

# Organisms Depend on a Healthy Environment

**KEY QUESTION:** What impacts do humans have on the environment, and what can we do to keep the environment healthy?

## Looking Ahead

- Ecosystems change naturally over time.
- Human activities can alter the environment.
- The skills of scientific inquiry can be used to investigate factors that affect local ecosystems.
- Humans can do many things to protect the environment.
- The skills of scientific inquiry can be used to assess how technology affects the environment.

## VOCABULARY

succession	extinction
primary succession	invasive species
secondary succession	native species
biodiversity	steward
endangered species	

## Words of Wisdom

"Take care of the Earth and she will take care of you."  
—Unknown

"Humankind has not woven the web of life. We are but one thread within it. Whatever we do to the web, we do to ourselves. All things are bound together. All things connect."  
—Chief Sealth

"Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has."  
—Margaret Mead

"Our personal consumer choices have ecological, social, and spiritual consequences. It is time to re-examine some of our deeply held notions that underlie our lifestyles."  
—David Suzuki

"We do not inherit the Earth from our ancestors, we borrow it from our children."  
—Aboriginal proverb

"Those who contemplate the beauty of the Earth find reserves of strength that will endure as long as life lasts."  
—Rachel Carson

"If you talk to the animals they will talk with you and you will know each other. If you do not talk to them you will not know them, and what you do not know you will fear. What one fears one destroys."  
—Chief Dan George

"When one tugs at a single thing in nature, he finds it attached to the rest of the world."  
—John Muir

### LINKING TO LITERACY

#### Critical Literacy

Critical literacy is about the power of language. It involves using language to improve people's lives and to question unfairness in the world. Authors express their beliefs about the world through their writing; readers can analyze these messages by asking themselves why, how, and for whom a text was written. The reader can also look to see whose point of view is represented, and whose point of view is silent.

- 1 Read the quotes on this page. Work with a partner or a small group to analyze and critique each one. You may draw a table or chart to explain your thinking. Allow one column for each of the following headings:
  - Quote
  - Logic (How logical is the quote? Does it make sense?)
  - Accuracy (How accurate is the quote?)
  - Bias (Does the quote support one person or group more than another? Whose voice is not heard?)
  - Comments (What are your personal thoughts or feelings about each quote?)



# 6.1

## The Dynamics of Nature: Succession



**Figure 1** This parking lot has become overgrown with vegetation.

**succession:** a series of gradual changes that result in the replacement of one community of plants and animals by another

**primary succession:** succession that develops a community of plants and animals in an area where no living things existed before

### LINKING TO LITERACY

#### Marking the Text

You can use sticky notes to help you stay focused and reflect on your reading. As you read the following three pages, make note of key ideas, words you need to check for meaning, or questions you have about the topic. Write your thoughts on sticky notes. Place the sticky notes on each page alongside the text.

When you have finished reading, follow up on your notes. Is there information that you have to learn more about?

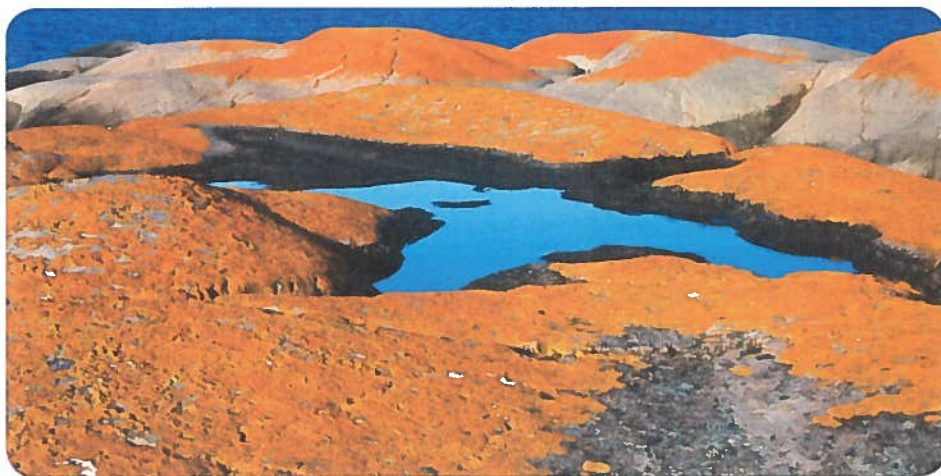
When you mark up your text and follow up on your notes, you develop a deeper, more complete understanding of a topic.

Have you ever noticed grasses or other plants growing in a vacant lot (Figure 1)? Eventually, bushes and trees will begin to grow, and animals will make their homes in the lot. Over time, ecosystems change.

Ecological **succession** is the predictable and orderly change over time in the types of organisms in an ecosystem. In succession, the dominant plant and animal species living in an ecosystem are gradually replaced by new species. This occurs in stages over many years. Plants play a key role in succession because they provide food and shelter for animals. The new, changed environment creates conditions that are ideal for new species. Over time, the community becomes more stable and succession slows down. Eventually, the community remains as is and simply renews itself.

### Primary Succession

**Primary succession** happens in areas where there has never been any life. Imagine that a volcano, landslide, or earthquake has created a large area of newly exposed bare rock. Lichens are the first organisms to “colonize” the bare rock (Figure 2). They begin the process of building soil. Lichens use photosynthesis to make food and to grow, and they produce acids that help them to absorb nutrients from the rock and the air. These acids break down the rock into soil. Lichens pick up some of the newly formed soil particles and other bits of debris as the wind blows over them. Once lichens are thick enough, mosses can live in the area. The death and decay of lichens and mosses also help build new soil. When enough soil gathers, small plants begin to grow. Plant roots continue to break up the rock and keep the existing soil in place. Eventually, the area develops enough soil for grasses and weeds to grow.

