you have labelled all of them.

3 Put 5 mL of sugar in each container. Using a graduated cylinder, add 50 mL of very warm water to the first container, 45 mL to the second, and 40 mL to the third. Continue to decrease the amount of water added by 5 mL until the tenth container has only 5 mL of water added to it. Then, put lemon juice in each container, as indicated on the label. In other words, put no lemon juice in the container labelled "none," put 5 mL in the container labelled "5 mL," and so on. Using a soup spoon, stir each container to dissolve the sugar. Work quickly but carefully.

4 In the large jar, put 100 mL of very warm water. Sprinkle the 25 mL of yeast into this jar, a little at a time. Stir with the other soup spoon after each addition.

5 Add 10 mL of this yeast mixture to each container. Swirl each container to mix. Note the time on the watch or clock.

6 Make your first observation 3 min after you add the yeast mixture to the containers. Continue to make observations every 2 min, until 15 min have passed. Record your observations in your table.

Analyze

1. Each container has a different amount of lemon juice. Was there a difference between any two containers that you think was important?
2. What did you learn from this investigation about the amount of a pollutant in water and the effect on the organisms that live in the water?

Write a Conclusion

3. Write a conclusion that explains the results of your investigation. Your conclusion should refer back to your hypothesis. Was your hypothesis correct, partly correct, or incorrect? Explain how you arrived at your conclusion.

Apply and Extend

4. Examine the photos in **Figure 1**. Which lake do you think has more acid in the water?

Figure 1

5. What do you know about acid rain? Write a brief paragraph about what it is and how it is currently affecting eastern Canada. You may need to do some research in a library or on the Internet.

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LEARNING TIP

For more information on variables, see the "Controlling Variables" section in the Skills Handbook.

CHECK YOUR UNDERSTANDING

1. What could you call the container with no lemon juice? Why was it important to have this container?
2. Why was it important to have the same amount of yeast, sugar, and water in each container?
3. What was the dependent variable in this investigation?

Land Use and Habitat Loss 3.4

Humans use land in many ways. Human activities, such as farming, building cities, and logging, can change or eliminate the conditions that are needed for other living things to survive. Thus, human activities can result in loss of habitat for plants and animals. Land use issues are complicated, however. Looking after the needs of ecosystems and both the needs and wants of humans can be very difficult.

TRY THIS: OBSERVE HABITAT LOSS

Skills Focus: observing, inferring, classifying

Explain how each land use in the photos below has resulted in habitat loss. What species of plants and animals might have been affected? Do you think biodiversity has been reduced? Suggest some ways that habitat loss could be reduced in these land use situations.

A Case Study in Land Use and Habitat Loss: The Antelope Brush Ecosystem

B4 · Vancouver Sun

Vineyards a threat to rare species

Larry Pynn Vancouver

A dry and little-known ecosystem—the antelope brush and needle-and-thread grass ecosystem—is being squeezed out by the ever-expanding grape-growing industry south of Penticton to the Canada-U.S. border. With the number of vineyards in the region predicted to double over the next several years, conservationists are urging immediate protection for what little antelope brush remains.

The antelope brush ecosystem is among the four most endangered habitats in Canada and is home to 88 species considered at risk by the B.C. government—a diverse and odd assortment of plants, insects, and animals, which, for the most part, are neither cute nor cuddly. Among the rarer species are the western red bat, tiger salamander, grasshopper sparrow, burrowing owl, white-tailed jackrabbit, badger, night snake, rough dropseed, flat-topped broomrape, Spalding's milk-vetch, Behr's hairstreak butterfly, and ground mantis.

Urbanization has been responsible for the loss of about 16 percent of antelope brush habitat. The other 84 percent has been lost to agriculture—vineyards, cultivated agriculture, orchards, and grazed pasture. Statistics are not specific to vineyards, but the consensus is that expansion of vineyards is the main threat.

Brian Sprout/Vancouver Sun

Conservationist Geoff Scudder in the endangered antelope brush system at the Osoyoos Desert Centre

The 400-member Osoyoos Indian Band (Nk'mip) has recently converted almost 500 ha (hectares) to vineyards as part of the band's mandate to become economically self-sufficient by 2005. Chris Scott, the band's chief operating officer, said he expects up to another 160 ha of antelope brush to be converted to vineyards over the next two or three years, if the band membership approves. But he also said the band will be asked to endorse setting aside close to 400 ha of antelope brush habitat for conservation.

