7Ca Environmental impact

How Science Works

About 180 000 new homes are built in the UK each year. These take up a lot of room and mean that there is less room for animals and plants to live.

A *Oakdale Housing Estate in Wales.*

B *Ecologist Colin Plant.*

Colin Plant is an **ecologist** – a scientist who studies organisms and the areas where they live. Colin is often asked by developers to study areas where houses are to be built. He writes a report to describe what would happen to the plants and animals if the houses were built.

Sometimes, rare organisms are found in an area. This can mean that the development is not allowed to go ahead or the development is delayed. The development might be delayed so that:

- the rare organisms can be moved to another area
- the development can be redesigned to allow the organisms to continue to live there; this is known as **sustainable** development.

If something is sustainable it means that it allows things to continue into the future.

C *The building of this tourist centre on Drumkinnon Bay was stopped for two weeks so as not to disturb the breeding of rare powan fish.*

1 a In order to build in some places it is the law that a survey is done of the organisms living there. Do you think this is a good law or not? Explain your reasons.
  b Who should carry out this survey?
2 What problems might building a city the size of London cause for the UK? Think of as many problems as you can.
3 What is a sustainable development?

! Some people think that between now and 2050 new housing in the UK will need to cover an area the size of London.

7Ca Home sweet habitat

What is in a habitat?

The place where an organism lives is called a **habitat**.

A *Woodland habitat.*

B *Pond habitat.*

C *Desert habitat.*

D *Arctic habitat.*

E *Underground habitat.*

1 a Imagine you went to each of the habitats A–E. Predict two organisms that you would expect to find in each. H S W

b How would you test your predictions? H S W

The word **environment** is used to describe the conditions in a habitat. Most of the conditions are caused by **physical environmental factors**. Examples include how much light there is, how wet it is, how much wind there is and how hot it is. These factors can all be changed if buildings are constructed in an area.

An ecologist often uses a **quadrat** – a square frame that is thrown around the habitat. The number of plants of one type that are inside the frame are counted for each throw. Knowing how many plants are inside a few quadrats helps you to work out the number of the plants in the whole area.

An environmental factor (e.g. the amount of light) can also be measured in each quadrat throw. This will allow you to make links between environmental factors and where certain plants grow best. It also helps you to see exactly where each type of plant is found in the habitat – its **distribution**.

F *Using a quadrat.*

2 Describe the environment in each of the habitats A–E.

3 Describe your environment at the moment.

4 Suggest what pieces of equipment you would need to measure the different environmental factors. H S W

5 How could the amount of light in an area be affected by a new building? H S W

H S W

How would you investigate why different numbers of a plant grow in different areas of a habitat?

- How would you measure the environmental factor?
- How would you survey the plants?

Organisms are **adapted** to live in their habitats. This means that they have features and behaviours that allow them to survive in an area. For example, fish have gills and fins, which are **adaptations** for living in water. Their fins will not let them walk on land and their gills will not let them breathe air. Fish are not adapted to living on land.

Behaviour describes what an animal does. Animals are born with some behaviours (e.g. fish can swim, human babies cry). However some behaviours are learned (e.g. fish learn where to find food, human babies learn to walk).

All the animals and plants that live in a habitat make up a **community**. Members of communities may have similar adaptations to cope with the problems of living in a particular habitat. For example, many organisms that live in fast-flowing rivers have adaptations to stop them being swept away.

Some organisms only live in certain small areas of a habitat. Centipedes live in woodland but are usually only found under logs and leaves. Smaller areas where things live are called **microhabitats**.


G

6 How are ducks adapted to:
- a swimming on water
- b flying?

!

Your body is a habitat and head lice live in a microhabitat – human hair! They suck blood from people's scalps.


H

7 Which of these are physical environmental factors?
light frog wind bush ant fungus temperature bird

8 Photograph I is of a hogsucker fish.

I

- a What habitat do you think it lives in? Explain your answer.
- b Draw a plant that might live in the same habitat. Label its adaptations. It does not have to be a real plant!

9 Describe the distribution of human head lice.

10
- a List the two types of behaviour.
- b Give the name of an animal and describe how its behaviour helps it to survive.

I CAN...

- describe the environments of some habitats.
- give some examples of how organisms are adapted to their habitats.
- explain what a distribution and a community are.
- use a quadrat to work out distributions of plants. H S W

7Cb Adept adaptations

How are organisms adapted to where they live?

