

Section 1.1

Abiotic and Biotic Environments



Figure 1.1 The lynx depends on the hare for food. The hare's white coat is hard for the lynx to see in the snow.

The lynx and the hare shown in Figure 1.1 live in an area of British Columbia where there is a lot of snow. Their thick coats help them keep warm in the frigid weather. The large feet of both the lynx and the hare help them run across the snow without sinking. As well, the hare's white fur helps it blend in with the snow. How these animals look and how they behave tells you something about the area in which they live.

Living organisms are affected by other living things and by the non-living parts of the environment around them. Could you imagine the lynx chasing after the snowshoe hare in a hot, dry desert? Do you think this chase would even happen in the desert?

The Abiotic Parts of the Environment

To understand living things, you need to learn about the abiotic [AE-bih-o-tik] parts of an organism's environment. **Abiotic** means non-living. The abiotic parts of an environment are the non-living things, such as temperature, light, air, water, soil, and climate. The abiotic parts of an environment often determine which organisms can live and survive in that environment. You just learned how the lynx and the hare are well-suited for a cold, snowy climate. The life cycle of a salmon, like the one in Figure 1.2, is another example of the way that the abiotic parts of an environment affect living things. The salmon will not lay its eggs in a muddy pond. They will lay eggs only in certain places in streams.



Figure 1.2 Salmon lay their eggs on beds of small stones in clean, fast-running streams.

Some examples of how the abiotic parts of an environment affect living things are described here.

- **Temperature and Light** Temperature often determines where organisms live. Sunlight provides warmth for many animals, such as the alligator lizard shown in Figure 1.3. Green plants need light to make food. The number of hours of daylight triggers changes, such as the flowering of plants and the migration of birds.
- **Air** The air contains oxygen gas, which animals breathe. The air also contains carbon dioxide gas, which plants use to make their own food.
- **Water** Plants combine water with carbon dioxide to make food and to grow. Animals need water to digest food and move food particles throughout their bodies. Some organisms (such as trout, whales, and British Columbia's largest water insect, the giant water bug) live in water.
- **Soil** The soil contains minerals as well as pieces of organisms that were once living. For example, pieces of dead insects and roots from dead plants are found in the soil. The soil provides a home for many animals such as the earthworms shown in Figure 1.4. They burrow into the soil and overturn it. These tunnels allow air and water to mix with the soil. The earthworms eat decaying leaves and other natural materials in the soil and leave the remains behind, close to the surface. In this way, they bring valuable nutrients to the surface. Thus, the soil provides nutrients, such as minerals, for plants. Plants, in turn, hold the soil in place. Their roots prevent wind from blowing the topsoil away and prevent rain from washing it away.
- **Climate** The term **climate** means average weather pattern of a region over a long period of time. For example, the climate of northern Canada is very cold, with long, harsh winters and short, cool summers. Climate affects where and how plants and animals live. For example, the bunchgrasses shown in Figure 1.5 on the next page look as if they are dead during the hot summer in the Okanagan. In fact, the roots are alive. As soon as the soil receives some moisture, usually in the fall or early spring, the bunchgrasses begin to grow again.