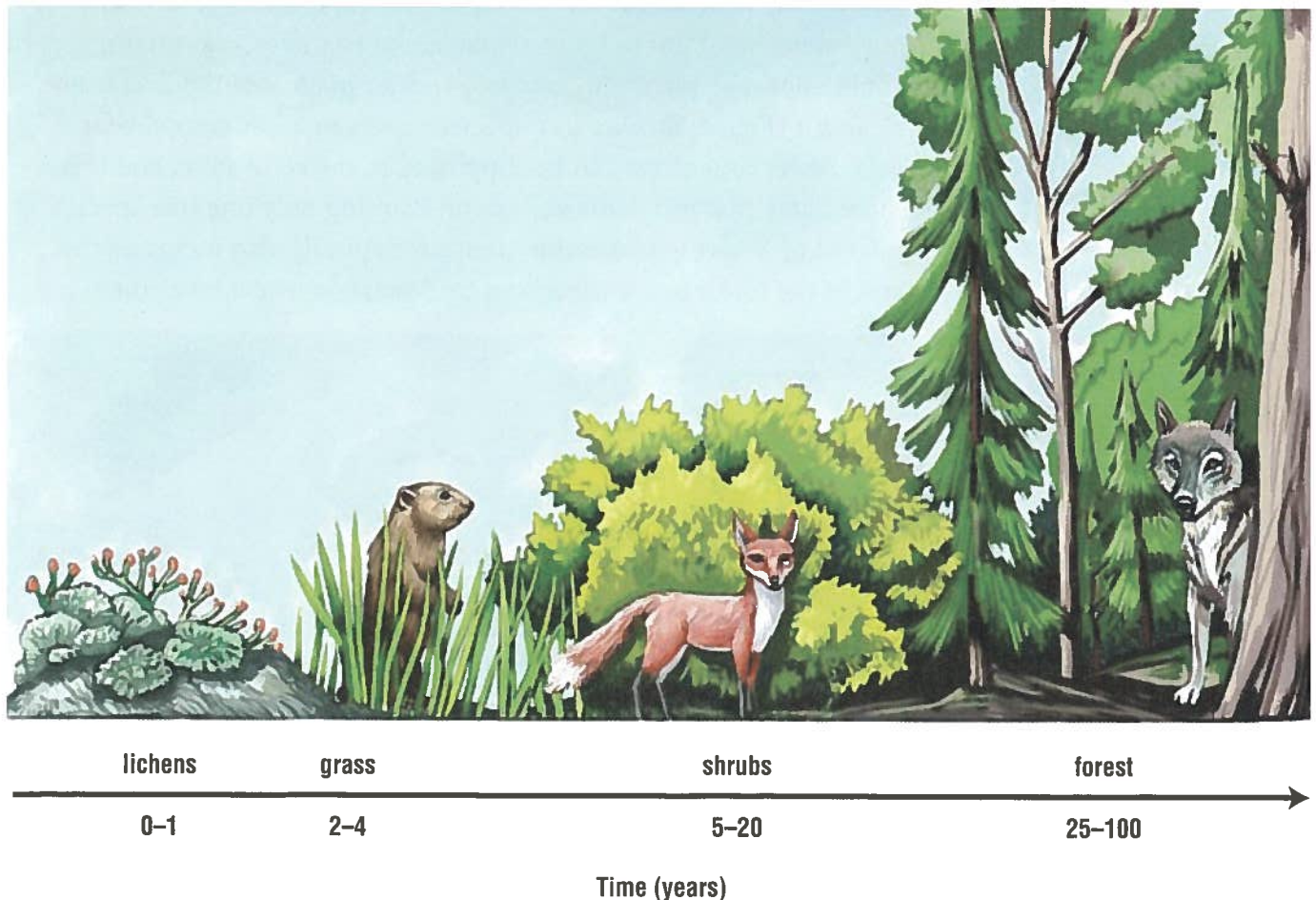


**Figure 2** Lichens form because of the interaction of an alga and a fungus. Lichens are the first organisms to appear in primary succession.

As each generation of plant grows and dies, more soil is created. This allows plants to grow even taller, and shrubs and other bushes begin to grow. As more shrubs grow, they out-compete the shorter plants, such as grasses, for resources. Shorter plants die out because they no longer receive enough sunlight to grow. The shrubs provide shade and more stable, moist soil for tree seedlings to develop. As the tree population expands, the trees out-compete the shrub species, and only shade-loving plants remain. The area eventually develops into a forest.

As each new plant species begins to grow, consumers that feed on that species move into the community (Figure 3). Grasshoppers and groundhogs feed on the grasses in the early stages of succession, but are replaced as more dominant species, such as shrubs and trees, cover the area and grasses die out. Caterpillars and squirrels move in to feed on the trees. Foxes, which feed on grassland animals, are replaced by wolves, which feed on forest animals. Grass-nesting birds such as sparrows are replaced by tree-nesting birds such as orioles.

In succession, early communities are quite simple, with few species interacting. As succession progresses, communities become more complex and contain many interactions.



**Figure 3** Succession is gradual; as plants change, so do the animals. Succession can take more than a hundred years.

## Secondary Succession

**secondary succession:** succession that develops a community in an area after it has been disturbed

**Secondary succession** is the slow change in species in an established community after the community has been disturbed. Examples of natural disturbances include forest fires and strong winds. Examples of human-made disturbances include cutting down forests for agriculture or urban development.

In secondary succession, soil already exists and needs to be revitalized. First, seeds from grasses and wildflowers blow in from neighbouring communities. The seeds grow on the exposed soil, enriching it over time. This enriched soil promotes the growth of bigger plants, such as blackberry bushes and birches (Figure 4). These plants provide food and shelter for animals such as deer mice, nesting birds, and garter snakes, which begin to move into the community. Eventually, larger trees begin to grow and out-compete the bushes and birches, pushing them out. Animals that prefer tall trees move in. Succession continues until the community re-establishes itself.

However, humans often interfere with succession. For example, clear-cutting a forest eliminates the entire forest ecosystem. Left alone, this area can recover through succession, eventually returning to a complex forest ecosystem. However, humans often replace complex ecosystems with simple ones designed for their own needs. These ecosystems tend not to be sustainable. For example, reforestation companies may plant only one tree species in an area that has been clear-cut (Figure 5). One tree species results in a less complex food web. Fewer organisms can be supported in the ecosystem, and it is more likely that problems will occur. Planting only one tree species instead of allowing succession to occur naturally also increases the risk of the forest being wiped out by disease or insect invasion.



**Figure 4** This area has been abandoned for some time. It is at the stage of succession where shrubs are starting to grow.



**Figure 5** Christmas trees often come from fir tree farms, such as this one. However, relatively few other organisms can live here.

### ✓ CHECK YOUR LEARNING

1. (a) What is primary succession?  
(b) Why are lichens so vital for primary succession?
2. What is the difference between primary and secondary succession?
3. A forest is clear-cut and left to regrow naturally. Describe the pattern of succession for the area.
4. Explain how humans interfere with succession. How does this negatively affect ecosystems?

# Human Impact on Ecosystems

What effects do human activities have on nature? Like all other living things, people can be in balance or out of balance with an ecosystem.

## Habitat Loss

Humans use land in many ways. Farming, building cities, mining, and even travelling can result in loss of habitat for other living things. Consider, for example, shopping malls. They are often built on farm fields or on “undeveloped” land (Figure 1). All the vegetation is cleared from the land so that it can be paved over or built on. The habitat for species in the local ecosystem is destroyed. The products sold in the mall are manufactured in other parts of Canada or the world. Manufacturing also contributes to habitat loss because factories all around the world destroy local habitats. In addition, some manufactured goods contain metal, which is obtained by mining. Mining can alter or destroy habitats. Humans pave over local habitats to build roads to transport goods and customers to the mall. You can see the impact that a shopping mall can have on an ecosystem!



**Figure 1** This shopping mall is sitting on prime farming land.

When forests are clear-cut, wetlands are drained, or meadows are paved over, habitat is lost. Habitat loss means that organisms that lived in these habitats have nowhere to go. Plants die because they cannot uproot and move. Some animals may die because they may not be able to travel far enough to find a suitable habitat. Animals that move to new communities may not be able to compete with the organisms already living there and may die. The end result of habitat loss is fewer organisms.

Land-use issues are complicated. It can be difficult to balance the needs of ecosystems and the needs and wants of humans. Humans need places to live, farmland on which to grow food, and jobs that may come from development. Our standard of living in Canada is very high compared to the rest of the world. It is time to think about how we can get what we want in ways that cause as little damage to ecosystems as possible.

