3.2 How Humans Influence Ecosystems

A sustainable ecosystem provides economic opportunities today while maintaining biodiversity and ecosystem health for the future. Ecosystem sustainability is threatened by habitat loss that results from human activities such as urban development and deforestation. Other human activities, such as certain agricultural practices and overfishing, also change ecosystems, decrease biodiversity, and affect ecosystem health. Better resource management practices in activities such as forestry, agriculture, and mining can help sustain ecosystems.

Words to Know

contamination
deforestation
extinction
habitat loss
soil degradation
resource exploitation
sustainability
traditional ecological knowledge

Figure 3.17 Burns Bog in Delta, British Columbia

Wetlands are ecosystems where the soil is waterlogged for all or part of the year (Figure 3.17). Unique populations of plants, animals, and micro-organisms that tolerate waterlogged conditions inhabit these areas. Wetlands are sometimes referred to as the kidneys of Earth. Just like your kidneys, bogs are able to filter out wastes. Some wetlands can reduce the concentration of nitrate by more than 80 percent and help regulate climate by retaining carbon. Bogs are also like sponges. They can hold great quantities of water, which helps to prevent flooding. One type of wetland is called a peat bog. In the Lower Mainland of British Columbia, peat bogs once formed a large network of habitats.

Human use of bogs in British Columbia has taken place for centuries. In the past, the wild blueberries and cranberries that thrived in the wet,

acidic soil were a main food source for Aboriginal peoples. To maintain these crops, peat bogs were frequently burned to prevent the growth of larger trees that could dominate the bog. Because peat retains water and lowers pH, it was mined and sold for use in gardens and nurseries. The addition of peat to soil improves the growing conditions for acid-loving plants such as rhododendrons. Currently, commercial cranberry and blueberry farms have been developed in bogs in places such as Richmond and Langley (Figure 3.18).

Figure 3.18 Cranberries are British Columbia's largest commercial berry crop.

Over the past 100 years, because of increased human expansion into natural ecosystems, many wetlands that took thousands of years to form have been transformed into parking lots, subdivisions, garbage dumps, agricultural land, and shopping malls. In the lower Fraser Valley and parts of Vancouver Island, it is estimated that 50 to 70 percent of the original wetland habitat has disappeared. Loss of wetland areas in the South Okanagan is reported to be as high as 85 percent. Such habitat destruction has affected biodiversity by reducing the numbers of some plant and animal species. Agricultural and industrial pollution and the introduction of invasive species have also contributed to the degradation of these ecosystems. Scientists are also concerned that, by draining and drying out wetlands, carbon dioxide and methane will be released into the atmosphere, contributing to climate change. Maintaining the ecological value of remaining wetlands and accommodating the interests of growing populations will become even greater issues in your lifetime.

Did You Know?

Burns Bog in Delta, British Columbia, is one of the world's largest natural bogs. Covering an area of 3000 ha, it can be seen from the International Space Station. Burns Bog is home to approximately 200 species of birds, 10 species of amphibians, 6 species of reptiles, and 50 species of mammals.

3-2A A Land Development Proposal for Barry's Bog

Find Out ACTIVITY

Maintaining wetland ecosystems becomes difficult as urban development takes place in these areas. In this activity, you will examine some of the issues involved. As a class, you will agree on a plan to preserve the wetland ecosystem of Barry's Bog and still allow some land development.

Materials

- land development template and map
- scissors
- tape
- large sheet of paper

What to Do

1. Your teacher will assign you to one of the following interest groups (or you may be asked to choose your own group).

   Interest groups:

   - Conservation group that wants the total area preserved for only plants and wildlife
   - Real estate company that wants to build homes in the area
   - Farmers who want to raise livestock and grow crops
   - Business people who want to build a small shopping mall that includes a convenience store, gas station, and laundromat
   - Off-road vehicle adventure company that wants a safe area for off-road recreation
   - Provincial government park officials who want the land to be used for recreation
   - Provincial government transportation officials who want to build access roads through the area

2. Your interest group will be making a proposal on how the wetland area should be used. Your teacher will distribute a land development template and a map of the area. Cut out the pieces from the template.