Great crested newts are adapted to living in and around ponds. They are protected by law. It is illegal to catch or harm them or to disturb their habitats.

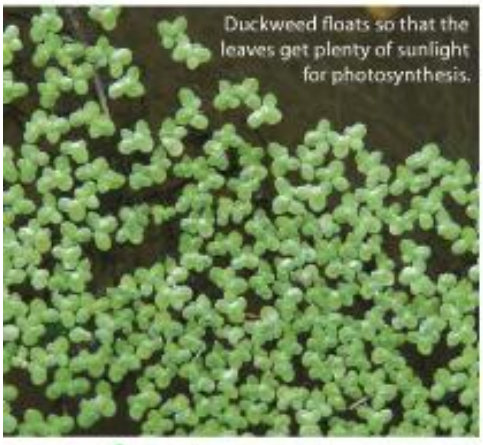
1 What adaptation do great crested newts have for swimming?
2 Why do you think they are protected by law? H S W

A *Great crested newts are adapted to living in and around ponds.*

In 2004 the Joseph Rowntree Foundation wanted to build 540 homes near York. However, some great crested newts were found on the site. The development may have caused the newts to die out because their adaptations only allow them to survive in areas with ponds. The plans were changed to include bigger and better ponds for the newts, so that their numbers could increase. The plans were approved in 2007.

3 Why might putting up houses without any ponds cause the newts to disappear?
4 A representative wrote this in a local newspaper: '… the Joseph Rowntree Foundation will continue to progress its interest… in a sustainable way'. In what way is the development sustainable? H S W

Pond plants are also adapted to where they live. Photo B shows some duckweed.



B *Duckweed is adapted to living in ponds.*

How would you find out whether duckweed plants are only adapted to live in fresh water or whether they can live in salty water too?
- How much salt would you use? (There are 30g of salt in every litre of sea water.)
- What would you look for in the duckweed plants?

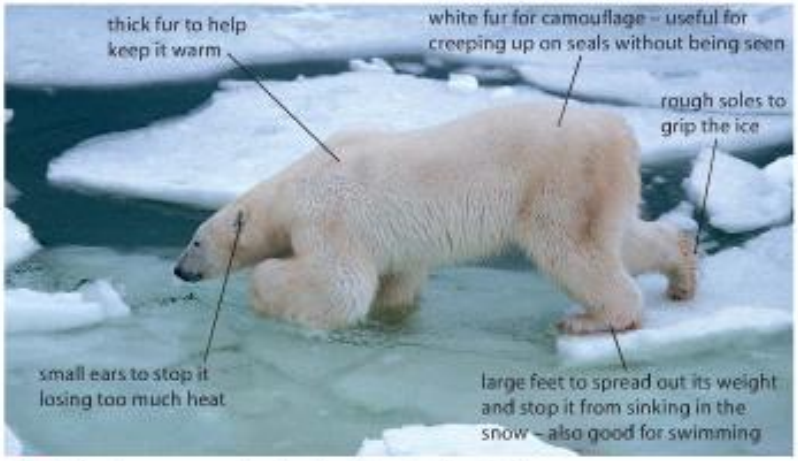
5 How do duckweed plants get a lot of sunlight?

Vultures live in the desert. They urinate on their legs to keep cool! The urine evaporates which cools them down.

C

It's not just buildings that cause problems for habitats. Most scientists think that humans are making the Earth warm up (**global warming**) and that this is causing problems in many habitats – including places where very few humans live, like the Arctic.

Polar bears are adapted to hunting seals, which live on the ice. Warmer temperatures in the Arctic mean that there is less ice and so fewer places to hunt seals.