### LINKING TO LITERACY

#### Topic Sentences

Locate the topic sentence in the paragraph under “Habitat Loss.” Often, the topic sentence will be the first sentence of the paragraph. In this case it is, “Humans use land in many ways.” This sentence tells you that the paragraph will be describing ways in which humans use land. Together, the subtitle and topic sentence give you a clue that the paragraph will also tell you about some of the ways in which habitat is lost.

When reading informational text, practise looking for the topic sentence in each paragraph. It will help you make a prediction about what you will be reading in the paragraph and remember key ideas.

## TRY THIS: Protecting Our Natural Heritage for Future Generations

### SKILLS MENU: analyzing, communicating

There are many organizations in Ontario and Canada working to protect habitat for future generations. In this activity, you will research some of these organizations to discover what they are doing to protect habitats.

**Equipment and Materials:** computer with Internet access

1. Select one of the following organizations to research: Greenbelt of Ontario, Ducks Unlimited, Nature Conservancy of Canada, World Wildlife Fund.

2. Use the Internet to research the organization you have chosen.

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- A. Choose an appropriate method to share your findings with the class, for example, a poster, multimedia presentation, or an oral report.

**biodiversity:** the variety of plant and animal life in an ecosystem


**endangered species:** species that are at risk of becoming extinct due to either reduction in numbers or an environmental threat

**extinction:** the complete disappearance of a species from anywhere on Earth

For more information on at-risk species in Ontario,

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## Habitat Loss and Biodiversity

For an ecosystem to be healthy, it needs a large variety of plant and animal life. The variety of organisms in an ecosystem is called **biodiversity**. Biodiversity can be used to measure the health of an ecosystem: the more varied the organisms in an ecosystem, the more interactions will take place. Loss of habitat can place a species at risk of becoming endangered (Figure 2). **Endangered species** are species that are in danger of becoming extinct. **Extinction** occurs when a species no longer exists anywhere on Earth! A species may become endangered because its population has been reduced, or because its population is being threatened by elements of the ecosystem (Figure 3). Loss of biodiversity can threaten the sustainability of ecosystems. 



**Figure 2** The Eastern Massasauga rattlesnake was commonly found in southern Ontario 50 years ago. Development and urbanization has endangered this species.



**Figure 3** The American chestnut has almost disappeared from eastern North America due to a fungus that was accidentally introduced into the population.

Earth's biodiversity provides many of the things humans need to live and enjoy life. For example, plants provide the raw material for a wide range of products. They also provide us with pleasant surroundings, and they help remove carbon dioxide from the atmosphere.

So far, scientists have identified close to 1.75 million species of living things. Most of these are small organisms, such as micro-organisms and invertebrates. Scientists estimate that there are between 5 and 30 million different species of organisms on Earth!

## Invasive Species and Biodiversity

**Invasive species** are species that are not normally found in a particular area. In most cases, they have been introduced into an area by human activities. Sometimes they are introduced by accident, and sometimes they are introduced purposely. Invasive species may be introduced into an ecosystem in many different ways. Invasive species can arrive on boats (Figure 4), trucks, or even people's shoes! They may also escape or be released from farms and pet collections (Figure 5). Common invasive species include pigeons and house sparrows. These birds were intentionally brought over to North America from Europe.

**invasive species:** a species that has been introduced into an area (accidentally or purposely) where it did not exist before; often reproduces so aggressively that it replaces some of the original species



**Figure 4** These zebra mussels were accidentally introduced to Lake Erie from Eastern Europe in the 1980s. Today, zebra mussels have spread to all the Great Lakes and are one of the worst invasive species in Ontario waters.



**Figure 5** The red-eared slider turtle was introduced to the Rideau River due to pet owners dumping their unwanted turtles. This invasive turtle species competes with native species for food and habitat.





When invasive species move into an area, they generally have a negative impact on the organisms in that ecosystem. Invasive species are not part of the existing food chains. They grow quickly and have few or less effective natural predators. They compete for the same resources as native species. **Native species** are species that have lived in an area for a long time and have adapted to the other organisms in the ecosystem. Because invasive species have few predators, native species are pushed out and the biodiversity of the area decreases. Kentucky bluegrass, for example, was introduced by American settlers for use in lawns. It spread into other communities and is now widespread in North American grasslands. A related species of bluegrass has become so common in Canada that it is known as “Canada bluegrass,” even though it is not a native species.

**native species:** species that occur naturally in an area



Table 1 shows other common invasive species in Ontario.

**Table 1** Some Invasive Species in Ontario and the Effects They Have on Local Ecosystems

Invasive species	Effects on ecosystems
 <p>Asian longhorn beetle</p>	<ul style="list-style-type: none"> <li>This wood-boring insect from China attacks healthy hardwood trees. It was introduced from wood packing material brought over in ships.</li> <li>Infested trees must be destroyed to prevent the beetle's spread.</li> </ul>
 <p>Garlic mustard</p>	<ul style="list-style-type: none"> <li>Garlic mustard competes with wildflowers that flower in the spring, such as spring beauty, wild ginger, and trilliums, stealing light, moisture, nutrients, soil, and space.</li> <li>Organisms that depend on these early plants for food soon disappear.</li> </ul>
 <p>Zebra mussels</p>	<ul style="list-style-type: none"> <li>Zebra mussels carried by ocean ships clog water intakes at treatment plants.</li> <li>They remove much of the plankton and other essential food sources at the bottom of the food web.</li> <li>Populations of native mussels, clams, and small fish disappear.</li> </ul>
 <p>Purple loosestrife</p>	<ul style="list-style-type: none"> <li>This garden plant was introduced from Europe by ships crossing the ocean.</li> <li>It out-competes native plants in wetlands and wild meadows.</li> <li>It clogs up irrigation systems and interferes with the recreational enjoyment of ponds and lakes.</li> </ul>

**LINKING TO LITERACY**

**Summarizing**

Think about what you read in this section. How much do you remember? How easily can you summarize “Human Impact on Ecosystems?”

Read the text again, but this time use sticky notes to mark the topic sentences you located earlier. Next, re-read the topic sentence for each paragraph, one after the other. Do these help you to remember important details more clearly? Is it easier to summarize the text?

Locating topic sentences as you read will help you keep important information in mind and summarize your reading afterward.

Fortunately, many people are trying to control the spread of non-native species. Volunteers spend many weekends removing invasive plant species from sensitive habitats. Creating your own natural habitat at school or home, if done carefully, can give back valuable resources to the original plants and animals that used to live there.

To learn more about invasive species,

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**CHECK YOUR LEARNING**

1. What is habitat loss?
2. (a) What is biodiversity?  
(b) How are habitat loss and biodiversity connected?
3. (a) Define invasive species and native species.  
(b) How do invasive species cause harm to the environment?  
(c) Name two invasive species found in Ontario and explain how they harm the environment.

# The Trouble with Invasive Species

In this activity, you will research invasive species in Ontario and determine an action plan to help control, or eliminate, that species.

## SKILLS MENU

- |  |  |
|--|--|
| <input type="checkbox"/> Questioning           | <input type="checkbox"/> Performing    |
| <input type="checkbox"/> Hypothesizing         | <input type="checkbox"/> Observing     |
| <input type="checkbox"/> Predicting            | <input type="checkbox"/> Analyzing     |
| <input type="checkbox"/> Planning              | <input type="checkbox"/> Evaluating    |
| <input type="checkbox"/> Controlling Variables | <input type="checkbox"/> Communicating |

## Purpose

To investigate an invasive species in your area and develop a plan to lessen the impact of that species on the environment.

