Topic 1.5

How do human activities affect ecosystems?

Key Concepts

- We cannot always accurately predict the consequences of our actions.
- Introduced species can affect the health of ecosystems.
- Pollutants from human activities can travel within and between ecosystems.

Key Skills

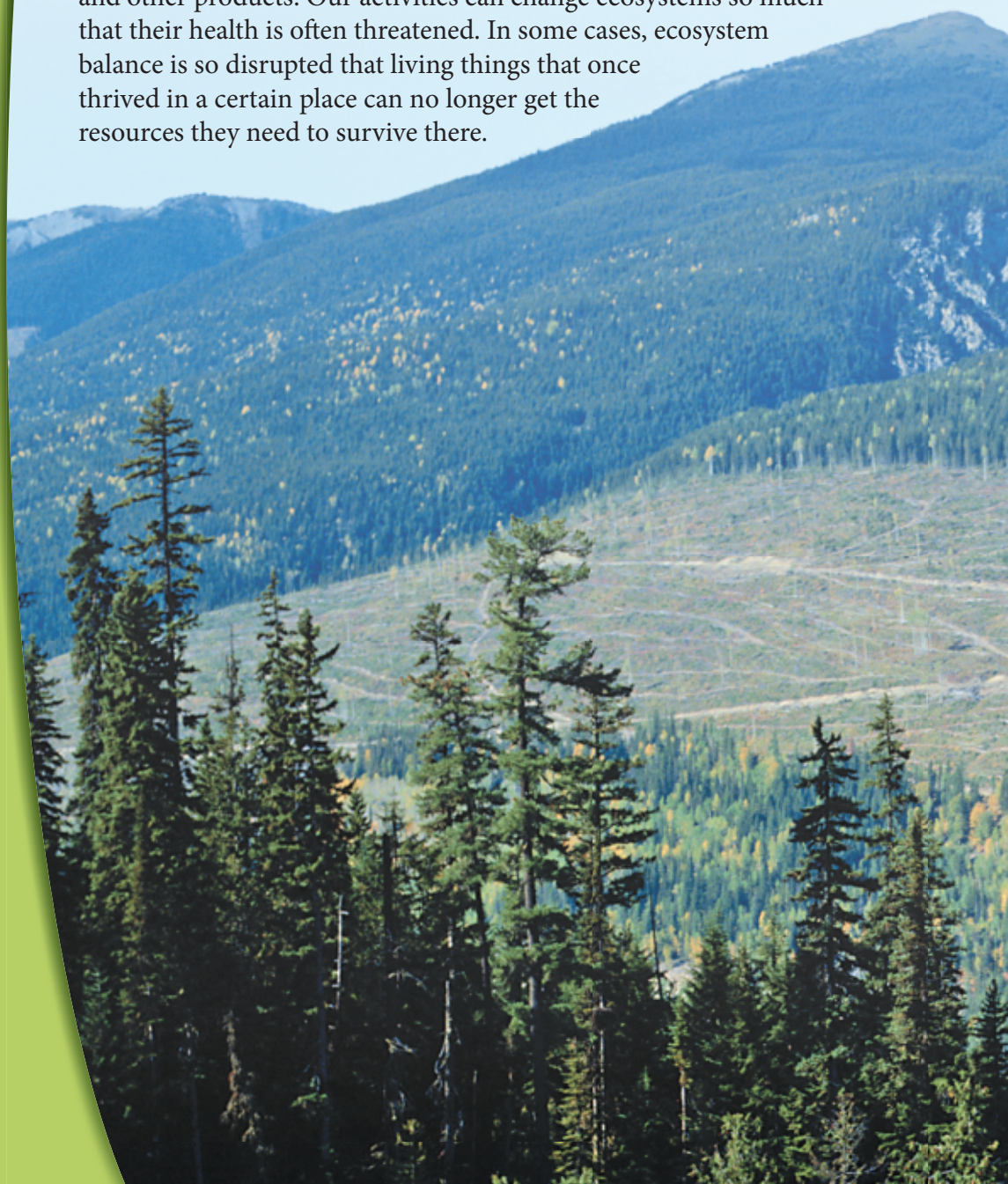
Inquiry
Literacy

Key Terms

introduced species
species diversity
watershed

Human populations have a greater impact on ecosystems than populations of most other living things do. Some of us live in very large numbers in fairly small areas such as Cambridge, Sudbury, and Cornwall. Others of us sprawl out to fill large areas such as Toronto, Windsor, and Ottawa. Either way, our need for resources is very great, because there are so many of us.

