

## HAVE YOU EVER WONDERED ...

- why there are different types of plants and animals?
- why different organisms live in different places?
- how human actions affect other living things?

### After completing this chapter students should be able to:

- identify the living and non-living things that influence survival in ecosystems
- relate the characteristics of an organism to its survival in its natural habitat
- construct and interpret food chains and food webs to demonstrate relationships in an environment
- classify organisms of an environment according to their position in the food chain
- describe the role of microorganisms within food chains and food webs
- investigate the effect of human activity on local habitats
- explore how living things can cause changes to their environment and impact other living things
- research specific examples of human activity.



# 5.1

## Living places

Some living things prefer to live in hot dry environments such as the deserts of inland Australia. Others prefer wetlands, rainforests or a coral reef.

### Habitats

All living things (**organisms**) have a place where they live. This is called their **habitat**. The habitat of an organism is its address. For example, your habitat includes your home, school and perhaps your sporting club.

Habitats are very varied. Figure 5.1.1 shows a wetland—one example of a natural habitat.



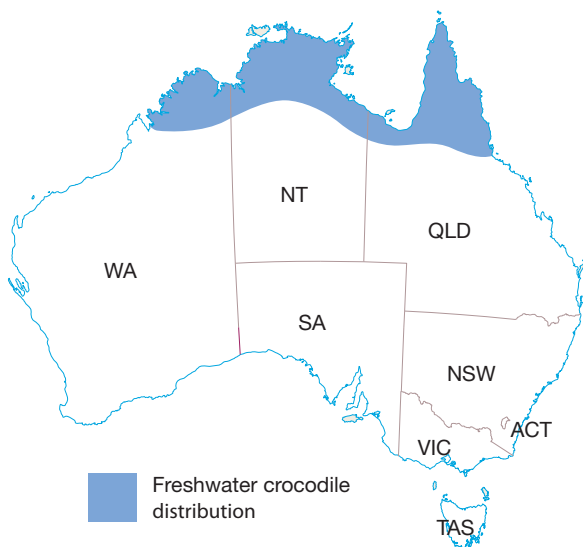
**Figure 5.1.1**

The place where an organism lives is its habitat.

Every living thing has particular needs, and will live only where these needs are met by the resources available in the habitat. Some of the resources a habitat must provide for an organism to survive and reproduce include:

- food
- water
- shelter and living space
- a suitable temperature
- mating partners for reproduction
- gases such as oxygen.

For example, all the needs of the crocodile in Figure 5.1.2 are met by the resources in the river and the surrounding river banks.



**Figure 5.1.2**

The Australian freshwater crocodile is found in freshwater creeks and rivers of northern Australia, where it can find the birds, frogs and fish that it uses as food. The females need sandy riverbanks in which to dig nests and lay their eggs.

The needs of living things can be divided into two types:

- **biotic factors.** These are living factors that include partners for mating, organisms to eat, and organisms they may compete with for food and shelter.
- **abiotic factors.** These are non-living factors that include light, wind, soil and temperature.

The number of organisms of the same type, living in the same habitat, will vary over time depending on the availability of food, water, living space and mating partners.



## Adaptations

To survive in their habitat, organisms have adaptations. **Adaptations** are characteristics that assist organisms to survive and reproduce. Adaptations help organisms to get food and water, protect themselves, build homes and reproduce.

The position of the eyes and nostrils of the crocodile in Figure 5.1.2 are adaptations. They allow the crocodile to breathe air and look for prey when it is almost totally submerged in the water.

The spotted-tailed quoll shown in Figure 5.1.3 is a marsupial that lives in the wet and dry forests of eastern Australia, from Queensland to Tasmania. The quoll's colouring means that it is well camouflaged and can sleep in hollow trees and rock crevices without being seen by other animals that would hunt it for food. A quoll uses its sharp claws and teeth to catch rats, birds and reptiles but will also eat dead remains. Quolls are **nocturnal**, which means they are active and hunt at night. A quoll can see in dim light.



**Figure 5.1.3**

The spotted-tailed quoll is the largest meat-eating marsupial on Australia's mainland. It was one of the first Australian animals to be encountered by Europeans.



Native trees growing in some parts of Australia need to survive frequent fires. Some trees have buds buried deep within the trunk where they are protected from the heat of the fire. Normally these buds do not sprout. However, if a fire destroys most of the leaves on the tree, these buds grow and quickly cover the tree with new leaves, as shown in Figure 5.1.4.



**Figure 5.1.4**

After fire destroyed the leaves of this tree, buds hidden deep in the trunk grew and produced new leaves.