The B.C. Wine Institute argues that vineyards are trying their best to be environmentally responsible. Initiatives have included drip irrigation to reduce water use, netting and bird calls to keep out birds that would consume grapes, donations to wildlife conservation, and in some cases a movement to organic wines that are free of pesticides.

Jim Wyse, proprietor of

Many human activities cause habitat loss for other species (**Figure 1**). The case study shows how difficult it is to look after the needs of both humans and plants and animals in the same ecosystem. The needs and wants of British Columbians affect how we use the land in our province. Many of the ways that we use the land result in habitat loss for other species that live in British Columbia. Some of the food we eat and the products we use are produced in other provinces and countries. So our needs and wants affect land use in other provinces and countries. The choices we make here can result in habitat loss in other parts of Canada and in countries around the world.

LEARNING TIP

It is easier to remember information if you personalize it. How do you feel about your choices concerning habitat loss? Compare your opinion with a partner.

Figure 1
Building this mall and its parking lot resulted in habitat loss in the local ecosystem. The production and transportation of the products sold in this mall resulted in habitat loss in ecosystems throughout Canada and in other parts of the world.

Canadians have a very high standard of living. We are able to meet many of our wants, as well as our needs. This means that we have a greater effect on land use and habitat loss than people in poorer countries with lower standards of living.

CHECK YOUR UNDERSTANDING

1. It is often difficult to look after the needs of both humans and ecosystems. Use examples from the article to explain why.
2. What type of land use causes the most habitat loss in the antelope brush ecosystem?
3. Using information from the article, explain how land use by humans can result in habitat loss for plants and animals.
4. The Nk'mip First Nation (near Osoyoos) is trying to protect rattlesnakes and their habitat in this ecosystem. Why do you think the Nk'mip consider rattlesnakes to be important?
5. Do human needs or human wants result in more habitat loss for other species? Explain your answer.

3.5 Explore an Issue

Perspectives on Land Use

Ecosystems are affected by the decisions that people make about land use. People have different values and needs, so they have different ideas about how to use the land. In this activity, you will work in a group to explore a land-use issue. Then you will role-play a roundtable discussion to reach a decision about the issue (**Figure 1**).

Figure 1
People share different viewpoints during a roundtable discussion. These different perspectives combine to help provide a solution to a problem.

LEARNING TIP

To learn more about the steps to use in exploring an issue, see the "Exploring an Issue" section in the Skills Handbook.

The Issue

Identify a proposal for a change in land use that will affect local ecosystems. Here are some examples to start you thinking. You should identify a proposal from your own community, or a community near you.

- logging in a forested area
- opening up new land for agriculture

- developing a new landfill site
- opening up a natural area for new housing
- developing a recreational area, such as a ski hill
- setting aside a natural area as a park
- restoring streams in urban areas
- setting aside land for city gardens
- installing a basketball court in a neighbourhood park
- widening a highway

Background to the Issue

Identify Perspectives

Work in groups of four or five. Have each group member choose a role for the role-play. For example, you could be someone who is in favour of the land-use proposal, someone who is opposed, someone who has a few concerns, or someone who is not sure what to think. Use the following questions to help you identify the different perspectives:

- Why are people planning to change how the land is used?
- Are there people who think that the change is a good idea? How does the proposal meet their needs and values?
- Are there people who are opposed? How does the proposal affect their needs and values?
- Are there people who are not opposed but have a few concerns? What are their needs and values?
- Are there people who are undecided?
- Are there people who do not care? Why do they think the issue does not matter, or is it not important to them?

Gather Information

Research what the person you are role-playing is thinking and saying about the proposal. You may be able to get this information from news articles, the Internet, community groups, or Aboriginal Elders. Take careful notes so that you can accurately represent his or her perspective, whether or not you agree with it.

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LEARNING TIP

For help with researching, see the "Researching" section in the Skills Handbook.

