

Section 3.1 Summary

There are many different ways in which people can gather information about ecosystems. These include:

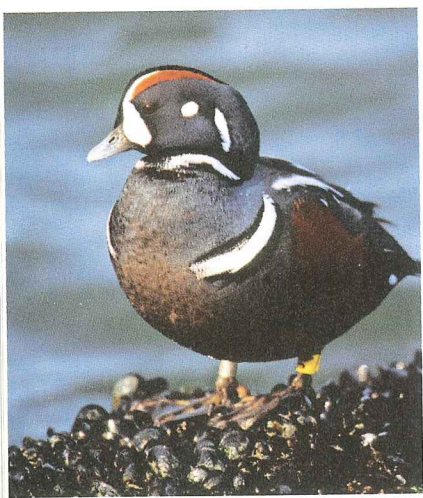
- learning from the traditional ecological knowledge of Aboriginal communities
- ecosystem monitoring, including physical, environmental, chemical, and biological monitoring
- long-term monitoring projects (for example, annual bird counts), and
- gathering of baseline data, such as the number of animals in a particular ecosystem.

Scientists can collect data in a variety of ways, including aerial surveys and the use of bird bands or radio collars. As well, thousands of volunteers participate in programs to monitor particular species.

People can use traditional ecological knowledge and scientific knowledge together to learn more about ecosystems and to make wise decisions about land use.

Key Terms

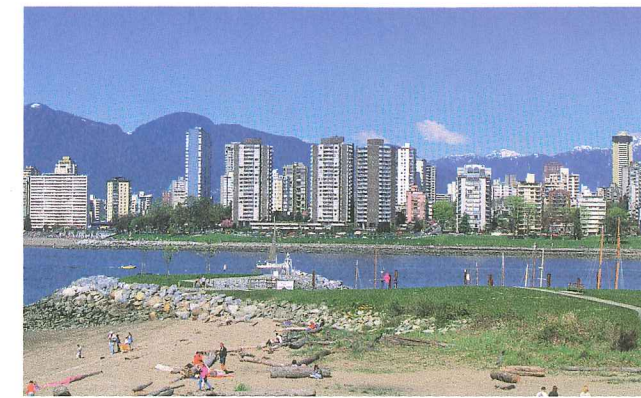
traditional ecological knowledge
ecosystem monitoring
long-term monitoring
baseline data
permanent plots
annual surveys
environmental impact assessment



Check Your Understanding

1. How can people use long-term monitoring to help protect natural ecosystems? Explain your answer.
2. What are the four types of ecosystem monitoring? Give an example of something that could be measured or monitored for each type of monitoring.
3. What is baseline data?
4. **Apply** Choose a species of plant or animal in your community. How would you monitor this species over a long period of time?
5. **Thinking Critically** The harlequin duck shown here was caught on the west coast of British Columbia. A band describing when and where it was caught was put on its leg. Months later, the bird was sighted resting on a rock near a stream in the Rocky Mountains. A researcher could tell where the duck had been originally caught by the colour and number-letter code on its band. Why do you think this information is important in helping ecologists understand species of duck and the ecosystem(s) in which it lives?

Section 3.2 Human Impacts on Ecosystems



When you look out the window of your home or classroom, are you looking at the same scene that you might have seen 100 years ago? You probably are not. As British Columbia's population began to increase, people cleared land for homes and farms. Eventually some of these settlements grew into the cities and towns we know today. Trees were cut for fuel and buildings. Roads were built and eventually paved. In some places, trees and grasslands were ploughed under to create farmland or orchards. Human societies affect the environment around them in an effort to meet their needs. What types of changes to the environment can you see in the two pictures in Figure 3.9?

Making Choices

Many people seem so far removed from nature that they forget how dependent they are on the environment. Most people buy food from the grocery store and spend most of their time in houses or other buildings. People put trash out at the curb for collection and never think about where it is going. However, everything people use for food and shelter comes from natural resources that Earth provides. You and everyone you know not only *depend* on nature but are *part* of nature.

Natural resources are objects found in nature, such as trees, water, oil, fish, and minerals, which people use to meet their basic needs. Resources that can be replaced are called **renewable resources**. For example, new trees grow, fish have offspring, and food crops grow from seed every year. Resources that cannot be replaced are called **non-renewable resources**. These include fossil fuels such as coal and oil.

Figure 3.9 How do you think the changes to Vancouver might have affected the plants and animals that lived in this ecosystem?

DidYouKnow?

Did you know that leaving the lights on in highrise buildings can result in the deaths of thousands of songbirds? At night, the birds are attracted to the lights of buildings and crash into the glass. Now some building owners voluntarily turn off the lights when there are large numbers of birds in the area.