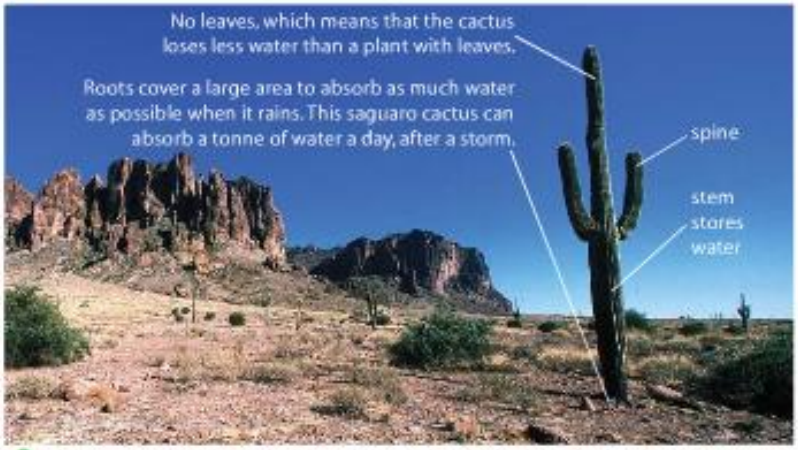


D *Polar bears are adapted to living in the Arctic.*

6 How are polar bears adapted to the cold in the Arctic?

7 Ecologists in Canada have found that polar bears are 10% thinner than they were 20 years ago. Suggest a reason for this. H S W

If the Earth continues to warm up, some species that are adapted to desert habitats may spread into new areas.



E *Cacti are adapted to living in deserts. They may soon grow in new areas that have become warmer and drier due to global warming.*

8 a A cactus has spines on its stem. Why do you think these are useful?

b Most cacti grow very slowly. Suggest why this is.

9 Photo F shows a jack rabbit.

a Suggest what habitat it is adapted to.

b Suggest some reasons for its long ears.

I CAN...

- state some adaptations of plants and animals for different habitats.
- explain why changes in habitats cause problems for organisms.
- give reasons why the plans for a development may need to be changed.

7Cc All change

How are organisms adapted to natural environmental changes?

There are natural, regular changes that occur in habitats. Changes during a day are known as **daily changes**, and changes during a year are called **seasonal changes**. Organisms are adapted to these changes.

Daily changes

Many flowers give off a smell to attract the animals that pollinate them. Some flowers open at night – they are **nocturnal** and so are the animals that pollinate them. The flowers shut during the day to avoid wasting scent when the animals are not around.

2 Daisy flowers open during the day and shut at night. Explain why.

Many animals are born with behaviours that change as daily changes occur. Great crested newts are nocturnal so that they are less likely to be seen and eaten. However, other animals, like many owls, are also nocturnal so that they can catch and eat other nocturnal animals! These animals have adaptations for darkness; newts have excellent eyesight and owls have superb eyesight and hearing.

Seashore organisms are adapted to tides. Sea anemones use tentacles to feed underwater. When the tide goes out, they pull in their tentacles to stop them drying out.

B *A sea anemone under water.*

C *A sea anemone when the tide is out.*

1 Describe how the amount of light in a wood changes during:
a a day
b a year.

A *Saguaro cacti flowers only open at night when the bats that pollinate them are active.*

A barn owl can hear a mouse's heartbeat from 10 metres away.

H S W

How would you find out if water fleas are found in different places during the day and at night?

D

Seasonal changes

In winter, **deciduous** trees lose their leaves because there is not much light for photosynthesis and their leaves lose water (which cannot be replaced if it is frozen in the ground). **Evergreen** trees have tougher leaves that don't lose much water, and so they keep their leaves all year round. These trees can grow quite far north where the summers are short. By keeping their leaves, they can start photosynthesising and growing again as soon as there is enough liquid water and light.

Some plants, like poppies, die completely in the winter. Their **seeds** grow into new plants in the spring. In other plants, like bluebells, only the parts above ground die. They leave **bulbs** underground that will grow again in the spring.

Animals are also adapted to survive in winter. Many animals, like rabbits, grow longer fur to help keep them warm. The ptarmigan has brown feathers in summer and white ones in winter. It also grows feathers on its feet in the winter that act like snow shoes.

An animal's behaviour can change too. In the autumn squirrels collect and store nuts to eat during the winter. Some animals eat a lot in the autumn and sleep through winter. This is **hibernation**. Great crested newts hibernate and so do hedgehogs, dormice, frogs and ladybirds.

Some birds fly to warmer places during the winter where there is more food. This is called **migration**. Swallows migrate to South Africa in October and come back to the UK in April.

5 Why do animals that hibernate eat a lot in the autumn?

6 **a** How do these physical environmental factors change from summer to winter in the UK?
i light **ii** temperature **iii** rain

b Suggest how you could collect measurements to show how one of these factors changes. H S W

7 How are these organisms adapted to survive the winter in the UK?
a hedgehog **b** oak tree **c** swallow **d** poppy

3 **a** In which season was photograph E taken?
b How do you know this?