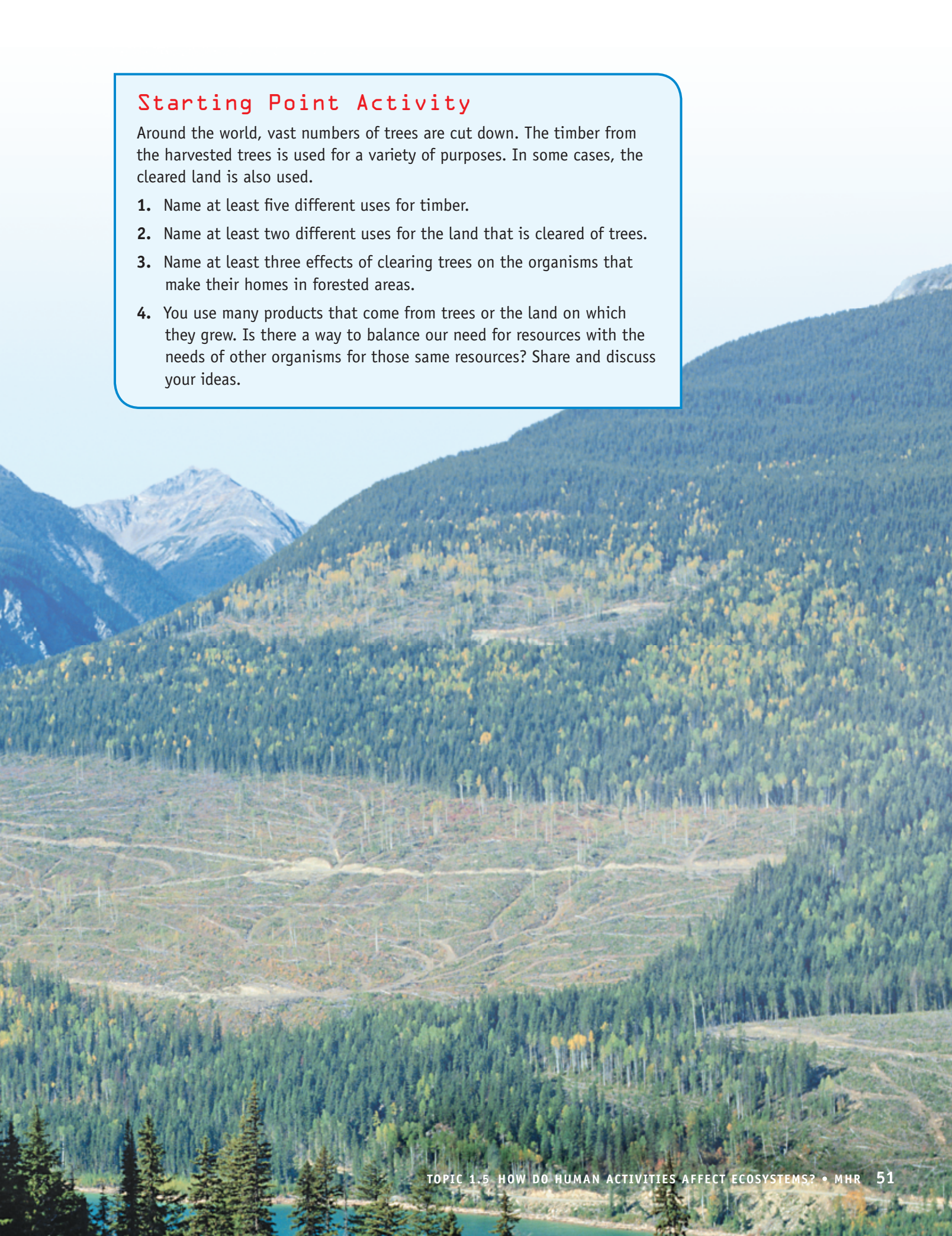
We also use resources that other organisms don't. For instance, we dig deep into the ground for petroleum to make fuels, plastics, and other products. Our activities can change ecosystems so much that their health is often threatened. In some cases, ecosystem balance is so disrupted that living things that once thrived in a certain place can no longer get the resources they need to survive there.