Identify Possible Alternatives

When all the group members are ready, set up a roundtable. The table does not have to be round, but all the members should sit so that they face one another. Decide how you will take turns presenting your perspectives.

Role-play your chosen perspective. Be sure to suggest alternatives to the planned change in land use. These alternatives should not only meet the needs and values of the person you are role-playing, but also meet the needs and values of people with different perspectives.

Identify Criteria for Evaluating Solutions

Still in role at your roundtable, discuss to what extent your suggested alternatives

- meet the needs of community members
- respect the values of community members
- maintain biodiversity in the ecosystem

Make a Decision

Try to reach a decision at your roundtable on what the best course of action would be with respect to this land-use proposal.

Communicate Your Decision

As a group, write a brief report for your school newsletter or community newspaper. Explain your decision and the process you used to arrive at it.

CHECK YOUR UNDERSTANDING

1. Why is it important to consider different perspectives on an issue?
2. Why is it important to consider alternative solutions?
3. In what other situations might a roundtable discussion be useful?

Evidence for Climate Change

For years, scientists have predicted that climate change caused by global warming would first show up in the Far North. The people of Sachs Harbour on Banks Island in the Beaufort Sea know this is true from their own observations.

Rosemarie Kuptana (**Figure 1**) is from Sachs Harbour. Rosemarie's grandfather predicted that the icy ocean surrounding their home would get warm and the animals would suffer. Rosemarie now knows that both the scientists and her grandfather were correct. Climate change caused by global warming is easy to see in her community. Rosemarie is working to bring it to the attention of the world.

The Inuvialuit people of Sachs Harbour have been making observations about weather patterns in their area for much longer than the Canadian government has been collecting this information. They are therefore better able to identify any changes that are occurring. They have shared their indigenous knowledge with the scientists. They also helped make a video to warn the rest of the world about climate change.

On the video, the Inuvialuit people report early spring thaws and later autumn freeze-ups. They describe winter ice so thin it will not hold hunters—either humans or polar bears. They describe summer ice floes that are smaller now and farther out at sea, taking the seals that live on the ice floes beyond the reach of the people who need the seals for food. They show where the permafrost (permanently frozen ground) is melting, causing their house foundations to shift. They tell of finding sockeye salmon, which normally live 1500 km farther south, in the nets they set for Arctic char. They tell of seeing robins in the spring, a bird so rare this far north that there is no word for "robin" in their language. They tell of more frequent storms, which make fishing from boats more dangerous. They report experiencing thunder and lightning for the first time.

Figure 1
Rosemarie Kuptana organizes climate change observations made by the people of Sachs Harbour.

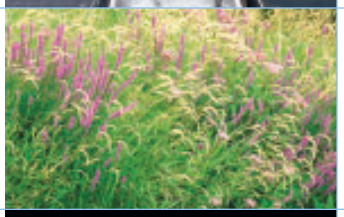
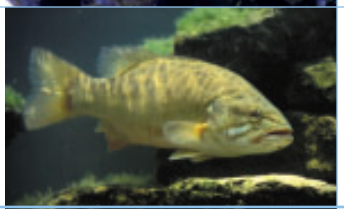
Rosemarie Kuptana took the video of her people's observations to a United Nations meeting on climate change in The Hague, Netherlands, in November 2000. Rosemarie is not only working to save her community. Melting Arctic ice will change weather patterns around the world, affecting all of us.

3.6 The Introduction of Non-Native Species

Non-native species are organisms that are living outside of their natural range. The introduction of non-native species is a lot like pollution. Non-native species can harm or destroy native species because they compete with them for food and water, or hunt them for food.

There are many examples of non-native species in British Columbia. **Table 1** lists several of them.