3. To develop your proposal, as a group decide how to arrange the land development pieces on the map of Barry's Bog.

   You must consider the following criteria:

   - Wildlife must be preserved.
   - All the land development pieces must be used, but you may cut the pieces smaller if you choose.
   - The land development pieces may touch but not overlap.
   - You may create additional land development pieces, if you choose.

4. Use small loops of tape to attach your land development pieces to the map of Barry's Bog.

5. As a group, brainstorm a list of the positive and negative consequences (pros and cons) of your interest group's proposal for developing the wetland area. Record your ideas on a large sheet of paper.

6. Post your ideas on a classroom wall. Once all the interest groups' ideas are posted, walk around the room and study other groups' proposals.

7. Return to your group and reconsider your original proposal for Barry's Bog. Revise your proposal by changing the position of your land development pieces, if necessary.

8. As a class, decide on which features from each proposal could be combined to make the best proposal.

What Did You Find Out?

1. How was your land development proposal similar to those of other groups? How was it different?
2. Did your group have difficulty making decisions for the proposal? Explain.
3. What were the major environmental issues you had to consider in your proposal?
4. How did the final class proposal address human needs yet still maintain the bog ecosystem?

Understanding Sustainability

You may have heard the word **sustainability** on television, in your classroom, at home, and on the Internet. But what does it mean? One definition refers to the ability of an ecosystem to sustain ecological processes. These processes are important to biological diversity and ensure the continuation of the ecosystem over time. In this unit, you have studied many of these processes. For example, you have learned how energy flows through food chains and food webs in ecosystems. You have also learned how nutrients move in and out of ecosystems, providing the essential chemical elements that sustain life on Earth.

Another way of thinking about sustainability brings people into the picture. You have seen how human activities can interfere with ecological processes. Sustainability can also refer to using the resources of an ecosystem to meet our needs today without reducing the function and health of that ecosystem or the ability of future generations to meet their needs. Sustainable practices, therefore, maintain or increase the sustainability of an ecosystem. A sustainable ecosystem would provide economic opportunities while maintaining biodiversity and ecosystem health. A sustainable Earth requires that society's demand on nature is in balance with nature's ability to meet that demand.

You and your classmates may already be taking steps toward a more sustainable way of living (Figure 3.19). In this section, you will look at how humans have affected ecosystems. You will also read about some approaches and technologies that may help us sustain ecosystems for future generations (Figure 3.20).

Figure 3.19 Recycling is important, but reusing materials and reducing the amount we have to recycle are even more important for sustainability.

Figure 3.20 In an effort to sustain fish populations, these people are helping to return young coho salmon to the rivers near Port Alice, British Columbia.

Suggested Activity

Conduct an Investigation 3-2B on page 135

Figure 3.21 Resources such as coal, wood pulp, and sulfur are exported from the Port of Vancouver.

The Effects of Land and Resource Use

You may live in a city, a suburb, or a rural community. To get to school, you may travel along streets or highways past shopping malls, forests, or farmland. Everything you see in your familiar environment is built on land that was once part of an ecosystem. **Land use** refers to the ways we use the land around us for urban development, agriculture, industry, mining, and forestry. Most of the products you use every day, from the food in your refrigerator to the gasoline in your family's car, come from resources found in the environment. Resources are naturally occurring materials such as soil, wood, water, gas, oil, and minerals. **Resource use** refers to the ways we obtain and use these materials.

Throughout human history, people have used the land and its resources to meet their needs. Many world economies rely on selling (exporting) raw materials such as wood or oil to other countries or manufacturing items from them. Other exports include manufactured goods such as cars and cultivated crops such as coffee. The economy of British Columbia, for example, relies on exporting goods such as coal, timber, minerals, fish, manufactured goods, and agricultural products (Figure 3.21).