Starting Point Activity

Around the world, vast numbers of trees are cut down. The timber from the harvested trees is used for a variety of purposes. In some cases, the cleared land is also used.

1. Name at least five different uses for timber.
2. Name at least two different uses for the land that is cleared of trees.
3. Name at least three effects of clearing trees on the organisms that make their homes in forested areas.
4. You use many products that come from trees or the land on which they grew. Is there a way to balance our need for resources with the needs of other organisms for those same resources? Share and discuss your ideas.



We cannot always accurately predict the consequences of our actions.

Consider this. A person cuts down a tree to let more sunlight shine on a small garden. Now think about some of the consequences of this action. For instance, before the tree was cut down, birds and insects used it for food, shelter, and nesting. Now the tree can no longer provide the birds and insects with these resources. As well, the insects, worms, and other organisms that lived in and among the tree's living roots can no longer get the resources they need to sustain them.

Human activities always cause changes to ecosystems. For example, in the situation in the first paragraph, many organisms have lost their living space and their source of food. As well, the area around the garden is now fully exposed to sunlight instead of being shaded from it. This will change the way that the soil holds rainwater. Plants that grew well in shaded conditions will also die.

The changes caused by human activities always have consequences for the biotic and abiotic parts of ecosystems. **Table 1.2** lists a few examples. Many of the problems that affect the health of ecosystems today come from the fact that we cannot always accurately predict the consequences of our actions. Sometimes, unfortunately, we do not even think about the consequences in the first place.

INVESTIGATION LINK
Investigation 1C, on page 59

Research Focus

Activity 1.12

PREDICT THE CONSEQUENCES

1. Work in groups. Choose one of the activities listed below.
   - logging
   - farming
   - outdoor recreation event
2. Brainstorm at least three consequences of the activity you chose. Be sure to think about things that could affect abiotic and biotic parts of the ecosystem. For instance, what are the effects on abiotic factors such as soil, sunlight, water, and air? What are the effects on biotic factors such as the size of populations, food webs, and nutrient cycles?
3. Research at least three of the consequences you have brainstormed to collect information about them.
4. Use a graphic organizer to help you organize your research and to record your findings.
5. Communicate your findings in a cause-and-effect map.

LEARNING CHECK

1. Use the text on page 52 to create a cause-and-effect map to summarize the consequences of cutting a tree in a garden.
2. Identify three human activities, different from those in **Table 1.2**, that could have consequences for the environment.
3. Create a t-chart to list the possible abiotic and biotic consequences for one of the human activities in **Table 1.2**.
4. The land that your school is built on was probably once a field or farmland. Identify some biotic or abiotic consequences that might have resulted from building your school.

ACTIVITY LINK
Activity 1.15, on page 60

Table 1.2 Examples of Human Activities and Their Consequences for Ecosystems

Human Activity	Possible Abiotic and Biotic Consequences
 Construction of roads and buildings	• Surface soil is removed, killing soil organisms and plants that were rooted in the soil. • The shape or slope of the land is changed, resulting in different patterns for drainage of rainwater. • Farmland that is taken over to build roads and buildings can no longer be used to grow crops and livestock.
 Dam-building	• The courses of rivers and streams are changed so that water will flow to the specific place chosen for the dam. • Land is flooded to create lakes in places where none existed before. • Huge numbers of living things are killed. • Huge numbers of living things are displaced and must find new places to live. (This includes humans, too.)
 Manufacturing and consumption of goods	• Soil and plant life are removed to make space to build factories and landfill sites for the solid wastes that the factories produce. • Factories consume energy to make products. • Production process creates wastes that can enter and pollute air, water, and soil. • Stores that sell goods consume energy to operate. • The packaging, transportation, and consumption of goods generate wastes that must be disposed of. • Disposal and recycling of wastes consumes energy.