Table 1 Non-Native Species in British Columbia

Species		Description
bullfrog		large frog that was brought to British Columbia to be raised as restaurant food but was released when there was no market for frogs legs; eats native species of frogs, ducklings, garter snakes, songbirds, and even mice
domestic cat		pet that kills large numbers of songbirds
Atlantic salmon		non-native salmon that uses up spawning space and food supplies of Pacific salmon when it escapes from fish farms
purple loosestrife		garden plant that spreads and quickly takes over moist marshy areas; crowds out native plants that provide food and shelter for local animals
red-eared slider		pet that competes with endangered native species of turtles when it is released into the wild
smallmouth bass		popular fish with fishers, who have introduced it (illegally) into lakes and rivers in many parts of British Columbia; competes for food and habitat with native fish; eats juvenile trout and coho salmon fry

It is usually humans who introduce non-native species, either accidentally or on purpose. Non-native plants and animals can arrive on boats, mountain bikes, or hiking boots. They can escape from farms, gardens, and pet collections. Some people deliberately release their pets into the ecosystem because they think their pets will be happier or because they are tired of looking after their pets. Other people knowingly commit a crime by bringing wild animals from other countries here as pets. Fortunately, many people are involved in the attempt to control the introduction and spread of non-native species.

LEARNING TIP

What is your reaction to what you have read about the introduction of non-native species? Check your understanding by comparing your reactions with a partner. Offer an opinion about what should be done about this problem.

CHECK YOUR UNDERSTANDING

1. Use an example to explain how the introduction of a non-native species can decrease biodiversity in an ecosystem.
2. Suppose that a class in your school has been studying insects. In a science kit, the students obtained some insects called stick insects, sometimes called walking sticks (**Figure 1**). Stick insects normally live in a tropical climate. They reproduce quickly and eat leaves. One day, you notice that the window near the cage is open, and the stick insects are nowhere to be seen! Should you be alarmed? Explain why or why not.

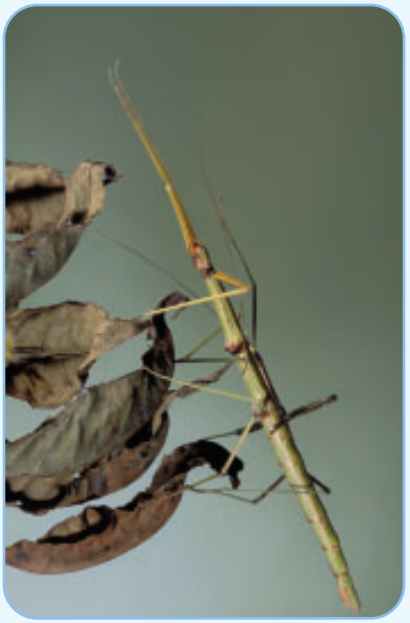


Figure 1

3. Your friend has always loved animals and has three pets: a cat, a corn snake, and a budgie. Lately, she has decided that it is cruel to keep animals in cages. She says that she plans to release all her pets into the wild where they will be free and happy. Write a letter to her, explaining all the reasons why this might not be a good idea.

3.7 Working to Preserve, Conserve, and Restore Ecosystems

Many people are concerned about the negative effects that humans have on ecosystems. They want to do something to help. They want to be caretakers, or stewards, of ecosystems. Taking personal responsibility for looking after an ecosystem is called **stewardship.**

Preserving Ecosystems

More and more, people recognize the need to keep safe from destruction, or preserve, the remaining ecosystems that have not yet been damaged by humans. People are working to preserve some of the remaining natural areas in British Columbia, such as the antelope brush ecosystem in the Okanagan and the Khutzeymateen Valley. Ecosystems that have already been damaged by humans also need our stewardship, however.

Conserving Ecosystems

People are learning how to conserve, or make wise use of, existing ecosystems. For example, the Guichon family is trying to graze cattle on their ranchland in a way that preserves the natural grassland ecosystem (**Figure 1**). The Guichons move cattle between small areas of grassland, allowing the land time to recover after the cattle have grazed there. They also plan the movement of cattle between areas to provide birds, such as ducks and sharptail grouse, with nest sites.

Figure 1
The Guichon family won an award for their careful observations of the effects of cattle grazing on grasslands near Merritt.

Restoring Ecosystems

People often help to restore or repair the damage to ecosystems that was caused by previous human activities. An example of this is the Salmon River Restoration Project.

The Salmon River flows through forest, grasslands, and rocky gullies before it empties into Shuswap Lake. In the fall, different species of salmon travel from the ocean to the river to spawn.