4 Why do you think the ptarmigan's feathers change to white in winter?

!

An Arctic tern flies about 35 000 km each year as it migrates from the Arctic to the Antarctic and back again.

I CAN...

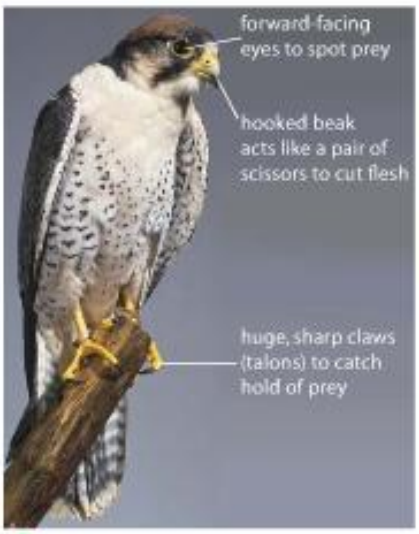
- give examples of adaptations to daily and seasonal changes.
- give examples of animals that hibernate, migrate and are nocturnal.
- state some differences between deciduous and evergreen trees.

7Cd Finding food

How are animals adapted to feeding?

Predators are animals that hunt other animals. The animals that they hunt are their **prey**. Predators have adaptations that allow them to catch their prey. The predators in the pictures are from Africa and live in an open grassland habitat (called savanna).

1 a What is a predator?
b Name one predator from the African savanna.
c Name one predator that you might find in the school grounds.



A *A Lanner falcon.*

B *A lion.*

Animals that are prey have adaptations to help them avoid being eaten.

2 a List two adaptations that predators have in common.
b How does each adaptation help the predator to trap its prey?
3 a List two adaptations that prey have in common.
b How does each adaptation help the animal avoid predators?

C *An oryx.*

D *A scrub hare.*

Animals that eat other animals are called **carnivores**. They use senses like sight, smell and hearing to find their prey. Animals that eat plants are called **herbivores**. They use senses like sight and smell to find plants to eat.

3 Humans have senses. Which senses do we use to find food?

Woodlice are **decomposers**. They eat rotting wood and leaves. How would you investigate what behaviour woodlice have for finding food?

- Think about the conditions in which rotting wood and leaves are found.
- You could use a **choice chamber**. The compartments can be filled with different substances.
- Calcium chloride removes moisture from the air but can harm woodlice if it touches them.

E

Many animals also have special adaptations for eating. For example, birds have different shaped beaks depending on what they eat.

F *Oyster catchers have long beaks to search in sand for shellfish.*

G *Ducks have flat beaks to sift out weed and small snails from water.*

H *Swallows have short, pointed beaks to catch insects in the air.*

I *Finches have thick, strong beaks to crush seeds.*

4 How is a Lanner falcon's beak adapted for eating other birds?

5 a What is a herbivore?
b List all the herbivores on these two pages.

6 a What is a carnivore?
b List all the carnivores on these two pages.

7 Look back at page 40.
a What is a nocturnal animal?
b Name one predator that is nocturnal.
c What sense does this animal use to hunt?
d What is this animal's prey?

8 a Many shellfish are found deep in the sand along beaches. Shelducks are ducks that live along the sea shore. Explain why shelducks don't eat shellfish buried in sand.
b Suggest what shelducks eat.

The pistol shrimp stuns its prey with a loud noise that it makes with its claws.

I CAN...

- describe some ways in which predators and prey are adapted to finding food and feeding.

7Cd Focus on: Parasites

What problems can parasites cause?

A **parasite** is an organism that lives in or on another living organism (called its **host**).

Some parasites cause diseases and even death. One-celled organisms called trypanosomes (found in Africa) live in blood and cause a disease called sleeping sickness. About 100 people die every day from this disease.

Discovery

Using a microscope Sir David Bruce (1855–1931) discovered trypanosomes in the blood of cattle that had sleeping sickness. He injected blood from sick animals into animals that had no trypanosomes. Those animals then got the disease and had trypanosomes in their blood. His later investigations showed that trypanosomes caused human sleeping sickness and were carried between animals by blood-sucking tsetse flies.