INTERNET CONNECT

www.mcgrawhill.ca/links/BCscience7

To find out more about ecological footprints, visit the web site above. Click on **Web Links** to find out where to go next.

People in North America and a few other countries use far more than their share of Earth's natural resources. Most of these societies do not live in a sustainable manner. **Sustainability** means that the resources of nature are being renewed or replaced at least as quickly as they are used. In addition, it means that all wastes can be absorbed or recycled without harming the environment. Today, people have many concerns over loss of Earth's resources. One way to determine how much of an impact you have on the environment is to determine your ecological footprint. An ecological footprint is the total area of land and water needed to supply all of the materials and energy that you use. As well, it must absorb all of the waste that you produce.



Figure 3.10 The western rattlesnake is losing habitat due to expanding towns and other developments.

Habitat Loss

When people drain water from a marsh or clear trees from a forest, the environment loses habitats. When habitats are gone, organisms that depend on these habitats must find another habitat to meet their basic needs. When too much habitat disappears, species have nowhere else to go and often disappear. Loss of habitat is the biggest threat facing living organisms today. The populations of western rattlesnakes (see Figure 3.10), for example, are threatened in British Columbia due to loss of habitat. Snakes live in the dry interior of

southern British Columbia and have lost much of their natural habitat to housing subdivisions, farms, highways, and other developments. Many rattlesnakes are also killed on the highway or by people who are worried the snakes will harm people or animals.

Sometimes people affect habitats when roads or other large projects expand into them. This separates one part of an animal's habitat from another part or breaks it up into smaller pieces. In some cases, the habitat may be reduced to an "island" of land surrounded by development. When one part of a habitat is separated from another, it is called **habitat fragmentation**.

Introduced Species

Sometimes people, either on purpose or by accident, bring a new species into an ecosystem. These new species are called **introduced species** (also called **exotic** or **alien species**). Introduced species can cause problems for **native species**, the organisms that naturally occur in that ecosystem. Introduced species occur naturally in another part of the world where their populations are controlled, or limited, by predators and other natural factors there. If introduced

READING CHECK

How does an introduced species differ from a native species?

species are able to survive and reproduce better than naturally occurring species, they can crowd out one or more native species.

The plant in Figure 3.11 is an introduced species to North America. Only three seeds of Scotch broom were planted on Vancouver Island in 1850! Today this plant is widespread. It has taken over the habitats of many native plants in southwest British Columbia. In the next Find Out Activity you will discover more about introduced species in British Columbia.



Figure 3.11 The introduced species, Scotch broom, now grows over most of southern Vancouver Island and parts of southwest British Columbia. It started from just three seeds that sprouted on Vancouver Island, near Sooke.

Find Out ACTIVITY 3-E

Alien Invaders

Many animals and plants have been introduced to British Columbia. Some quickly die out and make no impact. Others, however, are very destructive to native species and ecosystems. How did some of the invaders come to British Columbia? What impact are they having here?

Materials

art materials of your choice

What to Do

1. Choose a British Columbia introduced species to investigate. You may choose from the following list or select another species: common dandelion, ring-necked pheasant, brown trout, black slug, European starling, cowbird, knapweed, bullfrog, purple loosestrife, Scotch broom, European earwig, tent caterpillar, sowbug, gray squirrel, Asian long-horn beetle, English ivy, fallow deer, thistle, gorse, Norway rat, crested mynah, Asian or European gypsy moth.

2. Research your species using the library or the Internet. Try to find answers to the following questions.

- (a) The species is native to what country or region?
- (b) When did the species come to British Columbia (or Canada or North America)?
- (c) Where in North America did the species first arrive?
- (d) What impact, if any, did the species have on natural ecosystems in British Columbia?
- (e) What are some of your ideas for preventing the spread of this introduced species?
- (f) What are people doing to stop the spread of this introduced species?

What Did You Find Out?

Create a cartoon strip, story, short play, or other type of presentation to summarize your answers to these questions.

Air Pollution

Ecosystems can be damaged by air, water, and land pollution. The burning of **fossil fuels** — coal, oil, and natural gas — contributes to air pollution. When fossil fuels burn, they release large amounts of carbon dioxide gas as well as gases containing sulfur and nitrogen compounds. While plants require carbon dioxide gas, the increased amounts have resulted in more carbon dioxide gas than the plants on Earth can use. As a result, carbon dioxide gas accumulates in the atmosphere. Carbon dioxide gas as well as a few other gases trap heat from Earth, much like the glass in a greenhouse traps heat as shown in Figure 3.12. This condition is called the **greenhouse effect**. Many scientists believe that the greenhouse effect is causing a warming of Earth's atmosphere.