## Equipment and Materials

- map of Ontario
- computer with Internet access
- field guide to invasive species (optional)



map of Ontario



computer with Internet access



field guide to invasive species

## Procedure

1. Obtain a map of Ontario from your teacher. Working in groups, use the map to select an area close to your community. Try to choose an area that you can visit and study first-hand.
2. Find out which invasive species are found in your selected area, including species found in lakes or rivers. You can use field guides or the Internet to identify invasive species in your selected area.

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3. Once you have identified the invasive species in your area, choose one that is both common and destructive. Research how to recognize it, how it was introduced to the area, how it affects the balance within the ecosystem, and how well-established it is.

4. Research solutions that have been suggested to remove your invasive species from the area. Local naturalists' clubs, hunters' and anglers' associations, plant nurseries, Aboriginal Elders, farmers, and Conservation Authorities may provide you with information.
5. Create a three- to five-point plan of action to eliminate the species from the area, or to slow its spread. Make sure your solutions do not cause harm to the environment.
6. Create a brochure for the community that summarizes your research. It should also provide information about what people can do to eliminate the species or stop or slow its spread.

## Analyze and Evaluate

- (a) Why has your selected invasive species been able to become so established in the environment?
- (b) Predict which of the points in your action plan will be most successful. Explain.
- (c) Why might it be more effective to stop invasive species from entering a specific habitat as opposed to trying to remove such a species once it is already established?

## Apply and Extend

- (d) Determine if there is a group that you can contact to put your plan into action. How might you encourage them to take action?

**Unit Task** Can you use any of the points in your action plan in the Unit Task?

# 6.4

## Protecting the Environment

### LINKING TO LITERACY

#### Graphic Organizers: K-W-L Chart

Before you read this section, make a K-W-L chart in your notebook. Draw three columns and use the following headings: What I Already **K**now; What I **W**ant to Know; and What I **L**earned.

Before you read the section, write what you know about protecting the environment in the first column. As you read, add any further questions you may have to the second column. When you finish reading the section, complete the third column.

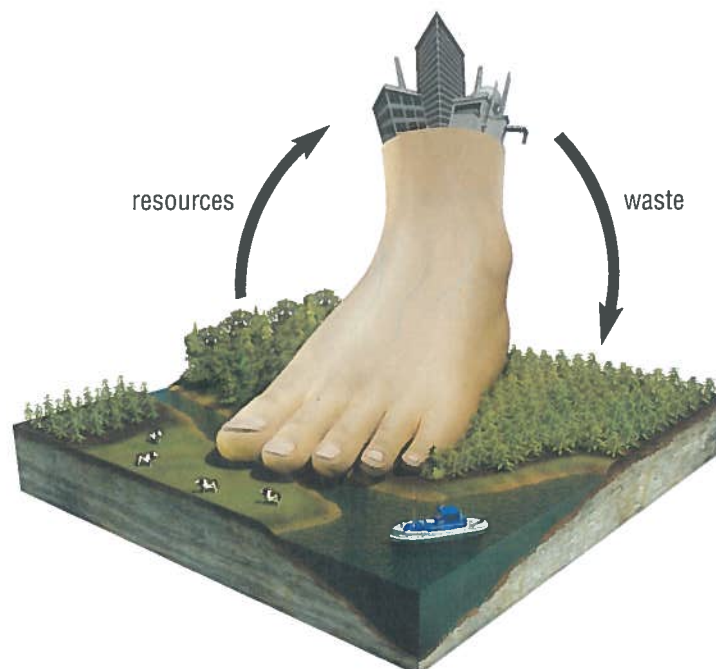
The K-W-L chart is a great tool to help you stay focused and make connections to your reading.

We depend on healthy ecosystems to meet our basic needs: to grow our food, to provide us with clean water, and to supply us with building materials and clothing. We also need someplace to put our waste. We use Earth's resources to provide us with energy. We use this energy for heating, transportation, manufacturing, and many other things.

We also use Earth's resources to make many things that we want, but do not necessarily need. How much we take from nature depends on our daily habits and the choices we make. How can we satisfy both our needs and wants in a way that does not hurt our environment? How can we live in a sustainable way?


### Ecological Footprints

In 1996, Matthias Wackernagel and William Rees, two researchers at the University of British Columbia, developed a way to measure human demand on Earth's ecosystems. They called this measure the "ecological footprint." An ecological footprint estimates the amount of land and water needed to regenerate the resources a human consumes, as well as to absorb the waste produced. Ecological footprints are used to make people aware of how much of Earth's resources we use. The more we consume, use, and throw out, the larger our individual footprint (Figure 1). The more we conserve and use only what we need, the smaller our individual footprint. The impact that humans have on the environment is a product of our population size and the total of our individual footprints.



**Figure 1** An ecological footprint compares human demand on nature with the ability of Earth's ecosystems to regenerate those resources.

North Americans have extremely large individual footprints. The average North American requires 12.4 hectares of Earth's space to support his or her lifestyle. Based on current consumption and population trends, Earth can provide only two hectares for every person on the planet. If everyone lived the way people in North America do, we would need at least three more planets to sustain the human population!

We need to be willing to decide which is more important: our wants, or our need for a healthy planet. Making this decision is part of becoming a responsible environmental citizen. We can all do things to reduce our ecological footprint. Making changes will then lessen our impact on ecosystems. 

To learn more about ecological footprints and ways to reduce them,

[Go to Nelson Science](#) 

## **TRY THIS:** Determining Your Ecological Footprint

**SKILLS MENU:** predicting, evaluating

In this activity you will determine your ecological footprint and explore ways to reduce your footprint.

**Equipment and Materials:** computer with Internet access; chart paper; markers

1. Find an ecological footprint calculator on the Internet and use it to determine the size of your ecological footprint.

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2. Compare your results with others in your group.

- A. Create a list of ten practical things that you and your peers can do to reduce the size of your ecological footprint.
- B. Some of the ways of reducing your footprint are harder to accomplish than others. Select one or two ways that would be difficult for you to do and explain why.
- C. How might the adults in your life score on this? Explain.
- D. Is there one thing that your entire class could commit to doing that would lessen your ecological footprint?

## Stewardship of Earth

More and more people are concerned about the negative effects that humans have on ecosystems. They want to do something to help. People can become stewards of the environment. A **steward** is a person who carefully manages a resource. To become stewards, we first have to learn about the environment. Secondly, we have to change some of our behaviours in order to care for the environment. Thirdly, we have to tell others about what we have learned and how they can help, too. An acronym for STEWARD is someone who does the following:

- Sustainably uses resources.
- Trains others to become stewards.
- Educates himself or herself about environmental concerns.
- Works to repair damage to the natural environment.
- Acts to save the environment and change policies.
- Reflects on her or his behaviour and personal impact.
- Decides to get involved!

**steward:** a person who carefully manages a resource by taking responsibility for their actions and educating others

## Preserving, Conserving, and Restoring Ecosystems

### Preserve

Stewardship means taking responsibility for your own actions. People across Ontario and Canada recognize the need to preserve areas that have not yet been damaged by humans. There are some areas of untouched boreal forest in northern Ontario that should be protected from being logged in the future (Figure 2).