Controlling the disease

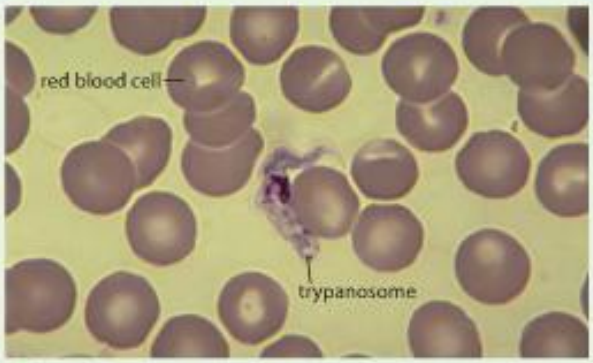
One way to control the disease is to decrease the numbers of tsetse flies. This can be done by:

- using poisons
- using traps
- destroying the flies' habitat (areas with bushes and small trees)
- killing wild animals that trypanosomes can live in
- releasing sterile males.

In this last method lots of specially bred male tsetse flies are given a dose of radioactivity. This makes them 'sterile' which means they cannot pass working sperm onto the females when they mate. It works because the females only mate once.

How Science Works

1 Head lice are parasites. What are their hosts?



A *Trypanosomes (magnification × 500).*

B *The black part of this trap contains a bottle of cow urine. Tsetse flies are attracted towards the bottle, fall into it and die.*

2 For each method of controlling sleeping sickness, explain:
a how it works b what problems it might cause.

3 What was Bruce's evidence for sleeping sickness being caused by trypanosomes?

4 Suggest a way of controlling sleeping sickness that does not affect tsetse flies.

7Ce Links and chains

What are food chains and food webs?

Every organism contains a store of **chemical energy**. Animals eat things to get this store of chemical energy. A **food chain** is a way of showing what eats what in a habitat. The arrows show the direction in which energy travels.

In this food chain you can see that oryx eat grass and lions eat oryx. Chemical energy is passed from the grass to the oryx and then from the oryx to the lion.

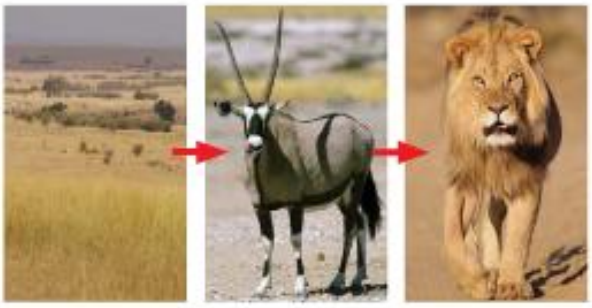
Food chains always start with organisms that make their own food. These are called **producers**. Plants are producers. Animals are **consumers**, which means that they have to eat other things. A food chain ends with a **top predator**.

1 Look at the food chain and name:
- a two consumers
- b a predator
- c a producer
- d a top predator.

On the African savanna it is not only oryx that eat grass. Many other animals do too. To show this we need to use a **food web**. A food web can also show how some animals (called **omnivores**) eat both plants and other animals.

2 Look at the food web.
- a What eats grass?
- b What do caracals eat?
- c Write down one of the two longest food chains in the food web.
- d Write a list of the organisms in your food chain from part **c**. Describe what each one is by writing one or more of these words next to it: carnivore consumer herbivore omnivore producer top predator

3 Why are plants called producers?

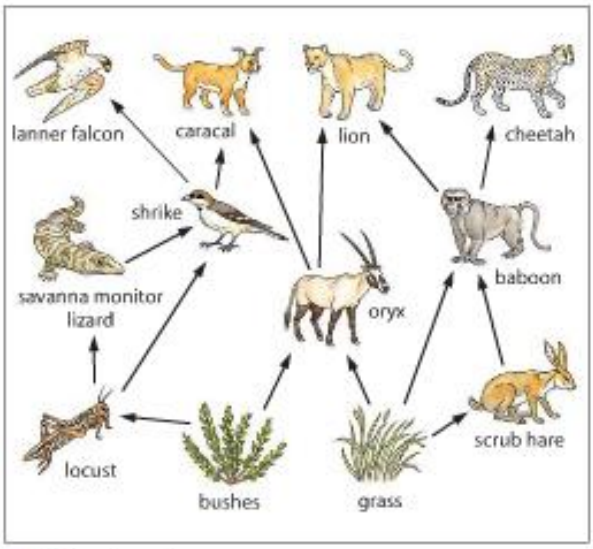


grass is eaten by an oryx is eaten by a lion

This can be written as a food chain:

grass → oryx → lion

A *A food chain.*



B *A food web.*

I CAN...