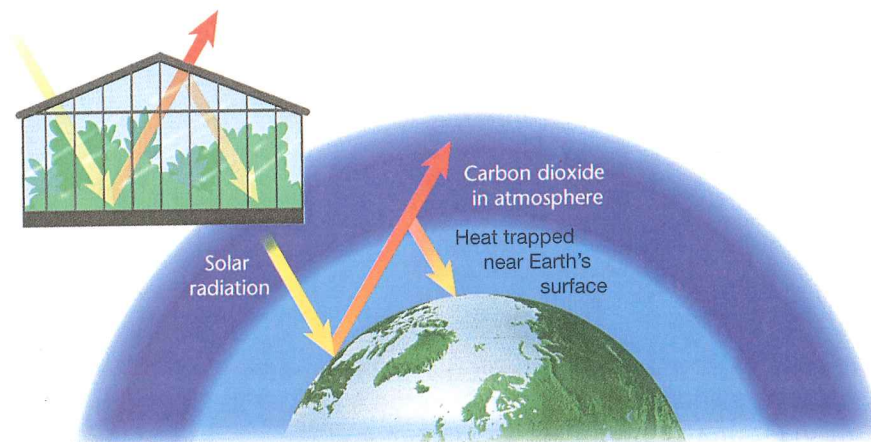


Figure 3.12 This model shows how many scientists believe the greenhouse effect works.

The warming of Earth's atmosphere is called **global warming**. Normal amounts of carbon dioxide help to keep Earth warm enough to support life. Many scientists believe, however, that increased amounts of carbon dioxide and other greenhouse gases are warming Earth at a rapid rate.

During the twentieth century, the average global air temperature increased by 0.6°C. This may not sound like too much, but it is a faster increase in temperature than at any other time during the last 1000 years. Even a small rise in temperature of a few degrees can change the climate and the ability of plants to grow in certain places. This, in turn, could impact food webs and other parts of ecosystems.

Many scientists feel that global warming is one of the most serious environmental issues of our times. Computer models suggest that the average temperature in British Columbia will increase by another 1°C to 4°C during the next 100 years.

READING Check

What are the similarities and differences between the terms “global warming” and “greenhouse effect”?

Water Pollution

Acid rain occurs when pollutants containing sulfur and nitrogen are found in large amounts in the air. When fossil fuels are burned, gases containing sulfur and nitrogen compounds are released as waste. These pollutants mix with water vapour, making it acidic. When it falls from the atmosphere as precipitation, it damages ecosystems. For example, entire lakes can “die” because the water is too acidic for fish or plants to survive.

Other types of water pollution can harm **aquatic** (water) habitats, such as streams, rivers, lakes, and oceans. A variety of pollutants, including fertilizers, pesticides, sewage, detergents, and oil, can run off the land into water. These pollutants often have a harmful effect on aquatic life. In turn, this would affect food webs in aquatic habitats.

Land Pollution

Garbage, or **solid waste**, is largely made up of plastic, paper, cans, bottles, metals, food, and other items that people discard every day. Each Canadian throws away about 1.5 kg of solid waste every day. That is about 547 kg of waste per person per year! Most of this solid waste is buried in landfills such as the one in Figure 3.13. Landfills take up wildlife habitat and some can contribute to land and water pollution. If we reduce our solid waste by reducing, reusing, and recycling, we can help minimize the impact of our waste on ecosystems.



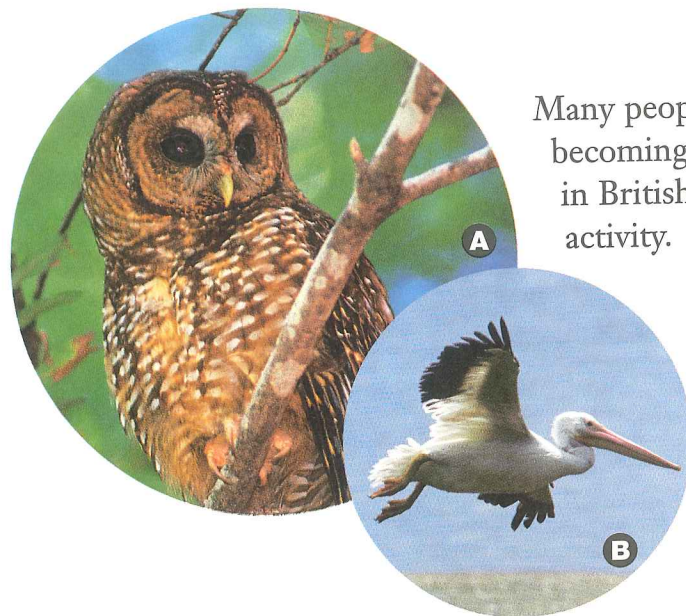
Figure 3.13 Solid waste is buried in landfills such as this one.