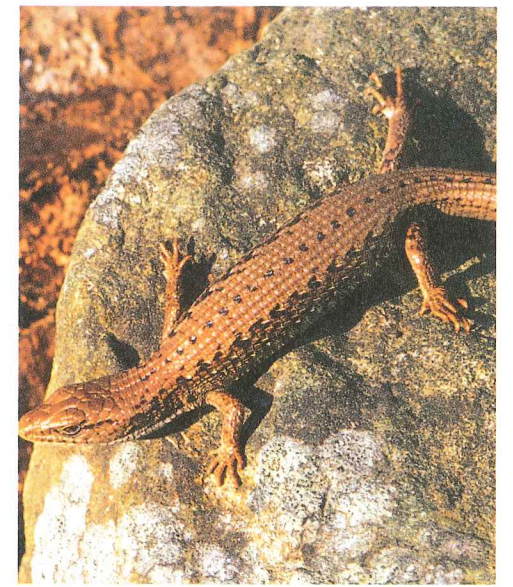
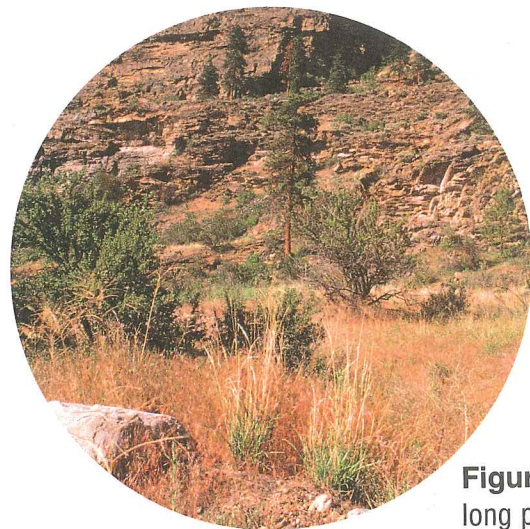


Figure 1.3 A northern alligator lizard basks in the sunlight each morning until it is warm enough to begin to feed.



Figure 1.4 The action of earthworms help water and oxygen move into the soil.



There are many other abiotic parts of the environment, in addition to those that were just listed. In the next Find Out Activity, you will learn about one of these abiotic part of the environment. You will see how salt in water can affect plants.

Figure 1.5 Bunchgrasses are able to survive long periods without water.

Find Out **ACTIVITY 1-B**

Salty Seeds

Salt and other minerals are often found in soil. How does salt water affect the germinating (sprouting) of certain seeds?

What You Need

- 2 plastic drinking cups (or similar containers)
- 30 mL salt water
- 10 bean seeds
- 2 paper towels
- 2 plastic self-sealing bags
- masking tape
- permanent marker

What to Do

1. Add water to the cups, until each cup is half full. Dissolve the salt in one cup.
2. Add five bean seeds to each cup. Leave the seeds to soak overnight.
3. The next day, wrap each set of seeds in moist paper towel. Place the towels in separate self-sealing bags. Use the masking tape and the marker to label the bags "fresh water" and "salt water."

4. After two days, count the number of seeds in each bag that show signs of root growth (sprouting). **Record** this number.

What Did You Find Out?

1. How did the amount of sprouting differ for the seeds that had been soaked in fresh water compared to the seeds that had been soaked in salt water? Describe any differences in the appearances of the seeds from the two groups.
2. What abiotic factor was tested in this activity?
3. What conditions were kept the same (controlled) for the two groups of seeds?
4. Do you think that seeds from all types of plants respond to salt in a similar way? How could you find out?
5. How does this activity model the way that an abiotic part of an environment can affect a biotic part of the environment?

The Biotic Parts of the Environment

Biotic means living. Living things are called the biotic parts of an environment. For example, seaweeds, crabs, and octopi are all biotic parts of the ocean environment off British Columbia's west coast. All living things affect and interact with other living things. For example, the octopus in Figure 1.6 depends on crabs and other living things for food. When the octopus was smaller, it might have become food for some other living organism. The octopus needs contact with other members of its species in order to reproduce. (A **species** is a group of organisms that can successfully mate with each other and reproduce.) To meet these needs, the octopus might compete with members of the same species for a mate. The octopus might compete with members of a different species for food or a home.



Figure 1.6 This giant octopus is eating a clam. Two biotic parts of the environment are interacting.

The Needs of Living Things

Since you are a living thing, you are a biotic part of the environment. Think about the basic things that you need to stay alive. Your basic survival needs are very similar to the basic survival needs of other animals. All living organisms need:

- **oxygen gas or carbon dioxide gas from the air** Animals need oxygen gas because it helps them break down food for energy. Plants need carbon dioxide gas because they use it along with energy from the Sun to make their own food.
- **water** Animals need water to dissolve their food and carry oxygen and food throughout their bodies.
- **food** Animals need food for energy and to grow and repair their tissues. Plants make their own food.
- **a suitable place to live** Many creatures find shelter in the environment. Some living things, such as humans, beavers, and wasps, build protective shelters.