Introduced species can affect the health of ecosystems.

In 1889, the only place you would find European starlings was in Europe. Then someone released 100 of these foreign birds in New York. Now there are more than 200 million of them in North America. Their dramatic success has had disastrous consequences, though. Large populations of starlings destroy grain and fruit crops. They also out-compete native birds for nesting sites. Because the native birds can't breed, their numbers decrease. Refer to **Figure 1.11**.

introduced species: any species that has been introduced into and lives in an ecosystem where it is not found naturally

European starlings are an introduced species in North America. An **introduced species** is a kind of plant, animal, or other organism that lives in a place where it is not found naturally. The species has been introduced there, either deliberately or accidentally, by human activities.

Introduced species often thrive in their new ecosystems, because there are so few limiting factors to keep their populations from growing too large. So they often survive and reproduce better than native species do. As a result, native species cannot get the resources they need, and their numbers tend to decrease. Not all introduced species are harmful, though. Apples, corn, and many other food crops grown in Ontario are introduced species. Limiting factors such as consumers and disease keep populations of these species in balance.

▲ **Figure 1.11** Starlings tend to congregate in very large groups, causing deafening noise and leaving behind great accumulations of dung.

Introduced Species Can Affect Species Diversity

Diversity refers to the "diverse-ness" or "different-ness" of things. So **species diversity** is the number and variety of different species of living things in an area. Species diversity in an ecosystem tends to decrease when an introduced species becomes well-established. For example, purple loosestrife lives in balance with other plants in its European ecosystems. But in Canada, this introduced species is deadly to other kinds of plants. Purple loosestrife, shown in Figure 1.12, quickly takes over a wetland ecosystem. It soaks up much of the water of the ecosystem and easily out-competes native plants. Loss of the native plants reduces food and nesting sites for waterfowl, and the ecosystem soon becomes choked off to other wildlife. As time passes, a healthy multi-species ecosystem changes to one that consists almost entirely of purple loosestrife!

species diversity: the number and variety of different species of living things in an area

▲ **Figure 1.12** Purple loosestrife is called the beautiful killer. This introduced species has invaded many aquatic ecosystems across Canada, turning them into terrestrial ecosystems with very little species diversity.

LEARNING CHECK

1. Use pictures or words to explain the following terms: introduced species, species diversity.
2. Introduced species such as apples and corn have less impact on ecosystems than European starlings. Explain why.
3. Use a graphic organizer to summarize the biotic and abiotic parts of an ecosystem that are affected by purple loosestrife.

Inquiry Focus

Activity 1.13

ONTARIO'S MOST WANTED—NOT!

1. These are some of Ontario's most destructive introduced species. Choose one, and use Internet and library resources to find out how and why this species is a threat to species diversity. Analyze the information you gather for reliability and bias. (Turn to Science Skills Toolkit 8: How to Do a Research-Based Project, for help with assessing information for reliability and bias.)
2. Create your own "Wanted" poster to communicate your findings.

Pollutants from human activities can travel within and between ecosystems.

watershed: any area of land (either natural or human-made or both) that drains into a body of water

You live in a watershed. So do all the other living things in and around your community. A **watershed** is any area of land that drains into a body of water. The area of land can be a natural area, or it can be a city, or both. The body of water that the land area drains into could be a pond, a river, a lake, or the ocean. **Figure 1.13** shows a watershed.

All watersheds include land and water. In other words, all watersheds connect terrestrial ecosystems with aquatic ecosystems. This connection means that what we do on land or in water can affect the land or water around us. For instance, if you pour old juice down the sink or flush a toilet, the wastes go somewhere. Where might that be?

- If you live on a farm or in a rural area, the wastes flow into a septic tank and then into a septic field on your property. There, they seep into the ground. Some of those wastes are taken up by the roots of plants. Some are consumed by soil organisms. And some seep deeper into water flowing under the ground, where they are carried to other bodies of water.
- If you live in a city or in a small urban area, the wastes flow into a system of pipes. These pipes lead to larger pipe systems that direct the wastes either to waste-water treatment plants or directly into bodies of water.