Habitat Loss

As human populations have grown, so too have trade, industry, and agriculture. In the past 150 years, greatly increasing human populations have expanded more rapidly into ecosystems. Human expansion into ecosystems has resulted in the destruction or fragmentation of habitats. (In section 1.2, you learned that habitats are the places within an ecosystem in which organisms live.) **Habitat loss** refers to the destruction of habitats, which usually results from human activities. When habitats are destroyed, they can no longer support the original species that lived there (Figure 3.22). Another effect of human expansion into ecosystems is habitat fragmentation. **Habitat fragmentation** is the division of habitats into smaller, isolated fragments (Figure 3.23). These isolated pockets of ecosystems affect plant pollination, seed dispersal, wildlife movement, and plant and animal reproduction.

Figure 3.22 Habitat loss occurs when parts of ecosystems are completely destroyed. In this rainforest, secondary succession will not be allowed to occur nor will the area be replanted with trees.

Figure 3.23 Road construction often causes habitat fragmentation.

Table 3.1 shows examples of how different land uses cause habitat loss in British Columbia. Table 3.1 also provides a few examples of sustainable land use approaches that have been developed in British Columbia to lessen the impact of habitat loss.

Table 3.1 Examples of the Effects of Land Use on Habitats in British Columbia

Land Use Effect		Sustainable Approach	
	The continuing expansion of populations into ecosystems can affect grasslands, forests, wetlands, and farmland. Urbanization causes biodiversity losses, greater reliance on motorized vehicles, and increased energy consumption.		Some cities are redeveloping industrial areas or buildings. These projects often include a mix of residences, businesses, and some industries. Waste treatment, storm water collection, native plantings, and other green areas to support native species and human activities are often part of the redevelopment plan.
	Clear-cutting large areas of forest at once and constructing steep switchback roads to harvest the timber have resulted in erosion and stream habitat destruction.		Some forestry companies use forest management practices that allow more trees to remain uncut and include streambed restoration (left) and less harmful road-building. These practices consider both ecosystem functions and the economic needs of local communities.
	Towns, cities, agricultural fields, and cattle ranches have covered most of our grasslands. Livestock grazing, recreational vehicles, and introduced plants have altered this ecosystem.		Grassland management plans have been developed to protect the health and functions of natural grasslands and provide productive grazing lands. The success of these plans relies on understanding the relationships between soil and vegetation types, plant succession, and weed control.

Reading Check

1. What is sustainability?
2. What does land use refer to?
3. Name three types of resource use.
4. Explain how habitat loss and habitat fragmentation threaten biodiversity.
5. Give an example of a sustainable practice.

Figure 3.24 Original species of coffee plants were adapted to grow in the shade of tropical forests.

The Effects of Deforestation

In northeastern Brazil, the owners of a coffee farm practise sustainable agriculture and work hard to protect biodiversity. The coffee plants grown on this farm are thriving in their natural habitat—in the shade of many fruit and tropical hardwood trees (Figure 3.24). Growing among a variety of other plants in a method called polyculture (the prefix "poly-" means many), these coffee plants benefit from cooler, moister, and more productive soil. Polyculture increases the amount of nutrients and helpful micro-organisms in soil. It also reduces soil erosion and weed invasions. Such plant diversity also protects the coffee plants from the pests and diseases that tend to attack monocultures (single plant crops). The variety of plant species on this farm provides food and habitat for native animals and financial security for the owners because they are not dependent on only one crop.

Many of the coffee farms in countries such as Brazil have been developed on land that once was lush tropical rainforest. **Deforestation** is the practice in which forests are logged or cleared for human use and never replanted (Figure 3.25). Deforestation, especially of tropical rainforests, continues at an alarming rate in many parts of the world. Deforestation and improper timber harvesting practices reduce the number of plants and animals living in an ecosystem (Figure 3.26) and result in soil degradation. **Soil degradation** can occur when water and wind erosion removes topsoil from bare land. Topsoil is the upper layer of soil, which is made mostly of humus (decomposed organic matter), minerals, water, and air. Most plants require adequate amounts of topsoil in which to grow. Deforestation causes erosion because few plants are left to hold the soil in place. When topsoil erodes, nutrients are taken with it.

Did You Know?

Scientists estimate that the creation of 25 mm of agricultural topsoil takes approximately 500 years, but 25 billion tonnes of topsoil are lost globally from cropland each year.

