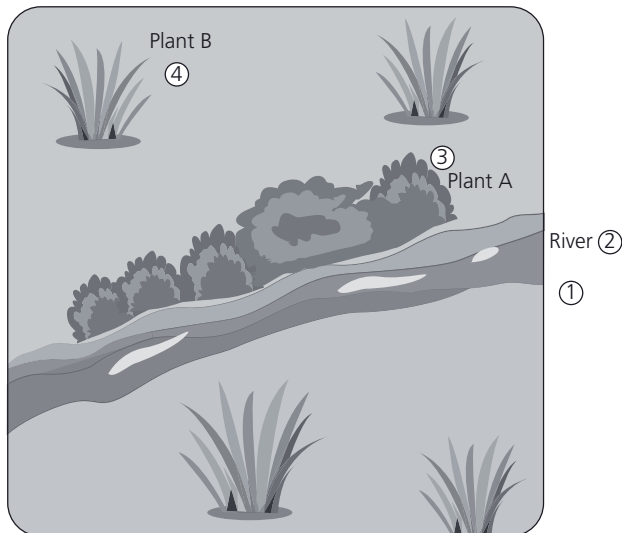


B9.4 Biodiversity

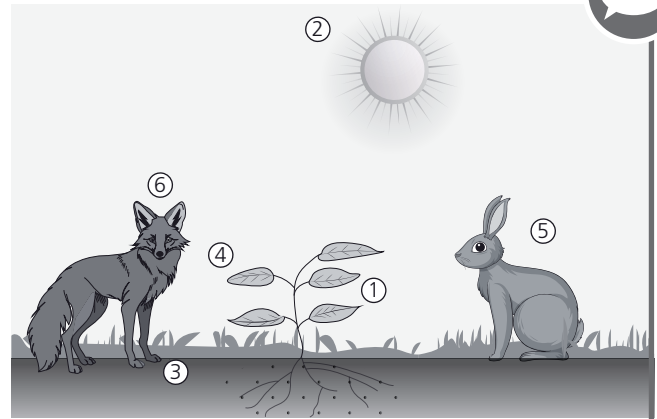
What factors affect organisms?

Draw the diagram below and explain as follows:



- 1 This is a field.
- 2 There is a river flowing through the middle of this field.
- 3 Plant A grows near the river. We use the word *abundance* to describe the number of organisms in a given area. Plant A is abundant near the river but not anywhere away from the river.
- 4 Plant B grows away from the river but is spread throughout the rest of the field. We use the word *distribution* to describe the way organisms are spread out in an area.

Display the slide to show the diagram below and explain as follows:



- 1 If we look at a plant growing in an area, there are several factors that affect how it grows.
- 2 The amount of sunlight available for plants is called *light intensity*. Plants need a high light intensity to do photosynthesis and grow.
- 3 Plants also need water, which they get from the soil. This is another factor that can affect whether plants grow well. Both light intensity and water availability, as well as temperature, are examples of *abiotic factors*. These are non-living parts of the ecosystem that can affect organisms in an area.
- 4 But living parts of the ecosystem can also affect organisms. For example, a caterpillar can eat leaves from a plant.
- 5 A rabbit can also affect how many plants are growing in an area.
- 6 A fox can eat the rabbit and affect its numbers. Living parts of the ecosystem that can affect organisms in an area are called *biotic factors*.

Check for understanding

Display the CFU slide and, using MWBs, ask questions like the ones below.

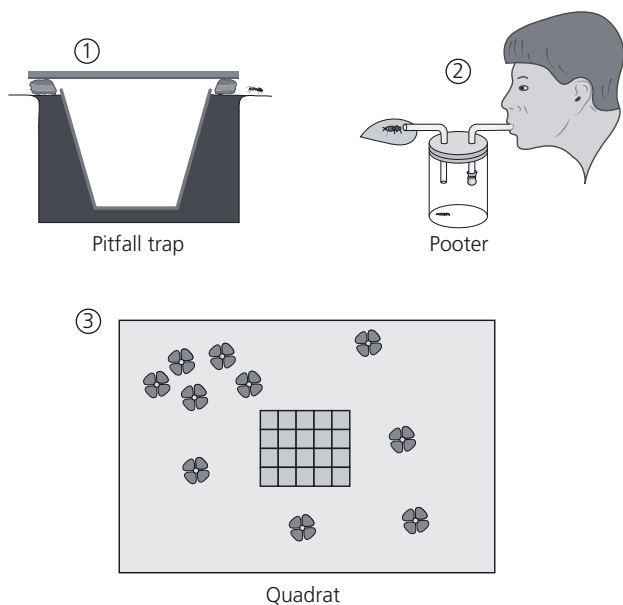
- What are the two types of factor that can affect organisms in an area?
- A plant grows better in a warm place than a cold one. What type of factor does this represent?
- What two measurements do scientists make when studying organisms in an area?

Guided explanation

How do we sample organisms in an area?

Explain that scientists can study organisms to determine their abundance and distribution in an area. They cannot count them all, as there would be too many. This is why scientists sample organisms. This means they count a few organisms of a species and estimate how many there are in the population. Scientists use several different ways to sample different types of organism.

