

Fieldwork and sampling

Revision notes · Core practical using quadrats and belt transects, and how to estimate the number of organisms in an area from raw data.

For Edexcel GCSE Biology 1BI0 and Combined Science 1SC0. **Triple only** is not in Combined Science. **Higher tier** is only on the Higher paper.

Fieldwork and sampling Spec 9.5–9.6

Core practical: quadrats and belt transects Spec 9.5

Field-work techniques let you investigate the relationship between organisms and their environment, for example how the number of a plant species changes with light intensity.

Quadrat	A square frame used to sample the organisms in a small, known area.
Belt transect	A line (a tape measure) laid across a habitat, with quadrats placed along it at regular intervals, to show how organisms change along an environmental gradient.

Random sampling with quadrats

1. Mark out the study area with two tape measures laid at right angles along two sides.
2. Use a random number generator to pick two coordinates, one along each tape measure.
3. Place the quadrat at that point and count the number of the chosen species inside it, or estimate the percentage cover.
4. Repeat for many quadrats and calculate the mean.

Belt transect

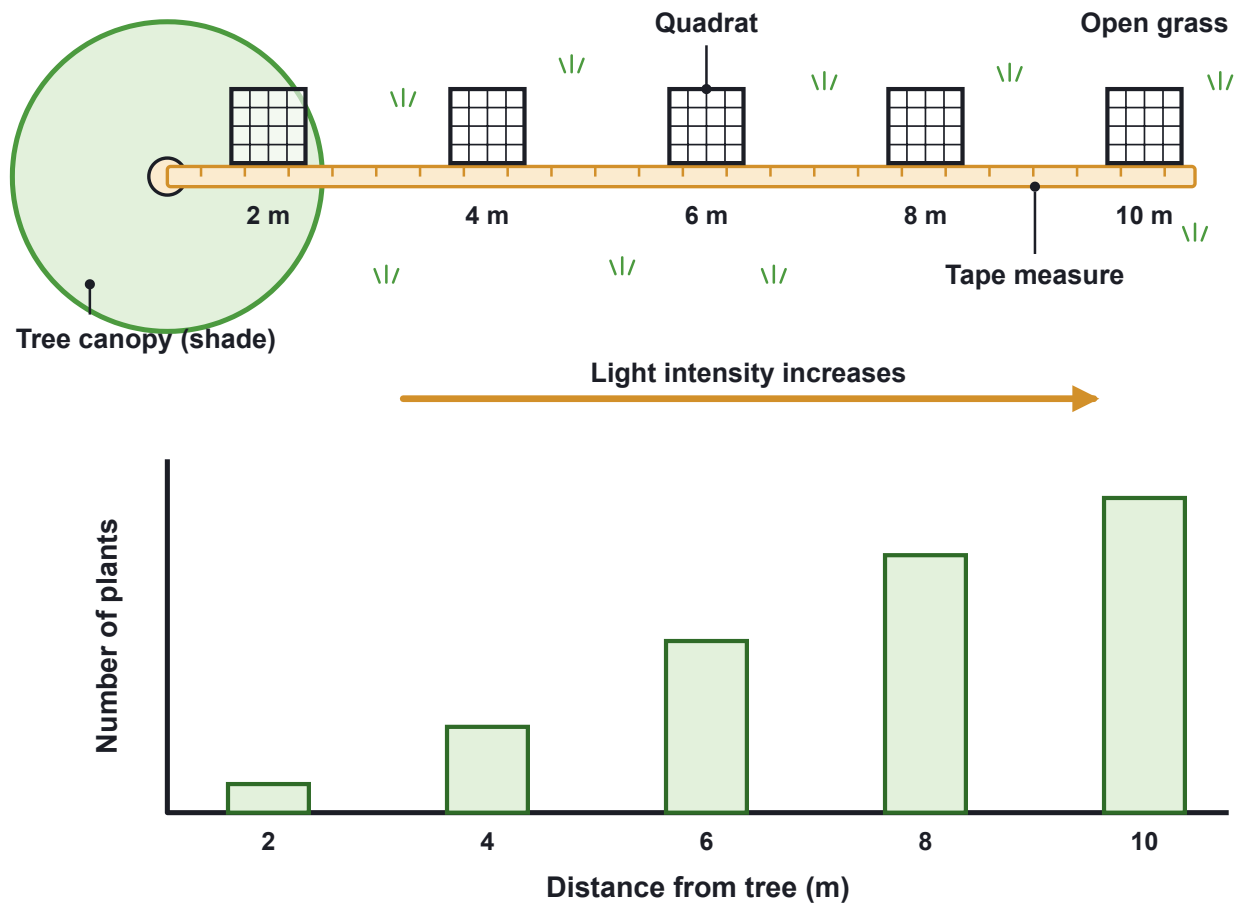
1. Lay a tape measure in a straight line across the habitat, for example from under a tree out into open grass.
2. Place a quadrat at regular intervals along the tape, such as every 2 m.
3. At each position count the organisms in the quadrat and measure the environmental factor, for example light intensity with a light meter or soil moisture with a moisture meter.
4. Record both in a table and plot a graph to look for a pattern.

Variables and safety

- **Independent variable:** the position along the transect, or the environmental factor such as light intensity.
- **Dependent variable:** the number or percentage cover of the species.
- **Control variables:** the quadrat size, the species being counted and the person counting.
- **Safety:** wear suitable footwear, wash hands after handling soil or plants, and do not touch plants you cannot identify.

Core practical: Say that random placement avoids bias, and that a belt transect is used when you want to see how a species changes along a gradient.

Typical result: along a transect from shade into open ground, plants that need lots of light increase in number as light intensity increases. A scatter diagram of number against light intensity can show a **correlation**, but a correlation alone does not prove that one factor causes the other.



A belt transect: quadrats at regular intervals along a tape measure, with the count from each quadrat plotted against distance.

Estimating the number of organisms Spec 9.6

You cannot count every organism in a large area, so you take samples and use them to estimate the total. A larger number of quadrats, placed randomly, gives a more reliable estimate.

$$\text{estimated population} = \text{mean number per quadrat} \times (\text{total area} \div \text{area of one quadrat})$$

Estimating a population

A student counted daisies in five 0.25 m² quadrats placed randomly in a field of area 100 m². The counts were 3, 5, 4, 6 and 2. Estimate the number of daisies in the field.

1. Mean per quadrat = $(3 + 5 + 4 + 6 + 2) \div 5 = 20 \div 5 = 4$
2. Number of quadrat areas in the field = $100 \div 0.25 = 400$
3. Estimated population = $4 \times 400 = 1600$

Answer: 1600 daisies

Plants that are difficult to count individually, such as grass, can be measured by **percentage cover**: the percentage of the quadrat covered by the species.

Other points to understand about sampling:

- Take as many quadrats as possible, because a bigger sample is more representative and reduces the effect of anomalies.

- Place quadrats randomly, to avoid bias.
- Calculate a **mean** from the raw data. A bar chart or frequency table is useful for presenting the results.

Maths skill: Check the units. If the quadrat is 0.5 m by 0.5 m its area is 0.25 m², not 0.5 m². This is the most common slip in estimate questions.

Quick check

1. How do you stop bias when placing quadrats?
2. What does a belt transect show?
3. Write the equation for estimating a population from quadrat data.
4. Why use many quadrats?

Quick check answers

Fieldwork and sampling

1. Use random numbers to choose the coordinates.
2. How the distribution of organisms changes along an environmental gradient.
3. Mean per quadrat $\times$ (total area $\div$ area of one quadrat).
4. To give a more representative and reliable sample, and reduce the effect of anomalies.