**Figure 2** Preserving areas of untouched wilderness helps to maintain Earth's biodiversity.

### Conserve

Conserving ecosystems means using ecosystems wisely. Traditional farming methods use chemical fertilizers and pesticides on soil and crops to help grow as much as possible. Organic farming methods use compost and biological pest control techniques to keep soil productive without destroying the natural balance in the soil. Conventional farmers can also be environmental stewards of their land. They can reduce the amounts of chemical fertilizer that they use. They can also use farming practices that help protect the soil.

We create a lot of waste that we usually put into landfill sites. These sites displace natural habitats. Garbage in landfill sites can contribute to air, water, and soil pollution. In improperly built landfills, water from rain and snow soaks through the waste, carrying contaminants into the soil and groundwater. The solutions are not simple. Still, there is something we can do to help. The “3 Rs” is a simple method of addressing the amount of garbage we produce: reduce, reuse, and recycle. We can reduce the amount of garbage we produce by buying goods that have little or no packaging. We can also buy fewer unnecessary things. Household items such as jars, boxes, paper, and clothing can be reused. Towns and cities have recycling programs (Figure 3). Glass and aluminum are melted down and reused. Paper is recycled into cardboard. Some plastics can be made into other products. We can recycle food waste using a backyard composter or by using the green bin recycling programs that some municipalities offer.



**Figure 3** The more we recycle, the more we help conserve ecosystems.

## Restore

We can restore ecosystems by taking steps to repair the damage done by human activity. Restoration projects can be as simple as planting trees to repair soil erosion, or as involved as building nest sites for birds such as loons, ospreys, and terns (Figure 4).



**Figure 4** (a) An osprey lands on a human-made platform. Osprey populations have increased as a result of these platforms. (b) People built artificial islands for terns, who like to nest on outcroppings in the water.

Biodiversity is important to healthy ecosystems. Homes and businesses displace plants and animals in local ecosystems. This means that there are fewer plants available to take up carbon dioxide from the air. Many towns and cities are finding ways to restore ecosystem biodiversity by creating more green spaces. Individuals can promote biodiversity by replacing lawns with a wider variety of plant species (Figure 5). This provides food and shelter for local wildlife. Using native plants in gardens also improves local biodiversity.

There are many small steps you can take to make big changes to the impact you have on Earth. Turn off lights and computers when you have finished using them. Shut off the water while you brush your teeth. Support environmental projects to save endangered species or to prevent pollution. All the steps you take will help you to become a “Steward of Earth.”



**Figure 5** Gardens with lots of different plants provide a better habitat for local birds and insects.

### Unit Task

When you choose an area for the Unit Task, decide whether you will preserve, conserve, or restore the area.

## ✓ CHECK YOUR LEARNING

- (a) What is an ecological footprint?

(b) How many hectares of land does a North American need to sustain him or herself?

(c) How many hectares are available for each human on Earth?
- What is meant by conserving ecosystems?
- How does organic farming help to conserve ecosystems?
- What problem is created by improperly built landfill sites?
- Name two ways in which people can help restore ecosystems.

## Traditional Knowledge and Stewardship of Earth

Poems are often used in Traditional Knowledge to express connections between humans and nature. Read the following poem.

*The old man  
Must have stopped our car  
Two dozen times to climb out  
And gather into his hands  
The small toads blinded  
By our lights and leaping, live drops of rain.  
The rain was falling,  
A mist about his white hair  
And I kept saying  
You can't save them all,  
Accept it, get back in  
We've got places to go.  
But, leathery hands full  
Of wet brown life,  
Knee deep in the summer  
Roadside grass,  
He just smiled and said  
They have places to go to  
Too.*

—Joseph Bruchac,  
"Entering Onondaga"



### What Is Traditional Knowledge?

Traditional Knowledge is the experience, wisdom, and practices gained by Aboriginal peoples over many generations. It is developed from centuries of close interaction with the local environment. Traditional Knowledge includes such areas as farming, fishing, health, forestry, hunting, and environmental management. It is passed from generation to generation through stories, poems, music, art, rituals, and laws.

Aboriginal peoples share knowledge by telling stories. These stories help explain complex relationships found in nature (Figure 1). Many of the stories show the relationships among living things and their environment. Traditional Aboriginal peoples understand very well how all things are interconnected. They also understand how important it is for humans to live in harmony with nature. This knowledge can help us change our attitudes and behaviour in order to protect our planet.



**Figure 1** Passing down stories from generation to generation is one form of Traditional Knowledge.

## The Value of Traditional Knowledge

Today more and more people are recognizing the value of Traditional Knowledge. This knowledge is valuable not only to those who depend on it in their daily lives, but to modern industry, farming, and society. It has also begun to play a key role in public education.

Many Aboriginal communities are located in areas that have large amounts of natural resources. These communities have cultivated and used the local land and organisms in a sustainable way for thousands of years. Because their way of life is so connected to the land, they work hard to maintain healthy ecosystems. We can learn from their skills and techniques for managing the land and its resources. For example, the Ontario Ministry of Natural Resources and the Anishinabek Nation have agreed to work together to help manage the Great Lakes water systems in a sustainable way. The Anishinabek Nation includes seven different First Nations that live in Ontario.

On a more local level, the Willow Beach Field Naturalists and the Alderville First Nation have teamed up to restore and manage the Alderville Black Oak Savannah, an area south of Peterborough. This fragile and rare area consists of grassland with oak and pine trees scattered through it. The Alderville Savannah was once a vast grassland with many wild blue lupine flowers. The Karner Blue butterfly (Figure 2), which depends on this flower for survival, was once common in the savannah. However, much of the savannah has been lost to development. As a result, the Karner Blue butterfly has not been seen in Ontario since 1979. The First Nation and the naturalists are planting blue lupines in an effort to restore the ecosystem. They hope that the Karner Blue will return to the area. The Willow Beach Naturalists and the Alderville First Nation have the same goal: to protect Ontario's unique natural habitat, as well as species at risk.



**Figure 2** The Karner Blue butterfly is a small butterfly about the size of a nickel. The female will only lay her eggs on blue lupines.

To learn more about the Alderville Savannah and the Karner Blue,

[Go to Nelson Science](#)



### ✓ CHECK YOUR LEARNING

- (a) What is Traditional Knowledge?

(b) How is Traditional Knowledge passed on from generation to generation?
- In what ways can Traditional Knowledge help Ontario strive toward sustainability?
- What is the message in the poem at the beginning of this section?



## SKILLS MENU

- Defining the Issue
- Researching
- Identifying Alternatives
- Analyzing the Issue
- Defending a Decision
- Communicating
- Evaluating

## Potential Solutions to Traffic

Traffic congestion in our urban centres gets worse every year (Figure 1). It takes drivers more time to get to where they are going, and it costs more to drive their cars. Drivers are frustrated. More time spent on the road also means that cars use more gas and produce more exhaust, which causes more air pollution.

Solving traffic problems is not easy. People depend on cars to get to work or school, and most of the goods we buy are shipped to stores in trucks. What changes can we make to help solve the traffic problem without inconveniencing people or denying them basic needs? How do we make those changes? Which solution is better for the environment or local ecosystems? If a solution is good for the environment but inconvenient for people, what compromises should we make?