Agriculture is the main human use of the area surrounding the river. Over the years, agricultural activities have changed the river, thus changing living conditions for the salmon. For example, water was taken from the river for irrigation. Logging and grazing cattle removed vegetation from the banks of the river, reducing shade and increasing water temperature. Water running off the fields carried fertilizers into the river. The runoff also carried soil into the river, silting up the gravel that salmon need for spawning beds.

Farmers, scientists, Aboriginal peoples, government officials, and volunteers are involved in the Salmon River Restoration Project (**Figure 2**). Students from nearby schools have helped plant trees and repair areas of the river. People with many different interests are working together to restore this ecosystem, using roundtable discussions.

Figure 2
Cooperative landowners aid student volunteers in the restoration of the Salmon River.

LEARNING TIP

Pause and think. Can you explain the difference between preserving, conserving, and restoring ecosystems in your own words? If not, re-read the section before you move on.

Through preservation, conservation, and restoration projects, humans are having a positive impact on many ecosystems (**Figures 3 to 10**). These projects usually involve people from within the community and from outside. They all come together and work toward a common goal.

Figure 3
Steelhead are given a helping leap on the Bonaparte River.

Figure 4
Everett Crowley Park in Vancouver is on a former landfill site.

Figure 5
These bat houses were built by elementary students for bats that were left homeless. A fire destroyed their previous home in an old church.

Figure 6
The Kitlope Valley is a complete watershed, from its glacier peaks to the ocean floor. In 1994, a timber company gave up its rights to log this area.

Figure 7
Scientists and the Huu-ay-aht community (near Bamfield) are working together to bring back abalone stocks. Abalone are harvested as a food source and for their shells, which can be used in jewellery.

Figure 8
Thousands of wooden fish are shown in school and community "Stream of Dreams" fence murals. These murals remind local residents that their storm sewers are connected to a stream, river, or ocean.

Figure 9
To help burrowing owls, these volunteers are inserting large pipes into the ground in the grasslands ecosystem. The owls will be able to build their nests in the pipes.

Figure 10
Strathcona Community Gardens are located in East Vancouver. These city-sponsored gardens provide space for people to grow flowers and food.

TRY THIS: ***PRESERVE, CONSERVE, RESTORE***

Skills Focus: classifying

Look at **Figures 3 to 10**. Study the photos and read the captions. Decide whether each photo shows an attempt to preserve, conserve, or restore an ecosystem. Do some of the photos fit into more than one category? Discuss your decisions with a partner.

CHECK YOUR ***UNDERSTANDING***

1. List three ways that people can work together to make a positive impact on ecosystems. Give an example of each, and state whether biodiversity is being maintained or increased.
2. Aboriginal groups are working with scientists and community groups on many of the preservation, conservation, and restoration projects in British Columbia. In a small group, brainstorm reasons why the involvement of Aboriginal groups is important.
3. Suggest at least one way in which people could have a positive impact on an ecosystem in your area.

3.8 Learning to Lessen Our Ecological Footprint

We use resources to meet our basic needs, to make our homes and clothing, and to provide energy for heating and transportation. We also use resources to provide a huge number of things that we do not need. We want these things, however, because they make our lives more comfortable, interesting, or enjoyable. How people choose to live has an effect on ecosystems.

On the other hand, there are many ways that people can restore the damage done to ecosystems. There are also many ways that people can behave to have a smaller negative impact on ecosystems. You can think of your impact as follows: When you put down your foot, you leave a footprint. In a similar way, when you use resources, you leave a footprint on the ecosystem in which you live (**Figure 1**). In 1996, Mathis Wackernagel and William Rees, two researchers at the University of British Columbia, developed a way to measure this ecological footprint, using summaries of resources used and waste produced. Their goal was to make us think about our ecological footprint as part of our stewardship of ecosystems.

LEARNING TIP

Make inferences—read between the lines. Ask yourself, "What does the ecological footprint idea really mean? Why is it important? How does it affect me?"

Figure 1
How large is your ecological footprint?

TRY THIS: DETERMINE YOUR FOOTPRINT

Skills Focus: collaborating, analyzing

Many Web sites can help you determine how big your ecological footprint is, or how much nature you use in your daily living. Search for the term "ecological footprint" on the Internet. Complete a survey to measure your ecological footprint. Compare your results with a classmate's results. What are the similarities and differences?