Watersheds provide:

- water people use for drinking, cooking, and washing
- water used by other living things for drinking, washing, and cooling off
- places to live
- irrigation for farmland
- water for use by industries for cooling and cleaning equipment
- recreation areas for swimming, boating, snowmobiling, relaxing
- beauty

▼ **Figure 1.13** You share your watershed with thousands, perhaps millions, of other living things. So everything you do affects each of those living things.

In both cases, the wastes from your watershed feed sooner or later into a body of water of some kind. In weeks, months, or years, trace amounts of some of those wastes will appear elsewhere. This "elsewhere" might be a place nearby or a place farther away. It even might be a place in another province or another country.

Go to **scienceontario** to find out more

LEARNING CHECK

1. What is a watershed?
2. How do watersheds connect terrestrial and aquatic ecosystems?
3. Why do we need to be careful about the things we wash down the drain and flush down the toilet?

Literacy Focus

Activity 1.14

A WATERSHED MIND MAP

Use the diagram below to make a mind map with "Watershed" as your starting term. In your mind map, include all the ways that the watershed is being used. Use a different-coloured pen to include other ways that watersheds are used but which are not shown in the diagram

Making a DIFFERENCE

As captain of her high school's 2007 Envirothon team, Dayna Corelli helped develop an award-winning proposal that was reviewed by the city of Sudbury. Dayna's team was concerned that water was wasted during lawn-watering and street-cleaning. They were also worried that the city's sewer pipe system could not handle heavy rainfall. This could cause storm sewers to overflow and dump raw sewage into the Great Lakes. Since reviewing the proposal, and recommendations from other groups, Sudbury has restricted lawn-watering, made street-cleaning more efficient, and improved the sewer system.

Dayna also has been a member of her school's Environmental Club and coordinated its recycling program. She campaigns to promote recycling, energy efficiency, water conservation, and anti-idling. "I am committed to continuing to make my community more environmentally friendly," she says.

What changes could your municipality make to improve water quality and energy conservation?

Rebekah Parker has motivated other people to help the environment. In 2007, she created the "Living Out Loud" conference for students in the Waterloo Region. More than 60 students took part to discuss environmental and social issues. Rebekah also started an Eco-Carnival in her community. She encouraged other teens to run environmental activities for elementary students at the carnival. While in high school, Rebekah also led the school's Roots and Shoots Club and organized her community's Car Free Festival.

Rebekah believes young people should pick one issue they are passionate about and get involved. "Don't be afraid to get your hands dirty. I think students can be more inspired to work toward saving a local conservation area if they actually have the chance to go and spend a day there."

How could you motivate people in your community to help the environment?

Skill Check

- ✓ Initiating and Planning
- ✓ Performing and Recording
- ✓ Analyzing and Interpreting
- ✓ Communicating

Human Activity in a Local Ecosystem

In what ways are human activities changing ecosystems in your community?

What To Do

1. With your class, gather stories from newspapers, TV, radio, and the Internet about activities that affect ecosystems in or near your community. Here are some examples of issues that might affect local ecosystems.
   - Diverting water for a construction project lowers the water level. This reduces the number of places where water birds nest and fish reproduce.
   - Adding fertilizers to a local field changes the make-up of the soil. This affects the kinds of plants that can be grown in the field.
   - The shoreline of a lake is being developed for a new recreation area. This can affect the numbers and kinds of organisms that can live by the lakeshore.
   - Chemical pesticides are used to kill a harmful introduced species. The chemicals may leach into rivers and lakes.
   - The growing human population is filling a landfill site with wastes faster than originally planned. The site must be expanded, or another solution must be developed.
2. Work in a group. Choose several ecosystems to study. Mark these ecosystems on a map of your community.
3. Your teacher will assign one of these ecosystems to your group.
4. Write a hypothesis to explain how a human activity that affects this ecosystem could threaten its health.
5. With your group, create a list of sources of information to help you learn about the activity and predict possible consequences for the ecosystem. Analyze all information for reliability and bias before using it. Create a "References Cited" page to record your sources of information.
6. Create a presentation to communicate your ideas and your findings.