**Figure 1** How do we relieve the amount of traffic congestion in our urban centres?

### The Issue

You have been hired by your city council to propose solutions to traffic congestion in and around your city. Currently, the roads and highways cannot handle the amount of traffic, and the public transportation system is not big enough to meet people's needs. Pollution from vehicles is affecting people's health, especially the young and the elderly. Your job is to find possible solutions, analyze their costs and benefits, and determine which solution solves the traffic problem and has the least impact on the local environment.

## Goal

To recommend a method, or methods, of reducing traffic congestion that is both effective and environmentally friendly.

## Gather Information



Working in groups, investigate ways to reduce traffic congestion. Brainstorm a variety of strategies before you start your research so that each person investigates a different strategy. As you analyze your strategy, ask yourself: What are the benefits to human populations? What are the drawbacks? Are there any negative repercussions to local ecosystems? Does it reduce air pollution? What are the economic and social implications? Is it practical? How will the strategy be maintained?

The Internet, local police or traffic control centres, local transit commissions, and newspaper articles may provide you with more information. If you are doing an Internet search, what key words can you use?



## Identify Solutions

Once you have finished your research, discuss which strategy is the most effective and the most environmentally friendly. You may decide to combine some of the strategies.

Consider the following ideas to help identify possible solutions:

- widening highways and major roads
- increasing access to public transit
- imposing a higher tax on gasoline
- introducing toll roads and dedicated lanes for carpooling
- introducing bylaws that stop vehicles from entering urban areas on certain days
- increasing the cost of parking

## Make a Decision

Upon reviewing your group's research, what will you recommend to city council? Be sure to support your position with evidence.

## Communicate



Present your group's recommendation to your class. The class will act as city council. Explain why your method or combination of methods is the most effective and friendly to the environment. Discuss as a class which of the methods presented seems most feasible after all the groups have made their recommendations.

## LINKING TO LITERACY

### Critical Literacy: Taking Social Action

Critical literacy text gives readers an opportunity to look at ways of taking action on important social issues. Explain why you believe traffic to be a social issue.

What is the purpose of the research activity outlined here? Who stands to benefit from your presentation? Whose opinions might not be represented? How might you use what you learned from this activity to take action on an important social issue in your community?

## Organisms Depend on a Healthy Environment

### BIG Ideas

- Ecosystems are made up of biotic (living) and abiotic (non-living) elements, which depend on each other to survive.
- Ecosystems are in a constant state of change. The changes may be caused by nature or by human intervention.
- Human activities have the potential to alter the environment. Humans must be aware of these impacts and try to control them.

### Looking Back

Ecosystems change naturally over time.

- Succession is the slow and predictable process in which the dominant species in an ecosystem are replaced by new species.
- Primary succession is succession that happens in places where no living things have existed previously.
- Secondary succession is succession that happens when an existing habitat has been disturbed by a natural or human-related event such as a forest fire or logging.



Human activities can alter the environment.

- When humans develop land and take resources from the environment, it results in habitat loss for local species. This alters, and sometimes destroys, the local ecosystem. Habitat loss can reduce biodiversity. Some species may become endangered or even extinct.
- Species that are introduced into areas where they are not normally found can become invasive species. They can reduce local biodiversity by out-competing native species.



**The skills of scientific inquiry can be used to investigate factors that affect local ecosystems.**

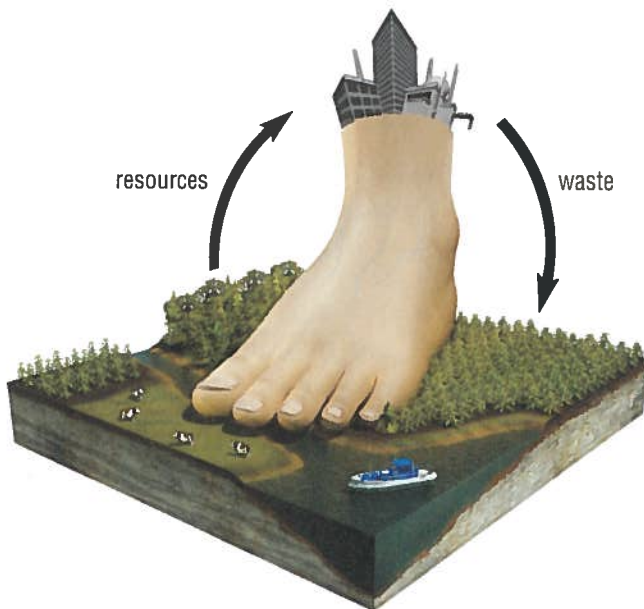
- Research skills can be used to learn more about the effects of invasive species on local ecosystems.
- Research skills can be used to learn more about ways to control or eliminate invasive species in an ecosystem.

**Humans can do many things to protect the environment.**

- We can measure our ecological footprint to learn how our consumption of natural resources affects the environment.
- By becoming stewards of the environment, we can preserve, conserve, and restore ecosystems.
- Buying less reduces the amount of waste we produce. Recycling waste and reusing items are ways to help the environment.
- We can help restore ecosystems and increase biodiversity by planting native species and building habitats for local species.
- Using the Traditional Knowledge of Aboriginal peoples can help us to be better stewards of the environment.

**VOCABULARY**

- succession, p. 148
- primary succession, p. 148
- secondary succession, p. 150
- biodiversity, p. 152
- endangered species, p. 152
- extinction, p. 152
- invasive species, p. 153
- native species, p. 153
- steward, p. 157














**The skills of scientific inquiry can be used to assess how technology affects the environment.**







- Research skills can be used to determine how traffic, and factors associated with traffic, affect the environment.
- Research skills can be used to learn about ways to solve problems associated with traffic.




### What Do You Remember?

1. What is the difference between an endangered species and an extinct species? 
2. What is an “ecological footprint”?  
3. Preserving, conserving, and restoring are three methods of helping to prevent habitat loss. Give an example of each. 
4. (a) What are the environmental “three Rs”?  
(b) Explain how each one helps the environment. 
5. Explain in your own words the meaning of “sustainability.”  
6. Define “succession” in your own words. 
7. Why is the grass in a garden lawn considered an invasive or non-native species? 
8. How does Traditional Knowledge help us to live in a more sustainable way? 
9. Why is biodiversity so important to healthy ecosystems? 

### What Do You Understand?






10. List three human activities that have reduced biodiversity in your area. Explain how they have reduced biodiversity. 
11. (a) Are humans the only species that harm the environment?  
(b) Make a list of other organisms that may cause harm.  
(c) Under what circumstances might other organisms harm an ecosystem? 
12. Why has the expansion of urban centres become a concern? 
13. List some of the ways that we can protect our natural habitats from invasive species. 
14. A mnemonic is a strategy that helps you remember something. Make up your own environment-based mnemonic for STEWARD.  

### Solve a Problem!

15. Drinking bottled water has become a growing trend in the last several years. Is it safer than tap water? Should companies be allowed to sell water? Use the Internet to research the pros and cons of bottled water. Decide whether this is a good thing for the planet. Be sure to justify your decision. 