Endangered Species

Have you ever seen a spotted owl or white pelican? If not, the photographs in Figure 3.14 might be your only chance. Both of these birds are endangered species in British Columbia. An **endangered species** is one that is nearly extinct. **Extinct** means that it will no longer exist. The population of an endangered species is so small that unless immediate steps are taken to increase the population, all individuals will die. A **threatened species** is one that could become endangered if the factors limiting its population are not reversed. Habitat loss is the main reason why so many species are at risk, but it's not the only reason. Some biologists think that the problem of introduced species is so serious that it will one day be the main cause of extinction. Pollution, changes in climate, and overharvesting or hunting are other factors that can also result in loss of species.

READING Check

What is the difference between an endangered species and a threatened species?



Many people are working hard to prevent species from becoming endangered. Find out just how many species in British Columbia are at risk by completing the next activity.

Figure 3.14 (A) Northern spotted owls and (B) white pelicans are endangered in British Columbia.

Find Out **ACTIVITY 3-F**

Risky Business

British Columbia designates threatened and endangered species as being “red-listed.” What percentage of animals and plants in British Columbia are on the red list? Find out in this activity.

Materials

graph paper

Threatened or Endangered Species (as of 2001)		
Type of organism	Red-listed species	Total number of species
Freshwater fish	24	80
Amphibians	5	19
Reptiles	6	16
Birds	34	465
Terrestrial mammals	11	104
Marine mammals	3	29
Plants	257	2333
Butterflies	12	187
Dragonflies	9	87

(Source: BC Ministry of Sustainable Resource Management, Conservation Data Centre)

Skill

POWER

For tips on making bar graphs, turn to SkillPower 5.

What to Do

- Calculate the percentage of species from each type of organism that are red-listed.

Sample Calculation:

$$\frac{24 \text{ red-listed freshwater fish in BC}}{80 \text{ species of freshwater fish in BC}} \times 100\% = 30\%$$

- Construct a bar graph of the percentages of each type of organism that are red-listed in British Columbia.

What Did You Find Out?

- Which type of organism has the highest percentage of species that are threatened or endangered?
- What do you think might have led to some of these species becoming threatened or endangered?
- What percentage of vertebrates in British Columbia are threatened or endangered? (Vertebrates are animals that have a backbone. They include fish, amphibians, reptiles, birds, and mammals.)

Section 3.2 Summary

There are only a limited number of natural resources on Earth. These must be used sustainably to maintain the health of ecosystems. In North America, natural resources are being used at a rate that may not be sustainable. This has impacts on the environment, such as pollution and global warming. One way to reduce our impact is to use fewer resources and less energy. We can achieve this by making better choices that have less environmental impact.

Other human-caused changes to ecosystems include the following:

- habitat loss
- introduction of alien or exotic species
- overharvesting of resources such as trees or fish
- air, water, and land pollution

All of these impacts can lead to species becoming endangered or threatened. In section 3.3, you will learn about ways to help protect ecosystems and the species that live in them.

Check Your Understanding

- What are four threats that can lead to the extinction of a species?
- Describe the relationship between each pair of terms in the list below.
 - introduced species and extinction
 - habitat loss and endangered species
 - greenhouse effect and global warming
 - renewable resources and non-renewable resources
- Apply** A species of wildflower grows only by the shores of a certain marsh in the British Columbia interior. Recent observations indicate the population is about half the size it was last year. Parts of the marsh are being drained and filled with dirt to make room for a new housing development.
 - What could be happening to the wildflower?
 - What could be done to stop or slow down the decline in wildflower population in this area?
- Thinking Critically** Why should people not release exotic pets, such as snakes, hedgehogs, or tarantulas, into the wild if they decide they do not want to keep them any longer?
- Thinking Critically** Sometimes our “needs” conflict with our “wants.” What is the difference between a need and a want? How does satisfying all of our “wants” make an impact on the environment?

Key Terms

natural resources
 renewable resources
 non-renewable resources
 sustainability
 habitat fragmentation
 introduced species
 native species
 fossil fuels
 greenhouse effect
 global warming
 acid rain
 aquatic
 solid waste
 endangered species
 extinct
 threatened species