What Did You Find Out?

1. What did you learn about the ways that human activities are changing ecosystems in your community?

Research Focus

Activity 1.15

I REMEMBER WHEN...

The ecosystems in and around your community have experienced a great deal of change over the last few decades. Many of these changes are due to human activities. In this activity, you will interview seniors or Elders who have lived in your community for a long time to learn what changes they have observed.

What You Need

writing materials

audio visual equipment, such as a video camera, tape recorder, or camera (optional)

What To Do

1. Your teacher will make arrangements for you to interview a local senior or Elder, either at your school or in the community.
2. Prepare a list of questions you would like to ask for this interview. Here are a few examples of questions you could ask.
   - How long have you lived in this area?
   - What was it like when you were a child (or when you first came here)?
   - How has the city (or town, or village, or area) changed since then?
   - Are there more or fewer animals around than there were in the past?
   - What kinds of work and other activities did people do in the past? How did their work and other activities affect the land and living things in the area?
   - Have you noticed changes in local ponds, rivers, or lakes? What has caused them?
3. Show your list of questions to your teacher for approval before you begin your interview. Your teacher will discuss guidelines for the interview process with you before you begin.
4. Take notes during the interview. You could also use audio visual equipment, such as a video camera, tape recorder, or camera, to capture the interview.
5. Use the material you gathered in your interview to prepare a newspaper article, a blog, or a film documentary of your research findings.

What Did You Find Out?

1. Did local ecosystems change as much as you expected over the years? Explain.
2. What part of your research surprised you the most? Why was this the case?

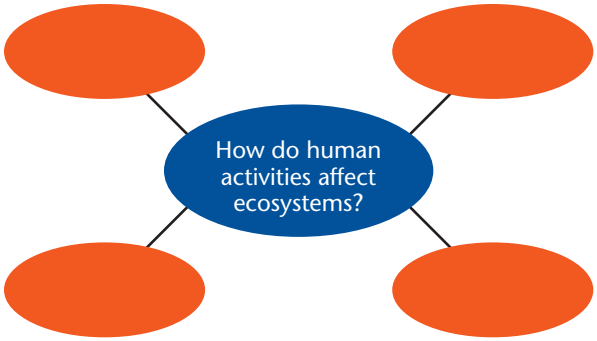
Topic 1.5 Review

Key Concepts Summary

- We cannot always accurately predict the consequences of our actions.
- Introduced species can affect the health of ecosystems.
- Pollutants from human activities can travel within and between ecosystems.

Review the Key Concepts

1. K/U Answer the question that is the title of this topic. Copy and complete the graphic organizer below in your notebook. Fill in four examples from the topic using key terms as well as your own words.



2. K/U Refer to **Table 1.2**. What biotic and abiotic parts of ecosystems can be affected by human activities?

3. A Make a flowchart to show the effects that a plastic bottle of water might have on the biotic and abiotic parts of ecosystems. In your answer, consider the manufacturing process as well as the disposal of the plastic water bottle.

4. K/U Explain how an introduced species can affect species diversity.

5. A **a)** Use a cause-and-effect map to show why people should not release exotic pets, such as snakes, hedgehogs, or tarantulas, into the wild if they do not want to keep them any longer.

b) Describe at least one responsible action that people could take to provide exotic pets they no longer want with the care and support they need.

6. C Make a labelled drawing to show an example of how watersheds connect terrestrial and aquatic ecosystems.

7. T/I Scientists have confirmed that the blood of certain shark populations contains common prescription drugs. Using your knowledge of how pollutants travel within and between ecosystems, make a hypothesis that could account for this phenomenon.

8. T/I People sometimes build dams to divert water from rivers, streams, and lakes. The photo below shows one of the reasons that people divert water. Water diversion results in lower water levels and affects waterfowl nesting areas and fish reproduction.

a) Identify at least two other reasons that people would divert water.

b) Research the effects of water diversion on waterfowl and fish in rivers and streams.

c) Summarize your research in a PMI chart or another graphic organizer of your choice.

The dams located at Niagara Falls divert water to generate electricity at the hydroelectric plant located there.