All plants need light if they are to survive. Plants use the energy from sunlight to help them make their food. Plants growing in dense rainforests often have adaptations such as hooks on stems and leaves, or long, thin threads called tendrils to help them climb over other plants to reach the sunlight. *Smilax* (shown in Figure 5.1.5) is a common plant in Australian forests. It sends out tendrils that coil around neighbouring branches.



**Figure 5.1.5**

Tendrils are adaptations that enable *Smilax* to climb over other plants to reach the light.

Adaptations enable animals to:

- protect themselves from predators (camouflage)
- survive hot and cold temperatures, and wet and dry seasons
- move from place to place (flippers, legs and wings)
- catch and eat food
- take in oxygen
- reproduce.

Adaptations enable plants to:

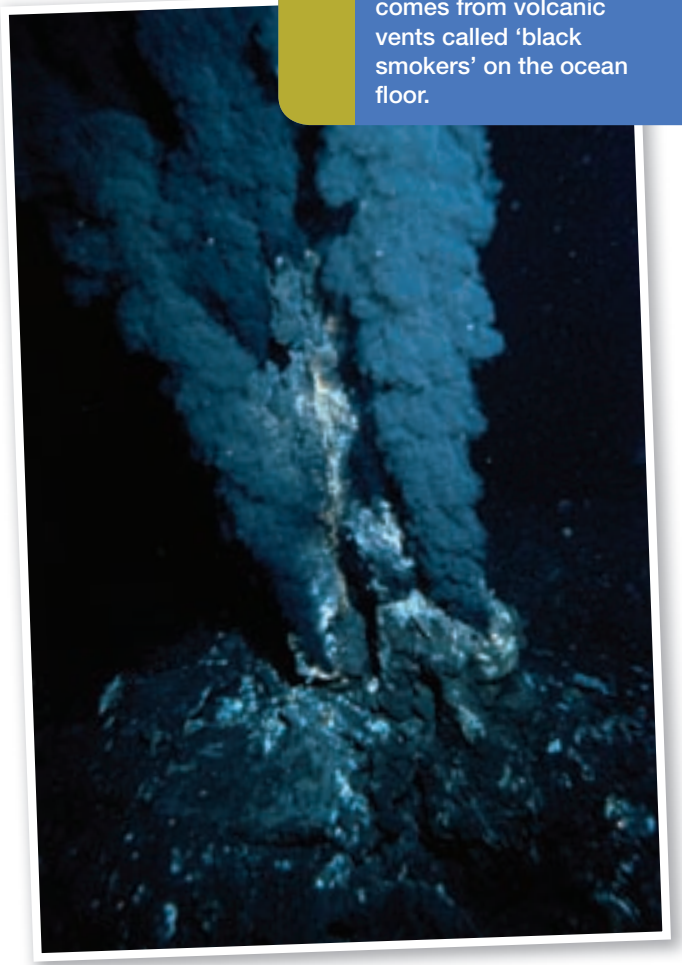
- protect themselves from grazing animals (spines and thorns)
- take in oxygen and carbon dioxide
- take in water (very long roots)
- capture light (large leaves)
- reproduce.



**SciFile**

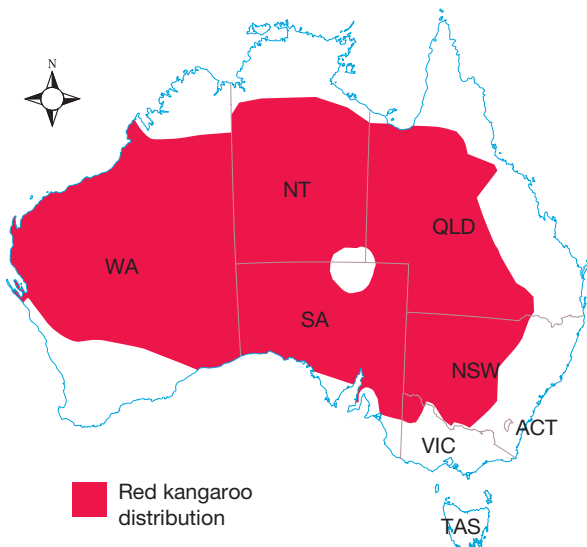
### It's hot!

Living things can be found in even the harshest environments. A variety of bacteria have been found in superheated (up to 300°C) water that comes from volcanic vents called 'black smokers' on the ocean floor.