Figure 3.25 Converting a remote tropical rainforest into farmland has improved the lives of poor farmers in China. But massive deforestation has resulted in devastating soil erosion and temperature increases.

Figure 3.26 Giant pandas are an endangered species in China. This is mostly due to deforestation, which has decreased the availability of bamboo, which is the panda's primary food.

The Effects of Agriculture

In many parts of North America, when fields are left bare during non-planting seasons, water and wind erosion can reduce the amount of healthy topsoil for plant production (Figure 3.27).

Figure 3.27 Without plants for protection, wind has blown away the topsoil from this farmland.

In locations where soils are moist and heavy, such as in southwestern British Columbia, wind erosion is not common, but soil compaction and the effects of run-off can be major problems. **Soil compaction** occurs when soil particles are squeezed together and the air spaces between the particles are reduced. The biggest contributors to compaction on agricultural lands are farm vehicles and grazing animals (Figure 3.28). Compaction reduces the movement of air, water, and soil organisms between the particles, all of which are essential for soil health. When this happens, the growth of plants is hindered and increased run-off can occur, especially on sloping land. Run-off, as you have learned, can add excess nitrogen and pollutants such as pesticides to the environment. **Aeration**, in which small plugs of soil are mechanically removed, is one method that reduces run-off by improving the movement of air and water through soil.

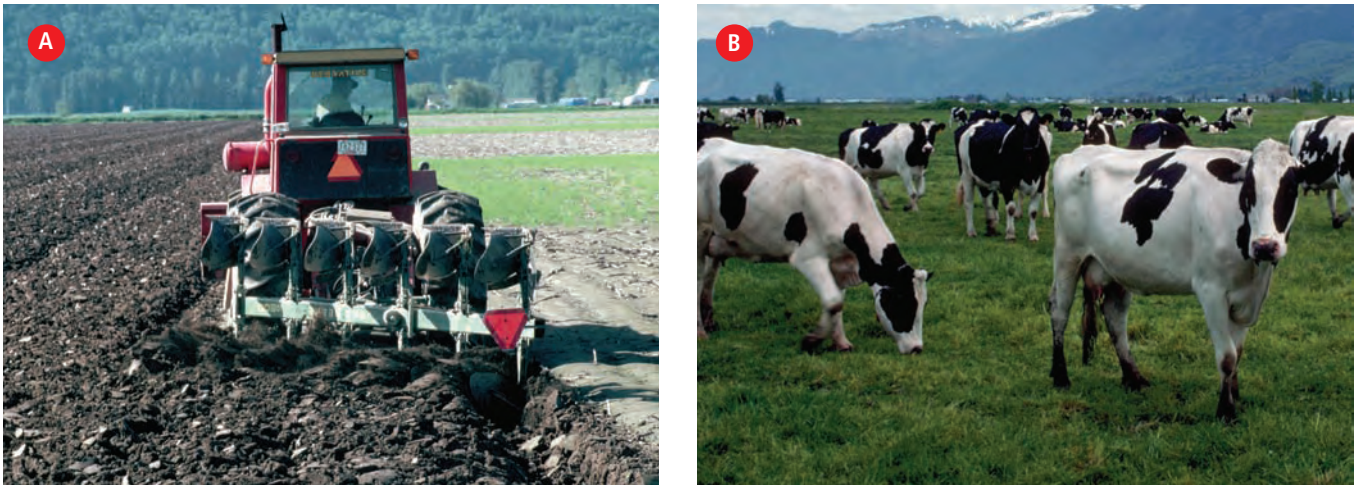

Figure 3.28 Tractors (A) and grazing animals (B) are major causes of soil compaction.

Reading Check

1. What is deforestation?
2. What is soil degradation?
3. Name two effects of agricultural practices on soil.
4. What is aeration, and how does it improve the soil?

Figure 3.29 This worker is taking samples in a mining operation.

The Effects of Resource Exploitation

Resource use is also referred to as **resource exploitation**. Examples include harvesting fish and timber, mining coal and minerals, and extracting oil and gas. We depend on resource exploitation to build our homes, put food on our tables, and provide energy to run our cities and industries. Resource exploitation also provides jobs for millions of people around the world (Figure 3.29).