- draw and explain food chains and food webs. H S W
- recall the words that describe organisms in a food chain (e.g. producer, predator).

7Ce Feeding evidence

How can we tell what eats what?

When ecologists study a habitat they try to find out what organisms live there and how they feed. They can then use this information to construct food webs.

Pooters and **sweepnets** are often used to collect organisms from a habitat. In woods, ecologists can also shake tree branches and collect the organisms that fall from them. This is called **tree beating**.

B *Using a sweepnet.*

Where an animal is found may give an ecologist an idea of what it eats. For example, aphids are found on plant stems because they feed on juice inside the plant. Ladybirds are found near aphids because they eat aphids.

A *Using a pooter.*

1 a Where would you use a sweepnet? H S W
b You would not use a sweepnet to collect animals from dead leaves. Why not? H S W
c What would you use to collect animals from dead leaves? H S W

2 If you remove any animals from a habitat to look at, you should always replace them where they were found. Suggest why.

C

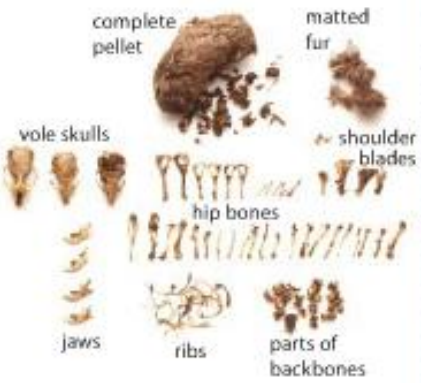
3 Look at photos D and E. H S W
a What do you think woodlice feed on? Give a reason for your answer.
b What do you think will eat the fly? Give a reason for your answer.

D

E

An ecologist can also find evidence from animal waste.

F *Thrushes are small birds that drop snails on stones to break their shells. The stones are called thrush anvils.*



G *Owls swallow their food whole and then cough up the bits that cannot be digested. The coughed up bits come out as a pellet.*

H *This dropping contains the seeds of what the bird has eaten.*

Animal droppings are distinctive shapes and can be used to show what animals are in a habitat and what they eat. Identifying the animal droppings found near a damaged plant or a dead animal will provide evidence for what animal was responsible.

Other evidence includes teeth marks, footprints and distinctive trails. For example, snails leave trails of slime behind, which can often be seen around damaged plants.

Once an ecologist has put together a food web, you can see how the organisms in a habitat rely on each other for food (**feeding relationships**). You can also see how they **compete** with each other. For example, earthworms are eaten by hedgehogs and shrews. The hedgehogs *and* shrews are in **competition** with each other for the worms.

Humans also compete with plants and animals. When building projects take place we compete for space.

4 Name one animal that an owl eats. H S W

5 a What do thrushes eat?
b How would you find evidence to support this? H S W

I *An ecologist working in the savanna in Africa would know that this hyaena has been killed by a lion because of what the teeth marks look like.*

6 Name two ways of finding out what a bird eats. H S W

7 Teeth marks are often found on the bark of trees. Suggest how you would go about finding out what animal made the marks. H S W

8 Look at the food web on page 45. Which animals compete for baboons?

9 Plants also compete with each other. Suggest what they compete for.

I CAN...

- plan how to find evidence of what eats what in a habitat. H S W
- use information to work out which organisms are in competition with each other. H S W

7Ce Using the evidence

HowScienceWorks

Ecologists are often called in to look at habitats before changes are made. Changes include planned building work or plans to kill certain animals that are causing a problem.

A farmer has called in an ecologist to advise on what might happen if he kills the field mice in his wheat fields. The farmer wants to know what affect this might have on other organisms in the fields. The ecologist has been to the field and done a study. The photographs show the evidence collected.

HAVE YOUR SAY

Some people think that farmers should be forced to call in an ecologist whenever they plan to kill wild animals on their farms. What do you think of this idea?

1 Why do you think the farmer wants to kill the mice?
2 Use the photographs to draw a food web for the field.
3 For each of the animals in the food web:
   a describe an adaptation for surviving in this habitat
   b explain how this adaptation helps it to survive.
4 Write a letter to the farmer to explain what effect the removal of the field mice might have on this habitat. Use your food web to help you.