## Where organisms live

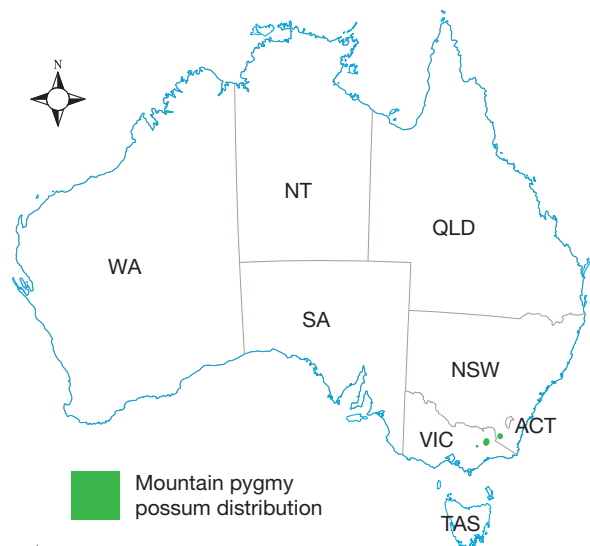
Some organisms can live almost anywhere. They are able to find suitable habitats in a wide range of areas. For example, the red kangaroo shown in Figure 5.1.6 can be found in arid and semi-arid regions from the extreme north of the east coast, to the south-west of mainland Australia.



**Figure 5.1.6**

The red kangaroo lives in grassland, wooded areas and desert. Red kangaroos prefer open grassland with scattered trees that provide shade and shelter.

Other organisms live in very restricted areas. The mountain pygmy possum is a threatened Australian marsupial. It is adapted to habitats found only in mountains at a height of over 1400 metres. Figure 5.1.7 shows the extent of the habitat in which the mountain pygmy possum is found.



**Figure 5.1.7**

Spring and summer in the high mountains are short. During this time the mountain pygmy possum feeds on seeds and moths that are rich in fat. In winter the pygmy possum hibernates under the snow.



### SciFile

#### Strong poison

Although poison-arrow frogs are very small (about two centimetres long) they produce a very powerful poison—less than a grain of salt can kill a human. Native hunters in South America use this poison on the tips of their arrows, which is how the frog got its name.



# Environmental conditions

How well an organism survives depends on how well it is adapted to the environmental conditions in the area. The term **environment** is used to describe all the things that affect a plant or an animal in its habitat. Many factors may shape and change an environment, including:

- the temperature
- whether it is wet or dry
- whether it is windy
- the quality of the air
- the water quality
- the type of soil
- the plants, animals, bacteria and fungi that live there.

The study of the interactions between living things and their environment is called ecology. **Ecologists** are scientists who study these interactions.

## Living together

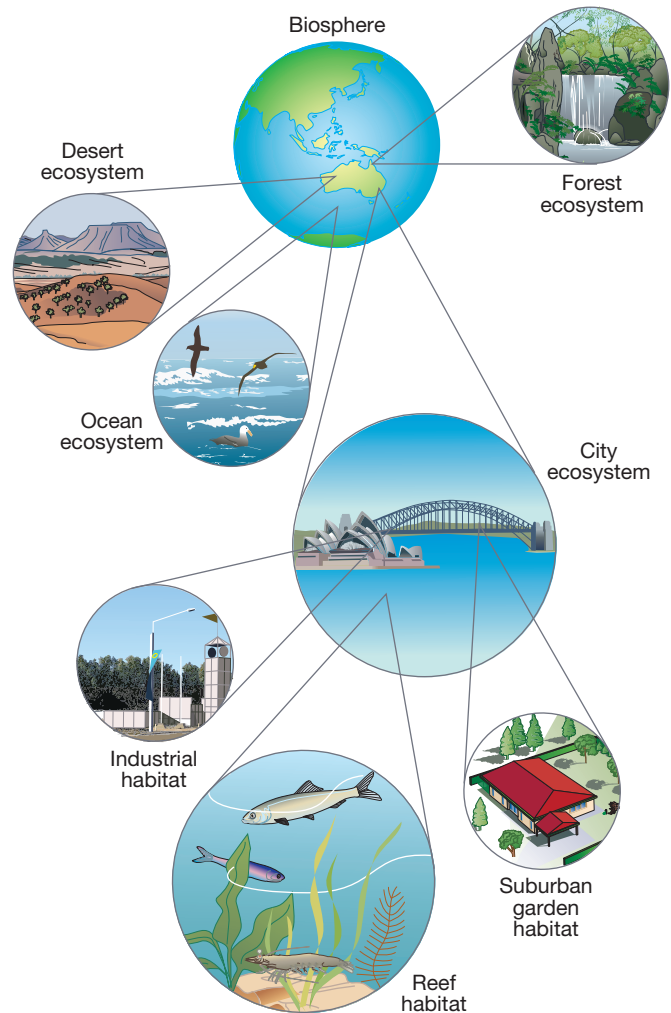
The **biosphere** is the place where all life as we know it exists. The biosphere consists of the surface of the Earth and its atmosphere. The biosphere is made up of many ecosystems such as forests, wetlands or the coral reef shown in Figure 5.1.8.