However, exploitation of resources, as you have seen, can cause habitat loss and soil degradation. Resource exploitation such as mining can also affect ecosystems by contributing to ground water and surface water contamination. **Contamination** is the introduction of chemicals, toxins, wastes, or micro-organisms into the environment in concentrations that are harmful to living things. For example, cyanide, which is used in silver and gold mining, may enter streams and rivers. Cyanide prevents cellular respiration from occurring in living organisms and is deadly in small doses. Figure 3.30 shows how the chemicals used in copper mining are collected in treatment ponds.

Word Connect

"Ground water" refers to sources of fresh water found under the surface of the Earth. "Surface water" generally refers to water in lakes, rivers, streams, and the upper part of oceans.

Figure 3.30 Untreated chemicals and other wastes harmful to living organisms may escape from treatment ponds into the environment.

In British Columbia, mine reclamation after a mine closes is required by law. Mine reclamation usually involves the restoration of land and the development of water treatment facilities to remove heavy metals draining from the mine site. At Britannia Beach, a water treatment facility treats about 12 million litres of run-off daily from the closed copper mine. This process removes about 454 kg of copper and an even greater quantity of other metals each day. It also adjusts the pH of the run-off to acceptable levels. The flow of ground water and surface water from the mine is used to power the treatment plant.

Mine reclamation often involves the use of plants to restore the land and decontaminate soil and water (Figure 3.31). Table 3.2 lists some plants that can tolerate contaminated soil. These plants absorb contaminants through their root systems and stabilize the soil to prevent contaminants from leaching into water.

Table 3.2 Plants Used in the Treatment of Contaminated Soil

Soil Contaminant	Contaminant-Tolerant Plant
Arsenic	Sunflower, Chinese brake fern
Lead	Indian mustard, hemp, poplar
Uranium	Sunflower
Zinc and cadmium	Alpine pennycress

internet connect

Today, fish and other animals are returning to Howe Sound near the old Britannia Beach mine. Find out more about the history of mining in British Columbia and the technologies used to prevent contaminated water from seeping through the rock in the 80 km of tunnels in the mine. Start your search at **www.bcscience10.ca**.

Figure 3.31 Land reclamation at Brenda Mines near Peachland, British Columbia (A). Secondary succession may restore this area to a coniferous forest (B).

Overexploitation

Ecosystems are negatively affected when resources are overexploited. **Overexploitation** is the use or extraction of a resource until it is depleted. Overexploitation can result in extinction. **Extinction** is the dying out of a species. For example, passenger pigeons, which numbered about 5 billion, were brought to extinction by early North American settlers hunting them for food. Overfishing of yellowfish tuna and Atlantic cod during the past few decades has reduced the numbers of these species by 90 percent. Overexploitation of species not only affects their numbers, it also results in a loss of genetic diversity. This means that populations are less resistant to disease and less able to adapt to changes in their environment.

The effect of overexploitation on food webs

Overexploitation affects many interactions in food webs, and sometimes the effects take decades to appear. The destruction of the kelp forests of the north Pacific Ocean is an example (Figure 3.32). Kelp forms dense forests that are important to marine ecosystems because they provide hiding places for many marine animals. Scientists believe that overhunting of sperm whales and baleen whales in 1946 resulted in the decline of the kelp forest almost 50 years later.

Sperm and baleen whales were once preyed upon by orcas. Scientists believe that overhunting of whales caused orcas to seek new prey, such as harbour seals, fur seals, sea lions, and sea otters. In the 1970s, the population of harbour seals declined, which was followed in the 1980s by a decline in fur seals. The food web continued to be affected throughout the 1990s, when the numbers of sea lions and then sea otters decreased.

By the late 1990s, low numbers of sea otters resulted in an explosion of sea urchins, a primary food source for sea otters. With the loss of the sea otter, which is a keystone species, sea urchins reproduced rapidly and have since destroyed the kelp forests. Biologists estimate that, at some locations, the average rate of kelp loss due to sea urchin grazing is as high as 45 percent in one day.