When you take a breath, put on a warm coat, wave to a friend, or avoid a buzzing bee, you are interacting with the biotic and abiotic parts of your environment. Organisms that live in the soil also interact with their environment. In the following investigation, you will take a closer look at the abiotic and biotic parts of a soil sample.

READING Check

What are the main differences between the abiotic parts and the biotic parts of an environment?

READING Check

What are the basic needs of plants and animals? Create two lists, one for the needs of plants and one for the needs of animals.

Interactions Between Abiotic and Biotic Parts of the Environment



Figure 1.7 This beaver dam is part of an ecosystem that includes biotic and abiotic factors.

Ecology is the study of the interactions among organisms, as well as the interactions between organisms and their environment. An **ecologist** is someone who observes and studies these relationships. An ecologist who is studying beavers, for example, might investigate what beavers eat, how changes in climate affect beavers, or where beavers build their dams (see Figure 1.7) or have their young.

Ecosystems

Ecologists study ecosystems. An **ecosystem** is all the interacting organisms that live in an environment, as well as the abiotic parts of the environment that affect the organisms. The pond ecosystem in Figure 1.7 is filled with different types of organisms that interact with one another. Organisms eat other organisms, defend themselves, reproduce, and compete for food and space. These are some of the interactions between two biotic parts of the ecosystem. For example, a beaver, one biotic part of the ecosystem, might eat the bark of a poplar tree, another biotic part of the ecosystem.

Its abiotic parts also affect the pond ecosystem. These abiotic parts might include the amount of sunlight and rain the pond receives, and the temperature of the air above it. When a heavy rain lowers the temperature of the water in the pond and raises the height of the water, abiotic parts of the pond ecosystem are interacting. Figure 1.8 shows some of the many different interactions that happen in an ecosystem.

READING CHECK

What is one way in which a beaver might interact with an abiotic part of its environment?