**Figure 5.1.8**

A coral reef is a complex ecosystem with many different types of animals living together.

An **ecosystem** is a system formed by organisms interacting with each other and their non-living surroundings in a balanced way. In an ecosystem there are many habitats. The relationship between the biosphere, ecosystems and habitats is demonstrated in Figure 5.1.9.



**Figure 5.1.9**

The relationship between the biosphere, ecosystems and habitats. In the biosphere there are many ecosystems. In an ecosystem there are many habitats.

### SciFile

#### Epiphytes

Epiphytes are plants that grow on other plants. Epiphytes use host plants for support, but take nothing else from them. The epiphyte and the host plant are both able to make their own food; therefore an epiphyte is not a parasite. Some common epiphytes you may have heard of are bird's nest ferns and staghorn ferns, as well as some types of orchids.



The organisms in an ecosystem are interdependent. **Interdependent** organisms depend on each other for survival. There are three main types of interdependence or **symbiosis**.

**1 Commensalism:** This is an interaction between two organisms where only one of them benefits, but the other one is not affected. For example, on the Great Barrier Reef there are small colourful fish called clown fish, seen in Figure 5.1.10. They are not affected by stings from sea anemones. The clown fish lives in the tentacles of the sea anemone and is protected from predators. The clown fish also gets bits of food not eaten by the anemone.



Figure 5.1.10

A clown fish in the tentacles of a sea anemone

**2 Mutualism:** This is an interaction where both the organisms benefit from the relationship and neither is harmed. In many cases, neither organism can exist without the other. Figure 5.1.11 shows lichen growing on a rock. Lichen consists of a fungus and algae growing together. The algae makes its own food using energy from sunlight and the fungus uses this food. The fungus provides the algae with a protected place to live.

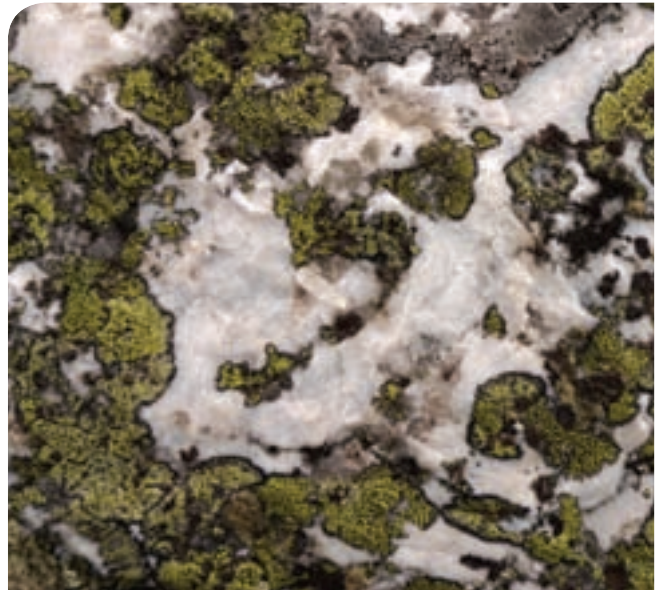


Figure 5.1.11

Lichen growing on a rock

**3 Parasitism:** This is an interaction where one type of organism (the **parasite**) lives on or in another type of organism (the **host**). The parasite obtains food and shelter from its host, but often harms or may even kill the host in return. Heartworm is a parasite that lives in the hearts of dogs. The worms breed rapidly and when present in large numbers can clog up the dog's heart. The worm uses the dog for shelter and food, but in the end the dog often dies. Figure 5.1.12 shows a dog's heart with a major infection of heartworm.



Figure 5.1.12

Heartworms infecting the heart of a dog



# SCIENCE AS A HUMAN ENDEAVOUR

Use and influence of science

## Tiny vampires



Figure 5.1.13

Leeches can take in several times their own weight in blood in one meal. They digest their meal slowly and may not need to feed again for many months.

After a walk in a damp forest, you may find that you have some small slugs on your legs. These small slugs are probably leeches, and they are sucking your blood. Leeches are parasites. Don't panic. They won't kill you and they are easily removed.