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The David Suzuki Foundation in British Columbia is an organization that looks at how we can decrease our negative impact on nature (**Figure 2**). This organization has developed a list of ten ideas to help us use less nature in our daily living.

The Nature Challenge	
Reduce home energy use by 10%.	Choose a fuel-efficient vehicle.
Choose an energy-efficient home.	Walk, bike, carpool, or take transit.
Replace dangerous pesticides.	Choose a home close to work or school.
Eat meat-free meals one day a week.	Support car-free alternatives.
Buy locally grown and produced food.	Learn more and share with others.

Figure 2
Have you ever asked what you can do to protect nature? David Suzuki has researched the ten most effective ways you can conserve nature. He challenges you to do three of them.

Canadians are encouraged to choose three of the ten ideas and commit to following them for one year. Which three ideas could you commit to following? If some of the ideas would be impossible for you, explain why. Is there one idea that your whole class could commit to following?

CHECK YOUR UNDERSTANDING

1. What does the term "ecological footprint" mean? Why is it important for people to reduce their ecological footprint?
2. List three ways that you could lessen your ecological footprint, without help from anyone else.

3 Chapter Review

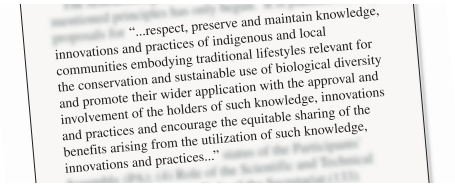
Human survival depends on sustainable ecosystems.

Key Idea: **Biodiversity keeps ecosystems strong and stable.**

Vocabulary

sustainability p. 60
biodiversity p. 60

Key Idea: **Indigenous knowledge can help us achieve sustainability.**


"...respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices..."

Key Idea: **Human activities can decrease biodiversity.**


Pollution


Habitat loss


Introduction of non-native species

Key Idea: **Humans can preserve, conserve, and restore ecosystems.**

Vocabulary

stewardship p. 78


Preserve


Conserve


Restore

Key Idea: **Humans can lessen their ecological footprint.**

Review Key Ideas and Vocabulary

When answering the questions, remember to use vocabulary from the chapter.

1. Why is biodiversity important in an ecosystem?
2. What is a sustainable environment? How can indigenous knowledge help us achieve sustainability?
3. In point form, list some of the ways that human activities have reduced biodiversity in your local ecosystem.
4. Name and describe three ways that humans can work to have a positive impact on ecosystems.
5. What is an ecological footprint? Why does its size matter?

Use What You've Learned

6. How might building your school and schoolyard have resulted in habitat loss for plants and animals?
7. Imagine that you are a plant or animal in your local ecosystem. You are suffering because of pollution or loss of habitat. Write a descriptive paragraph from the point of view of this plant or animal.
8. Research the reasons why people felt that a grizzly bear sanctuary was needed in the Khutzeymateen Valley. Find out about other sanctuaries or wildlife preserves, and the reasons why they were established.

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9. Why does the David Suzuki Foundation suggest eating meat-free meals one day a week? What is being conserved and how?
10. Choose one of the following situations. Create a cartoon, with captions, to show the effects this situation might have on your local ecosystem.
    a) A pet red-eared slider escapes.
    b) A person releases mink from a fur farm.
    c) A family moves to an apartment where pets are not allowed. They decide to let their pet cat live in the wild.
11. Abalone stocks are so low that it is illegal to harvest them off the coast of British Columbia. Use the Internet to research why abalone stocks are so low. What kind of restoration work is going on?

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Think Critically

12. Does any other species besides human pollute? Explain your answer.
13. Research a conservation or preservation society in British Columbia. Determine what the goals of this society are. Decide whether you would support this society, and give reasons for your decision.
14. Do you think that the ecological footprint of the average Canadian is larger or smaller than the ecological footprint of someone who lives in a less developed country, such as Haiti? Why?

Reflect on Your Learning

15. Describe how something you learned in this chapter will affect your future behaviour.
16. What topic or issue in this chapter would you like to investigate further? What questions do you still have? How will you find answers to these questions?