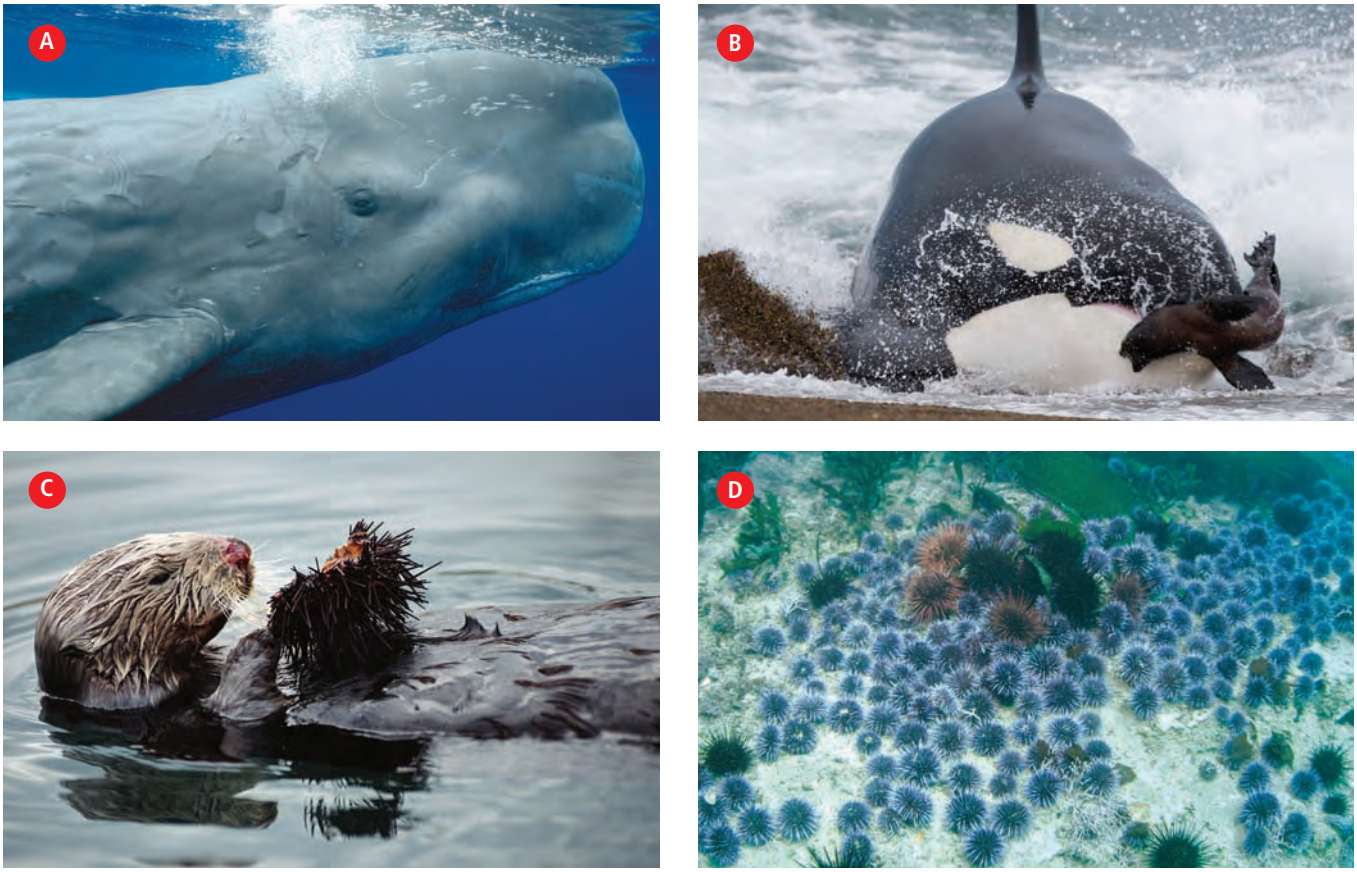

Figure 3.32 Whaling reduced the number of sperm whales (A). Orcas turned to other food supplies such as sea otters and sea lions (B). Sea otters kept the population of sea urchins in control by consuming them (C). Once sea otters were removed from the food web, sea urchins began to reproduce rapidly and graze unchecked on kelp (D).