Leeches are common in wet areas along the east coast of Australia. Leeches can detect the warmth of your body and the vibrations caused by your movement. This is how leeches are able to find you. The head of the leech has suckers, which the leech uses for moving along and for sucking. Behind the suckers are jaws that act like little saws to pierce the skin. Australian leeches have only two jaws, but leeches in the rest of the world have three!

When people see a leech attached to their body they want to remove it as soon as possible. Dropping salt, salt water, vinegar or tea tree oil on the leech will cause it to drop off your skin. However, if you wait until the leech has finished feeding, it will drop off by itself—but this can take over half an hour. During this time the leech will expand to many times its original size.

You can prevent attack by leeches if you rub insect repellent over your legs, or wear long trousers tucked into thick socks, and high boots.

In the nineteenth century, bloodletting or bleeding was believed to be a cure for many illnesses. Leeches were commonly used to take blood from the patient. A wound from a leech bite will continue to bleed for up to 10 hours. The leech's saliva contains a chemical that prevents blood from clotting as quickly as normal. When the leech bites, this chemical passes into the body.

As medical science advanced, bloodletting or 'leeching' declined. However, doctors are now using leeches again. The leeches in Figure 5.1.14 are used to reduce swelling after surgery.

Leeches are used after microsurgery to reattach fingers, hands, toes, ears or noses that have been damaged in accidents. The tiny blood vessels in the damaged body part often become blocked as blood clots form within them. The chemical in the leech's saliva keeps the blood flowing through these tiny blood vessels. Leeches are also used during plastic surgery to prevent bruising. A chemical from their saliva is used in treating heart disease where blood clots are a problem. Researchers are continuing to investigate medicinal uses of other chemicals found in leech saliva.



Figure 5.1.14

Medical use of leeches





# 5.1

## Unit review

### Remembering

- 1 **Recall** an alternative name for a *living thing*.
- 2 **State** the meaning of the term *habitat*.
- 3 **List** the important things a habitat must provide so that organisms will be able to live there.
- 4 **Recall** the name for a scientist who studies the environment.

### Understanding

- 5 **Explain** what an adaptation is.
- 6 **Explain** why some organisms are found over a very wide area, whereas others live in very restricted areas.
- 7 **Describe** possible causes of a change in the number and type of organisms living in an area.
- 8 **Outline** what scientists mean when they say that organisms are 'interdependent'.

### Applying

- 9 **Use** examples to **describe** two types of symbiosis.
- 10 **Use** your understanding of adaptations to suggest why a particular type of organism cannot just move to another area if its habitat is destroyed.

### Analysing

- 11 **Contrast** biotic and abiotic factors.
- 12 **Compare** the biosphere and an ecosystem.
- 13 **Classify** the following as commensalism, mutualism or parasitism. Give reasons for your answers that include a description of the benefit or harm to each of the organisms.
  - a a leech sucking on the blood of humans and other mammals
  - b a baby kangaroo attached to its mother's nipple
  - c cleaner fish taking the parasites off the gills of large carnivorous fish
  - d bees carrying pollen from one flower to another as they collect nectar
  - e rainforest vines using hooks and tendrils to climb up large trees to reach the light

### Evaluating

- 14 Complete the following table by **proposing** adaptations that an animal or a plant would need to live in each environment.

| Environment that is very hot | Environment that is very cold | Environment that contains a large number of predators |
|------------------------------|-------------------------------|---|
|                              |                               |   |
|                              |                               |   |
|                              |                               |   |

- 15 In a tropical rainforest, very little light reaches the ground because of the dense canopy formed by the trees. Imagine that one very large tree falls down.
  - a **Deduce** the changes in abiotic factors that would occur in the area of the forest where the tree fell.
  - b **Propose** ways in which the changes would affect the plants and animals living in the immediate area.

### Creating

- 16 Think about a koala living in the Australian bush. **Create** a concept map of the biotic and abiotic factors that would be in the koala's environment. Include any adaptations that the koala would need to survive in its environment.
- 17 **Create** a poster or electronic presentation outlining the features of commensalism, mutualism and parasitism. Include at least two new examples of each.
- 18 Work in a small group to **design** a coastal rockpool ecosystem. Attach a concept map showing how the organisms in the rockpool interact.

### Inquiring

- 1 Parasites can affect the health of humans.
  - a Identify a human parasite.
  - b Describe how humans become infected with the parasite.
  - c Describe the symptoms the parasite causes and the long-term effects on health.