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16. Taxing items is a way for governments to get people to stop or reduce harmful activities. Both cigarettes and alcohol are heavily taxed for this reason. Suggest some things that could be taxed to help us decrease our ecological footprint. For each one, explain how the tax might help. 
17. We have to make some changes in our daily lives to live in a more sustainable way.
  - (a) What changes are you willing to make to ensure a healthier planet for the future? Explain why each of the changes would be effective.
  - (b) Share your “top 10” list with your classmates.
  - (c) Note changes that others have placed on their lists that do not appear on your list. Will you keep your list the same or will you change it? Follow through with your decision.  
18. Changing attitudes and behaviours is not easy to do. It helps if making a change is a positive experience. From all that you have learned in this chapter, particularly about our ecological footprint, create two lists with the titles “Top Ten Changes for Students” and “Top Ten Changes for Adults.” These changes should help promote a healthier planet and be reasonable to make.  



19. Urban sprawl is what occurs as cities increase in size. Urban sprawl results in a loss of biodiversity.
- Outline a plan to increase biodiversity in a nearby natural setting (for example, a lawn consisting of grass and one tree, or the front of a building with a few trees).
  - What effect would adding a bird feeder or a water feature such as a birdbath or pond have on the area you selected?
  - What are some of the advantages of biodiversity? **A C**
20. Revisit the quotes at the beginning of the chapter.
- What is the value of quotes such as these?
  - Create your own environmental saying that summarizes the chapter. Write it on a sheet of paper and display it in the classroom. You may want to add diagrams or pictures. **A C**
21. Every year, there are fewer and fewer monarch butterflies (Figure 1). Use the Internet to research the plight of the monarch butterfly.
- Devise a plan to help restore monarch populations in your area.
  - Devise a campaign strategy to promote your monarch rehabilitation plan. **A**
22. Using carpools and taking public transportation would certainly help reduce our ecological footprint by reducing fuel consumption. Make a list of the pros and cons of these two methods of reducing fuel use. Should there be laws to make people carpool or take the bus? Explain. **A C**
23. (a) Write a poem that expresses your views about sharing this planet with other species.  
 (b) Share your poem with a friend or your family.  
 (c) Why is writing a poem about the environment and sharing it with friends and family a good thing to do? **C**
24. The energy bills in your school have increased tremendously in the past few years. Develop a plan to reduce the school's energy bill. Find out what types of energy are being used in the school and what they are being used for. Devise ways to reduce energy consumption. Once the school starts following your plan, how will you know if your plan was effective? **T/I A**
25. What is your "wish list" for a healthy planet? Create a poster or collage to express your views. Invite others to evaluate the ideas you have represented and to make suggestions for what they think could be missing. What can you do with your poster to help others become better stewards of the environment? Why would this have an effect? **A C**

### Create and Evaluate!

### Reflect on Your Learning

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**Figure 1**

## Naturalizing Your Community

You have learned about interactions that take place within ecosystems and how all living and non-living things are interconnected. You have also learned that humans have positive and negative effects on ecosystems. All organisms depend on healthy ecosystems for survival. If we can increase the natural habitats in our neighbourhoods, both humans and other organisms will benefit.

“Naturalizing” means improving an area to increase its beauty and its usefulness to wildlife. This is done by planting vegetation and making changes to the area that will attract organisms. More and more people are seeing the value of naturalizing their communities (Figure 1).



**Figure 1** (a) Sudbury was one of the first communities in Ontario to restore the local environment. (b) Sudbury looked very different in the 1970s before the local ecosystems were restored.

### Purpose

To select an area in your neighbourhood and prepare an action plan to naturalize that area.

### Equipment and Materials

Read the Procedure carefully. Write a list of Equipment and Materials that you will need to perform the Task.



### Procedure

1. Working in groups of four, investigate the community around your school or home to find an area that can be naturalized. This area can be any size and may include your school grounds, an empty lot, a neighbourhood street, or even an existing park.
2. Before beginning step 2, make sure you have a notebook to record all of your information and steps in planning. Determine which environmental factors affect the area you have chosen. For example, is there a source of water? Is there enough soil to encourage plant growth? If there is a human influence, where is it most visible? Make a list of these factors.
3. Describe the ecosystem(s) that you want to protect, restore, or enhance in this area. Include the biotic and abiotic elements, and interactions within the ecosystem, that your plan will encourage.
4. A natural habitat includes native species. Make a list of native plants currently growing in your area and plants that you would like to plant in your area. Determine whether there are any invasive species currently in your area.

5. Draw possible food webs and food chains for your area.
6. How is the area currently being used? Will naturalizing this area encourage human activity or will it reduce it? What rules for using the area might be needed?
7. What safety issues need to be considered? How can you attract individual species and keep the human population safe?
8. Determine whether your plan for your area will preserve, conserve, or restore an ecosystem.
9. Use the information you have gathered to create a plan for your area. Draw a diagram that shows what the area would look like if your plan were completed. Include a picture of what the area currently looks like. Include a way to represent the organisms that you expect to inhabit the area. Also, indicate the abiotic elements of the area and any other important landscape features.
10. Your plan should include the possible new (or changed) food chains or food webs that could occur in the area.
11. If invasive species are a problem, indicate how you will address the problem.
12. Develop a plan to maintain the health of this ecosystem for future generations.

## Analyze and Evaluate

- (a) Describe your plan's benefits to the organisms that will inhabit the area.
- (b) How will your plan benefit humans today and in the future?
- (c) Will your plan have any negative effects? If so, what are they?
- (d) Describe how completing this activity has affected your understanding of ecosystems.

## Apply and Extend



- (e) Prepare a summary of your plan in the form of a presentation.
- (f) Present your plan to your class and discuss whether you have missed or neglected anything. Determine how your plan is similar to and different from the other plans.
- (g) How has this project influenced your class?
- (h) Discuss next steps. What might your class do to put your plans into action?

## Assessment

You will be assessed on how well you

- show your knowledge and understanding of the local ecosystem
- observe your area and gather evidence about what types of organisms can live in your area
- develop a reasonable plan to naturalize your area
- organize your ideas in your plan
- propose practical solutions for naturalizing your area
- evaluate the impact that your plan will have on organisms that will inhabit the area, as well as on humans living nearby



# Interactions in the Environment

### Make a Summary

Each Chapter Review lists the new words and terms that were introduced in the chapter. Use these vocabulary lists to help you complete the following activity.

### Equipment and Materials

- sticky notes or small pieces of paper
- markers
- chart paper

### Procedure

1. In groups of three or four, write each of the vocabulary words from each chapter on the sticky notes (or paper). Write one word (or one term) only on each note.
2. Copy the fishbone organizer in Figure 1 onto the chart paper. The fishbone organizer in Figure 1 is just a start. Other “bones” could include “limiting factors,” “benefits of protecting the environment,” “energy and food chains/webs,” “human activity and perspectives,” and “cycles and sustainability.”

3. Organize the words on the sticky notes onto the chart paper under the appropriate headings.
4. Below each group of words, write one sentence that describes an important idea from the unit that is associated with that group of words.
5. Use these sentences as the basis of one or two paragraphs that summarize your learning.