Resource Management and Traditional Ecological Knowledge

In section 1.2, you learned how the Tl'azt'en First Nation near Fort St. John is working with scientists to develop better forest management practices. The Tl'azt'en First Nation's thorough understanding of the plants, animals, and natural occurrences in their forest environment is referred to as **traditional ecological knowledge**. In Aboriginal cultures, traditional ecological knowledge is passed down from generation to generation.

Traditional ecological knowledge reflects human experience with nature gained over centuries. It takes the form of stories, songs, cultural beliefs, rituals, community laws, and practices related to agriculture, forests, and ocean resources. Traditional ecological knowledge also reflects knowledge about local climate and resources, biotic and abiotic characteristics, and animal and plant life cycles. This knowledge has developed through everyday experiences such as travelling and hunting. It has also been gained through experimentation in food gathering, harvesting, and managing resources such as fish (Figure 3.33). In British Columbia, provincial and federal governments, the scientific community, and Aboriginal representatives are working together to develop land use and restoration plans in various parts of the province.

Figure 3.33 The Nisga'a First Nation in the Nass Valley produces aluminum fish wheels that are based on a traditional wooden design. The Nisga'a use the fish wheels to catch salmon swimming upstream, enabling them to count, weigh, and measure them.

As you learned at the beginning of section 1.2, traditional ecological knowledge provides researchers with valuable data about soil types, plant and animal species, and practices that enhance the productivity and health of local ecosystems. For example, spring burning of prairie grasslands by the Cree in northern Alberta was commonplace before Europeans settled in North America. The Cree used controlled burning to renew grassland ecosystems. Burning recycles nutrients and increases plant growth. This early form of grassland management sustained the grasslands on which bison and small mammals depended for survival. Healthy populations of small mammals provided food for fur-bearing carnivores such as coyotes, bobcats, foxes, and wolves. Moose populations also increased because moose were attracted to the secondary growth along the edges of the grassland.

Figure 3.34 Fire suppression increases the amount of litter on the forest floor.

Burning was also practised by First Nations in British Columbia to improve the growth of desired plants, such as berry bushes, and to attract wildlife. Burning recycles nutrients and creates more diversity in the understorey of a forest. Fire also reduces forest litter and opens the canopy, allowing plants that require more sunlight to grow in the understorey. In contrast, suppressing fires, a forest management technique used in British Columbia since the late 1800s, has created forests with much more forest litter (Figure 3.34) and resulted in large numbers of dead or diseased trees. Increasingly, controlled burning (or prescribed burning) is becoming an important part of forest management in British Columbia and Alberta (Figure 3.35).

Explore More

Biofuels are manufactured from crops such as corn, soybeans, and sugar cane. The production of biofuels produces few greenhouse gas emissions, minimizes toxic waste, and promotes rural economies by using local crops. However, the production of biofuels could lead to increased deforestation to clear land to grow crops. Find out more about biofuels. Start your search at **www.bcscience10.ca**.

Figure 3.35 Controlled burning

Anchor Activity

3-2B Be a Media Watchdog on Environmental Issues

Conduct an INVESTIGATION

SkillCheck

- Observing
- Evaluating information
- Working co-operatively
- Explaining systems

Inquiry Focus

Environmental problems are receiving increased attention in news media, such as newspapers, television, and the Internet. With the new scientific knowledge you have gained in this unit, you are prepared to be a media watchdog on environmental issues. Media watchdogs analyze news reports and articles covering the activities of scientists, government officials, environmentalists, and citizens. If you completed Find Out Activity 1-2A on page 35, you have already been monitoring the media on environmental issues. In this activity, you will compare the coverage of environment-related stories that appear during one week in newspapers, television news programs, and the Internet. (Begin your Internet search at **www.bcscience10.ca.**)

Question

How do the media report on environmental issues?