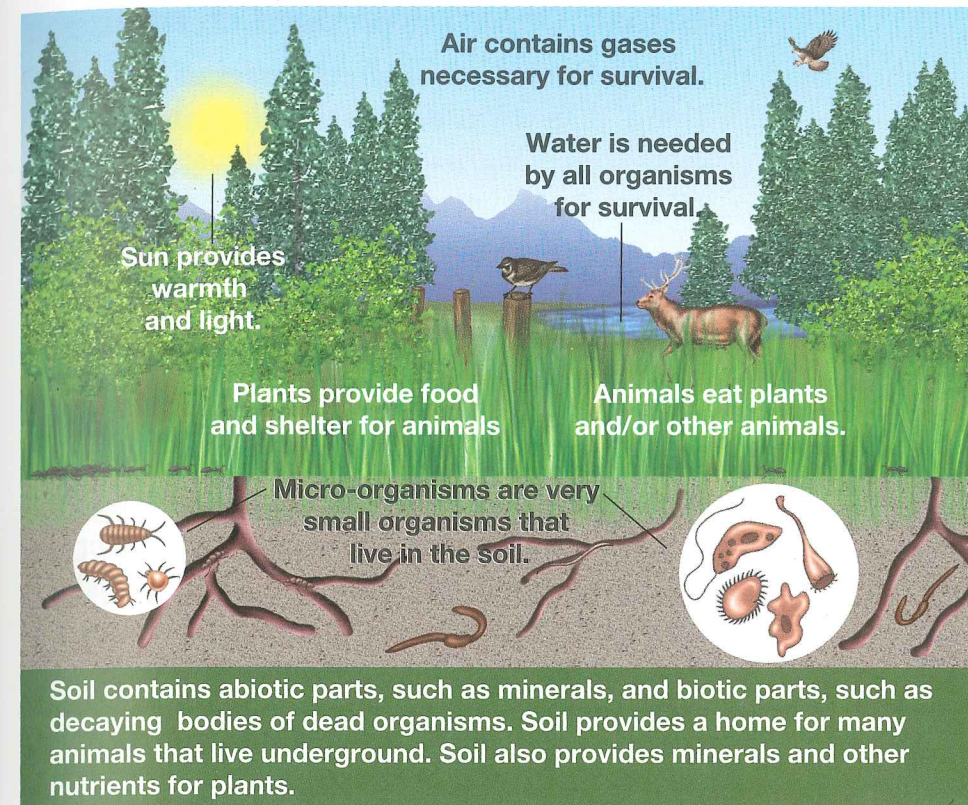


Figure 1.8 This ecosystem includes living things that interact with each other and with the abiotic parts of their environment.

Biomes

Many ecosystems have broadly similar temperatures and have similar amounts of rain every year. Therefore, the plants and animals that are found in these ecosystems could also be similar. Ecologists have a name for large regions that have about the same temperature and amount of rain or snow. These regions are **biomes**. Canada has four *major* biomes as shown in Figure 1.9. The *tundra* is very cold. Very little rain or snow falls in the tundra so there are no trees, just shrubs and grass. Nearly all of British Columbia is considered *boreal forest*. The most common trees in boreal forests are evergreen trees. The *temperate forest* biome receives more rain than the boreal forest. There are many deciduous trees. The fourth biome in Canada is the *grassland* biome. There are large amounts of rain with long dry periods in between. These conditions prevent trees from growing but shrubs and grass grow well.

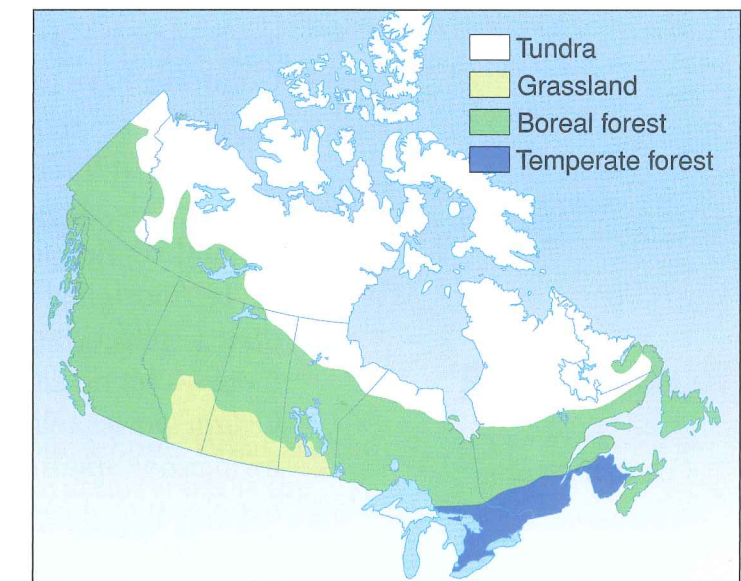


Figure 1.9 Canada has mostly tundra and boreal forest biomes. There are smaller amounts of grassland and temperate forest biomes.