Display the slide to show the diagram below and explain as follows:



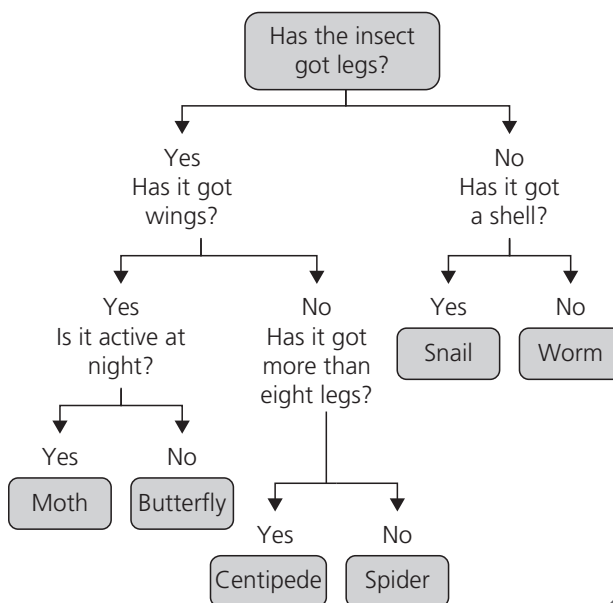
- 1 For small ground-dwelling organisms, such as insects, we can use a *pitfall trap*. This is a small container placed in a hole in the ground. The top of this container is covered with a lid that is set slightly above the ground level so insects can fall in.
- 2 For small insects, such as ants and green fly, found on leaves of plants we can use a *pooter*. This is a small container with two

tubes. One tube is aimed at the insect and the other tube is used to suck in the air from the container. This creates a vacuum inside the container pulling in the insect through the first tube. The tube used to suck in air has one end covered in a mesh, so that the insect does not enter the person's mouth.

- 3 For plants or slow-moving animals, such as snails, a quadrat is used. A *quadrat* is a square frame with a known area. It is placed randomly on a field and the number of the organisms found within the quadrat is counted and recorded. This is repeated several times over the field and then the total is used to estimate a population size for that organism.

Once scientists have caught an organism using a pooter or pitfall trap, they need to identify it in order to record the number of different types of organism correctly.

Display the slide to show the diagram below and explain as follows:



This is a *biological key*. Scientists use this type of key to identify different organisms. They observe the organism they have caught and answer questions about it to correctly identify it.

Display the slide to show the image below and explain as follows:



If we observe this insect carefully, we can use the biological key to answer some questions to identify it.

- The insect has legs.
- It does not have wings.
- It has more than eight legs.
- It is a centipede.

Check for understanding

Display the CFU slide and, using MWBs, ask questions like the ones below.

- A scientist wants to count the number of ants in an area. Which sampling method should they use to capture them?
- Why cannot we use a quadrat to record the number of rabbits in an area?
- What do scientists use to identify organisms?

Independent practice review

Student Practice Book questions 127–43.

Q	Notes
130	Accept answers that include living organisms that can affect the growth of plants.
132	Students should mention two tubes, one aimed at the insect and the other used for sucking it into the container. The word 'vacuum' need not be part of the answer.
141	Accept responses that suggest that pitfall traps are for ground-dwelling insects, not ones that live on leaves.



Using quadrats to measure abundance

A method is provided on the *Practical worksheet* and *Teacher and technician notes on Boost* – including equipment list and safety notes – if you wish to allow your students to proceed independently. However, for most students it will ordinarily be better to take a *Slow Practical* approach following the guidance below.

Students should work in pairs or groups of three. For each group and for yourself, you will need quadrats, one dice, clipboards, pencils and a trundle wheel or tape measure.

- 1 This practical needs to be conducted outdoors where dandelions or daisies grow. Pick one of these plants to focus on. Ensure you have a map (a rough drawing can suffice) of the area you will sample. Draw gridlines on this map with coordinates with letters A–F down one side and numbers 1–6 down the other, as shown.
- 2 Using the trundle wheel or measuring tape, measure the length and width of the area to be sampled. Make a note of these measurements.
- 3 Using a tape measure, measure the length and width of one quadrat. Write down these measurements. Provide these measurements to students.
- 4 Ask students to collect a quadrat.
- 5 Demonstrate how to place a quadrat randomly by using a dice to choose the letter and the number of the coordinate. For example, roll the dice once to determine the letter (1 = A, 2 = B, etc.). Then roll the dice a second time to determine the number. Explain that we need to place the quadrat randomly to avoid bias.
- 6 Ask students to record the number of daisies (or dandelions) within the quadrat. Only plants that are fully or halfway within the quadrat should be counted. Any that are slightly within should be ignored.
- 7 Students should repeat this process of determining the coordinates using the dice, placing the quadrat and recording the number of the chosen plant a total of ten times.
- 8 Demonstrate how to calculate the area of the field (length multiplied by width), area of one quadrat (length multiplied by width) and mean number of plants (add up all the numbers recorded and divide by ten).
- 9 Assuming area of the field is $5\text{ m} \times 7\text{ m} = 35\text{ m}^2$
 Assuming area of one quadrat is $1\text{ m} \times 1\text{ m} = 1\text{ m}^2$
 Assuming numbers of daisies recorded were: 5, 0, 2, 1, 2, 0, 0, 3, 1, 2, calculate the mean:
 $5 + 0 + 2 + 1 + 2 + 0 + 0 + 3 + 1 + 2 = 16 \div 10 = 1.6$ daisies
 Calculate the population size of daisies in this field = (area of field $\times$ mean number)
 $\div$ area of one quadrat
 For example,
 population size = $(35 \times 1.6) \div 1$
 population size = 56 daisies