Procedure

1. Working with a partner, collect news articles from local papers and the Internet on environmental issues. Watch Canadian, American, and international news reports, and record the information you gather on environmental issues.
2. After reading each article or viewing a news report, complete the Media Analysis sheet provided by your teacher.
3. Share your information with your partner. Compare similarities and differences in your analyses.
4. Share your findings with the whole class.

Analyze

1. When TV news programs, newspaper articles, or Internet reports addressed the same issue, were there noticeable differences in coverage? Explain.
2. Based on your findings in this activity, which environmental issues do you think are most likely to make the news? Which are least likely to be reported?
3. Did a news story appear to be of increased importance because it was related to other factors such as jobs or health?

Conclude and Apply

1. Write a short summary paragraph about what you have learned about how environment-related issues are reported in the media.
2. Write a short persuasive paragraph about an environmental issue that you believe is important, and suggest how the media should cover this issue.

Science Watch

Putting a Lid on Waste

Toxic soil testing

Thousands of ecosystems in Canada have been degraded by soil or ground water contamination and require remediation. Ground water contamination comes from municipal landfills and industrial waste disposal sites. Leaking gasoline storage tanks and accidental spills are also sources of contamination. Contamination problems are on the increase in Canada because of the large and growing number of toxic compounds used in industry and agriculture. Heavy metals in landfills and in pesticides are the major contaminants of soil. Ground water contamination is extremely difficult, and sometimes impossible, to clean up. However, a new technology called biofilm may prevent the erosion of contaminated soil and put a lid on environmental waste.

Contaminants left on or under the ground do not remain there. Erosion of toxic soil and leakage of contaminants from ground water often spread the effects of dumps and spills far beyond the site of the original contamination. Scientists suspect that many household wells are contaminated by substances from such common sources as septic systems, underground tanks, used motor oil, road salt, fertilizer, pesticides, and livestock wastes that seep into wells.

Scientists are looking at biofilms as a method to both contain and destroy these toxic pollutants. Some bacteria, such as the bacteria that grow on your teeth, secrete sugars that allow them to attach to different surfaces. In the natural environment, bacteria can also stick to grains of sand or rock to form a syrup-like substance known as a biofilm.

Scientists are searching for ways to use the potential of bacteria in environmental clean-ups. Bacteria are already being used in sewage treatment plants to break down human waste, food waste, soaps, and detergent. Bacteria are also used to break down toxic waste such as heavy metals, some pesticides, and oil spills into harmless substances. Biofilm technology is relatively inexpensive and may allow water and soil to be safely reused.

Trapping ground water contaminants at their source by sealing fractured rocks with bacterial biofilm will reduce further contamination in the environment.

Questions

1. What are the sources of soil and ground water contamination?
2. What are biofilms?
3. What properties of biofilms make them good candidates for the job of toxic clean-up?

Checking Concepts

1. How have human activities affected wetland ecosystems?
2. What are three characteristics of a sustainable ecosystem?
3. How does habitat fragmentation harm ecosystems?
4. How does deforestation result in soil degradation?
5. Explain how the loss of topsoil affects an ecosystem.
6. (a) What is water contamination?
   (b) How can mining cause water contamination?
7. State two ways in which plants can be used in mine reclamation.
8. How can overexploitation lead to extinction?
9. How do controlled burning practices positively affect ecosystems?

Understanding Key Ideas

10. Describe one sustainable practice that can reduce the negative effects of urban expansion on an ecosystem.
11. Once an abundant resource, the Canadian cod fishery collapsed in the 1990s. This collapse has had a serious impact on fishing communities in Atlantic Canada.

   (a) Explain what led to the collapse of the fishery.
   (b) Explain how populations in ecosystems are affected by this activity.

12. (a) Describe the sustainable practice shown in these two photographs.
    (b) Explain how this practice might affect the ecosystem over the next 10 years.

13. Use an example to describe how overexploitation can affect many interactions in a food web and can have a negative effect on an ecosystem.
14. Using examples, explain how resource management practices based on traditional ecological knowledge can affect the biodiversity of an ecosystem.

Pause and Reflect

Some people have said that meeting human needs is more important than the loss of one species. Based on what you have learned in this section, write a paragraph that supports or refutes this statement.