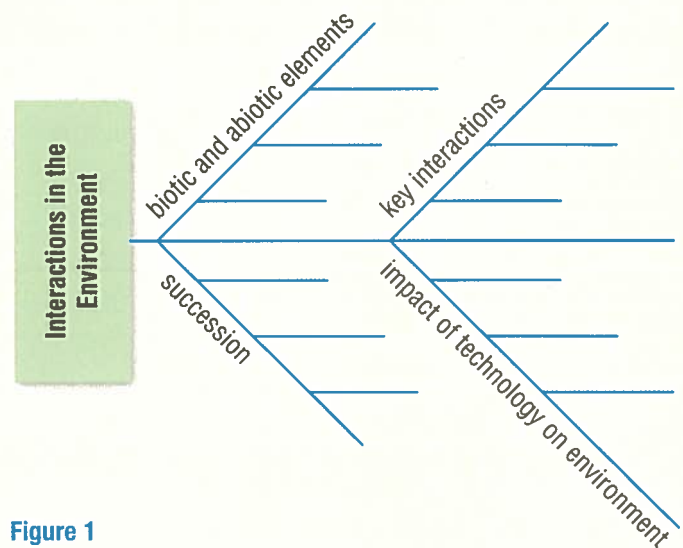


Figure 1

## Unit Review Questions

### What Do You Remember?

1. What are the essential abiotic elements of an ecosystem? **K/U**
2. What is the difference between a habitat and an ecosystem? **K/U**
3. For each of the following, state two ways that they are important to life: sunlight, earth (soil), water, air. **K/U**
4. What role does temperature play in an ecosystem? **K/U**
5. Select a natural habitat in your area. Give two examples of each of the following:
  - (a) an interaction between living things
  - (b) an interaction between a living thing and a non-living thing **K/U**

The following icons indicate the Achievement Chart categories:

**K/U** Knowledge/Understanding  
**C** Communication

**T/I** Thinking/Investigation  
**A** Application

6. (a) Give an example of a producer and a consumer.  
(b) Describe three differences between producers and consumers. **K/U**
7. Create a simple food chain with four species involved. **K/U C**
8. Describe two factors that limit the number of living things in a given ecosystem. **K/U**
9. Explain how decomposers recycle nutrients within ecosystems. **K/U**
10. Water and carbon are two essential substances that cycle through ecosystems. Describe the cycles and explain how the two cycles are connected to each other. **K/U**
11. Explain how the energy you obtain from eating a hamburger originally came from the Sun (Figure 2). **K/U**
14. What is meant by a “closed system”? How is Earth a closed system? **K/U**
15. Describe the flow of energy in the food chain that you created in question 7. What would happen to this flow if any part of the food chain were eliminated? **K/U**
16. Matter cycles through our environment. Explain how this promotes sustainability. Give a clear example of this. **K/U**
17. Predict what would happen if earthworms disappeared from the soil. **T/A**



**Figure 2**

12. Plants play a key role within an ecosystem. Explain this statement. **K/U**
13. Predator–prey interactions are very important to a healthy ecosystem. Demonstrate this using a specific example. **K/U**
18. Find out which provincial or national park is closest to your home.
  - (a) What makes the park environmentally special?
  - (b) What ecosystems are being protected?
  - (c) Are there any human economic activities going on in the park?
  - (d) How can humans enjoy the park?
  - (e) What can people learn about ecosystems from this park?
  - (f) Is the land worth keeping as a park, or should some of it be sold to developers to build low-cost housing? **T/A**
19. “You have a very important role to play in keeping our planet healthy.” Explain what this statement means using ideas you have learned in this unit. **K/U**

### What Do You Understand?

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20. The buildings in an entire city block have been demolished and the rubble has been removed.

- What will happen on the bare soil over the next few years?
- What type of succession is this? Explain.

K/U A

21. The use of technology has a great impact on our environment, both positive and negative. How has the use of automobiles affected ecosystems? A

22. How might Traditional Knowledge about the environment help with efforts to conserve and preserve habitats and wildlife? A

23. Human activity often alters the interactions in ecosystems. Select one example from below and describe the effects it can have: A

- clear-cutting a forest
- extensive overuse of chemicals in farming
- overuse of motorized vehicles
- increasing the number and size of roads

24. Select a habitat in your area. This could be part of the school grounds, a vacant lot, or a natural habitat in your neighbourhood. It could also be a small ecosystem like a rotting log or backyard pond. Describe the importance of sunlight, soil, water, air, and temperature on that habitat. A

25. “We are part of the Earth and it is part of us.... This we know.” Refer back to the quote attributed to Chief Sealth on the first page of Unit B. From what you have learned in this unit, explain the significance of this quote. Write your own quote or find a similar quote from another culture. K/U A

26. Loss of jobs is often a reason given for not protecting a habitat or ecosystem. For example, protecting a forest may interfere with logging jobs and result in unemployment for some loggers. Write a one-page supported opinion essay in which you evaluate the loss of jobs that may be caused by activities aimed at protecting the environment. T/I A

### Solve a Problem!

27. In many urban areas, there are too many of some species and not enough of others. For example, the city of Windsor has many squirrels (Figure 3). Using the concepts of food chains and food webs, explain why these imbalances occur and provide solutions to help solve the problem. Be sure to provide solutions that will not harm other parts of the ecosystem. T/I A



Figure 3

28. In recent years, young people have been exposed to fewer natural habitats.

- With the help of other classmates, create a list of suggestions to encourage youth to “get back to nature.”
- Suggest an effective way to communicate this information. With your teacher’s permission, perform your plans. T/I A C

29. It is said that by the age of six, most children can recognize 1000 company logos but they cannot name 10 species that share their neighbourhood. Research 10 species in your neighbourhood. Create a pamphlet to educate your neighbours about these species. **A C**

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30. A vegetarian diet is considered by some people to be more “Earth-friendly” than a diet that contains lots of meat. Use what you know about energy flow to explain how our environment would be healthier if people ate less meat. **A**

### Create and Evaluate!

31. Matter constantly cycles through an ecosystem. How well does your school recycle materials?

- Determine what materials are recycled and how much of the waste produced in the school is actually recycled.
- Devise a plan to reduce the amount of waste produced in your school. Include strategies for the classroom, lunchroom, office, and staff room.
- Exchange your plan with a classmate. Evaluate each other’s ideas, and then produce a plan that incorporates only the ideas that you both consider to be the best. **T/I A**

32. Your friend wants to start a club called “Lunch Room Litter Vigilantes.”

- What do you think the goal of the club is? Is this a good idea?
- Is this a good name for the club? Why?
- Suggest ways to improve on this idea. **A**

33. Traditional Knowledge is becoming very important to groups trying to understand the complexities of ecosystems and to protect them from further abuse. Think of an area in your neighbourhood that could use human protection or care. Create a story or legend similar to Aboriginal stories to give people a new respect for that area. Have a classmate read your story, and evaluate his or her reaction to it. **C**

### Reflect on Your Learning

34. As you finish learning the content in this unit, reflect on what you have learned. Are there any questions that you still have on this topic? What can you do to ensure your questions are answered? Is this a strategy you can use after you finish every new unit of learning?

35. Real learning happens when you take what you learn in the classroom and allow it to change the way you live and think everyday. To what degree have you done this with what you learned in this unit? What does your answer show you about what you believe and how much you understand about what you learned?