

## Objectives

- B9.2** Explain how communities can be affected by abiotic factors including  
a temperature, light, water, pollutants
- B9.5** *Core Practical: Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects.*
- B9.6** Explain how to use raw data from field-work techniques, including quadrats and belt transects.

## Maths requirements

- 1c** Use ratios, fractions and percentages.
- 2c** Construct and interpret frequency tables and diagrams, bar charts and histograms.
- 2d** Understand the principles of sampling as applied to scientific data.

## Learning outcomes

-  **SB9.2** Give examples of abiotic factors.
-  **SB9.2** Explain how communities are affected by abiotic factors (temperature, light, water, pollutants).
-  **SB9.6** Explain how to investigate the effect of abiotic factors on the distribution of organisms using belt transects.

## Exploring

### 1. Quadrats and transects – Core practical

This practical forms part of the core practical requirement of the specification, looking at the effect of the environment on the distribution of organisms. It is supported by the information on *Students' sheet CP8(Using transect and Quadrat)* and in the Student Book.

Worksheet SB9c.1 provides a practical using a transect and quadrat to measure the effect of environmental factors on the distribution of organisms. This practical can be adapted to any available example of changing distribution related to environmental change, such as the distribution of plants between shade and bright light, or from a well-trampled area to an area of little trampling, or the distribution of seaweed or shellfish on a rocky seashore from low to high tide. If the practical work is to be done on the school playing fields, consider a preparatory session on the field to provide students with the opportunity to decide where best to take samples.

A preparatory discussion will be needed to identify which environmental factors to measure and how best to measure and record them. It may also help if students become familiar with the organisms they will record, from identification charts, before they go into the field. Suggest they focus on recording details of only one or two species. Note that abundance can be measured by counting individuals within the quadrat, or estimating percentage coverage of the quadrat for species such as grass that are very common. Alternatively, students could use the ACFOR (abundant, common, frequent, occasional, rare) method of scoring. (Information on this can be found on the Internet.) If soil samples are taken, students will need time in the lab to carry out analysis, for example using nutrient test kits.

Question 2 on the worksheet requires students to consider the best way to display the results. This will depend on how the data was recorded, as some (discontinuous data) will need presenting as a bar chart and some (continuous data) as a line graph. Some students may be able to combine results on one set of axes, using different scales and a key for each factor measured. Other students may need to draw separate charts or graphs for each factor. In the latter case, encourage them to align the x-axis of each chart, to make comparison easier.

**Support:** During the practical work, make sure that students are clear about what to measure and record, as well as how to set out the transect and quadrats for sampling. When students are recording and analysing results, work with them to draw up the record table and chart(s). Discuss the remaining questions before students complete the rest of the sheet.

**Stretch:** Students could plan and carry out their investigation without the worksheet. Challenge students to consider all the environmental factors that might affect the distribution of the organisms. For example, a tree with a large canopy not only creates shade, but also may reduce the amount of precipitation reaching the ground, as well as removing more moisture and nutrients through its roots. This will probably result in students not being able to identify which factor has the greatest effect, but should lead to deeper understanding of the interaction between biotic and abiotic factors in an ecosystem.

 **Safety**

Carry out a full risk assessment of the area where sampling will take place and make sure students are fully aware of safety issues and how to tackle them.

**Expected results**

If a clear change in distribution of an organism along the transect was measured, students should be able to associate that with a change in value of an appropriate environmental factor (e.g. abundance of daisies is greater where light intensity is greater or trampling less). Note, this may not always occur, because an environmental factor that was not measured may be controlling distribution more than the factors measured. In this case, discuss with students what else might be causing the distribution, and ask them to suggest how they would test their ideas.

**Course resources**

Bio Students' sheet CP8a

**Equipment**

long tape measure (at least 20 m) with pegs at each end to hold it firmly in place on the ground, quadrat (e.g. 50 cm<sup>2</sup>, or 1 m<sup>2</sup> if recording larger plants/seaweed), apparatus for measuring suitable abiotic factors (e.g. light sensor and recorder, soil humidity sensor, small bags for collecting soil samples for nutrient testing in the lab, trowel, soil nutrient testing kit, wind speed measurer), identification charts, labels for bags, pencil