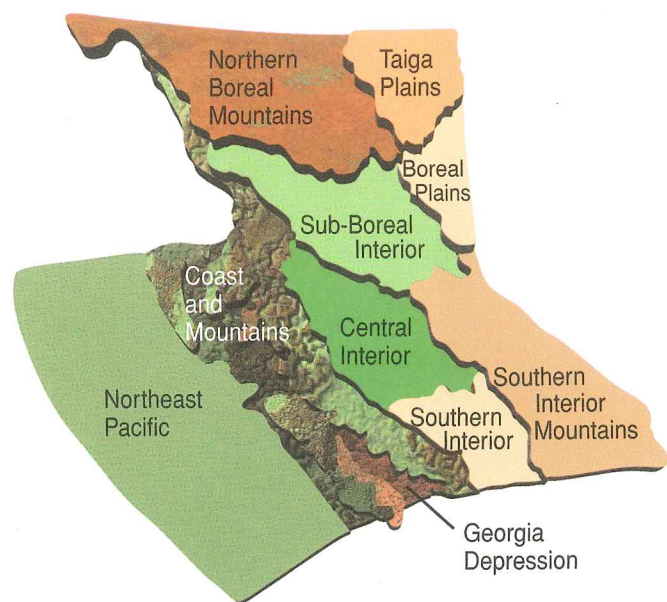


Figure 1.10 British Columbia has ten ecoprovinces. Each ecoprovince has a distinct combination of climate, geography, landforms, and organisms.

British Columbia's Ecosystems

British Columbia has more species of living things than any other province in Canada. In fact, 72 percent of Canada's land mammals, 60 percent of Canada's plant species, 67 percent of Canada's fungus species, and 79 percent of Canada's bird species are found in British Columbia. Why does our province have such a variety of organisms? The answer lies in the diversity of British Columbia's geography and climate. Ecosystems in British Columbia include high mountains, dry grasslands, wet coastal forests, and vast plains. Biologists have described and mapped ten different natural regions, which they call **ecoprovinces**, in British Columbia. Look at the map of ecoprovinces in Figure 1.10. Can you locate your ecoprovince?

Aboriginal Peoples and Ecology

Do you have a favourite outdoor place? Perhaps it is a tree you climb or a site where your family goes camping every year. The more time you spend in this place, the more you learn and care about it. Aboriginal peoples in British Columbia have lived in the same regions of British Columbia for thousands of years. They have gathered a vast store of information and knowledge about these regions. Aboriginal peoples can be considered British Columbia's first ecologists.

In Aboriginal teachings, an ecosystem is a whole, rather than a collection of separate parts. All parts of the environment — biotic and abiotic — are alive, related, and sacred. Origin stories tell of living beings transformed into rock formations and mountains, of animals transformed into people, and of the first people emerging from the ocean. For Aboriginal peoples, all plants, animals, water bodies, land forms, and natural forces such as weather are interconnected and should be respected. Their understanding of ecosystems guides Aboriginal peoples today when they consider how their actions may affect ecosystems.

Section 1.1 Summary

Organisms interact with both the abiotic (non-living) and biotic (living) parts of their environment.

- The abiotic parts of an environment include temperature, light, air, water, soil, and climate.
- The biotic parts of an environment include plants, animals, and all other living things. The biotic parts of an environment interact with each other.
- An ecosystem is all the organisms in an area and all the non-living parts of the environment that affect them.
- People are part of ecosystems. Humans have the same basic needs as all other living things.
- Aboriginal peoples were the first ecologists in Canada. Ecologists study the environment and the relationships among living things and their surroundings.

Check Your Understanding

1. (a) What are the basic needs of all living things?
(b) Imagine that you are a black bear. You live in a coastal rain-forest ecosystem. What are some different ways in which you meet your needs?
2. What is one abiotic part and one biotic part of a polar bear's environment?
3. What are three biotic parts of a marsh community?
4. A lizard is warming itself in the morning sunlight.
(a) What abiotic parts of the environment affect the lizard? Describe them.
(b) What biotic parts of the environment affect the lizard? Describe them.
5. **Apply** Describe the ecosystem near your school. What are the most common plants and animals in the area? What is the nearest body of fresh water? How much rainfall and snowfall does the area receive? What kinds of plants and animals lived in the location of your school 100 years ago? How did building a town or city change the ecosystem near your school?
6. **Thinking Critically** The light and fluffy seeds of dandelions are spread by the wind. How are these seeds adapted to the dandelion's ecosystem?

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Key Terms

abiotic
climate
biotic
species
ecology
ecologist
ecosystem
biome
ecoprovinces

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Ecoprovinces are further divided into smaller areas called *biogeoclimatic zones*. Go to the web site above to learn more about the biogeoclimatic zone in which you live. Click on **Web Links** to find out where to go next.