

Ecological Sampling with Quadrat and Transect

- ▶ **Ecology** is the branch of biology that studies the **distribution** and **abundance** of species, the **interactions between species**, and the **interactions** between **species** and their **abiotic** environment.
- ▶ Ecologists are biologists that study these interactions by investigating ecosystems.
- ▶ One piece of equipment that is routinely used to investigate population size is a **quadrat**

Quadrats

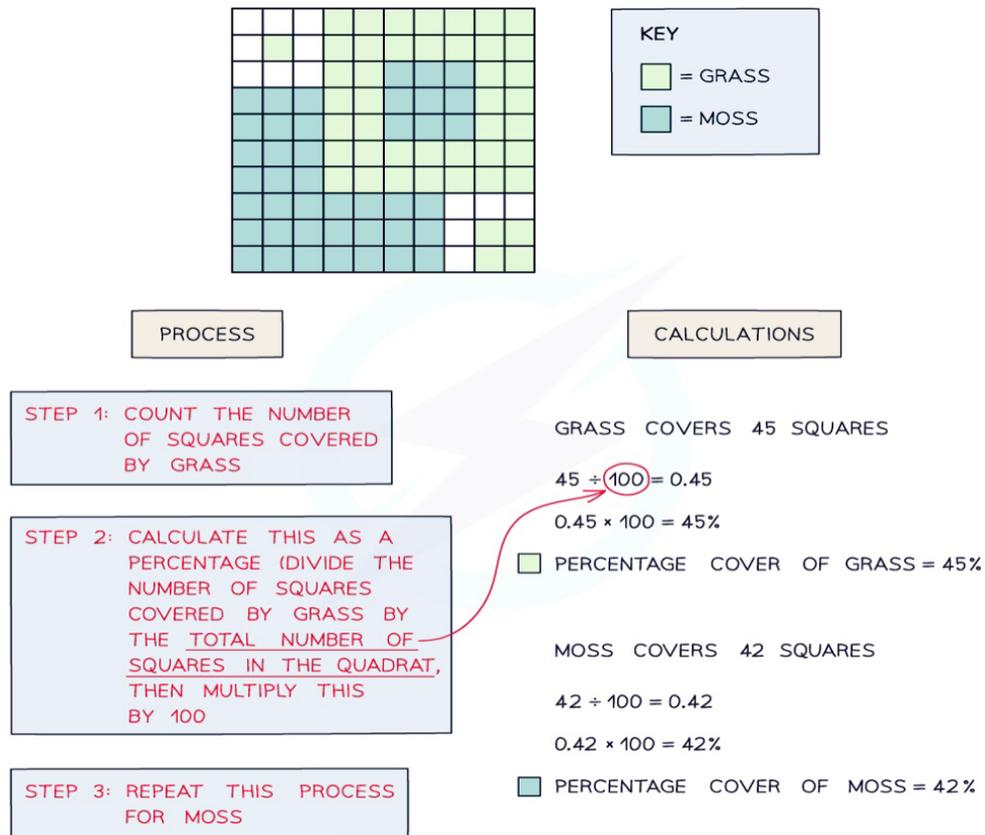
- ▶ Quadrats are **square frames** made of wood or wire.
- ▶ They can be a variety of sizes eg. 0.25m² or 1m².
- ▶ They are placed on the ground and the organisms within them are recorded.
- ▶ **Plants species** are commonly studied using quadrats to estimate the **abundance**.



Quadrats can be used to measure abundance by recording:

- ▶ **The number of an individual species:** the total number of individuals of a single species (eg. buttercups) is recorded.
- ▶ **Species richness:** the total number of different species (but not the number of individuals of each species) is recorded.

- ▶ **Percentage cover:** the approximate percentage of the quadrat area in which an individual species is found is recorded (this method is used when it is difficult to count individuals of the plant species being recorded eg. grass or moss)



Investigating population size in 2 different areas using quadrats

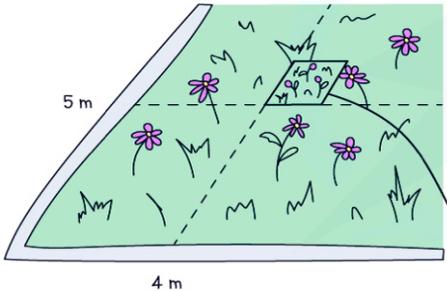
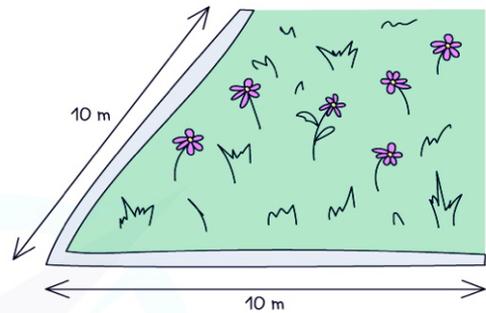
Apparatus

- I. 2 tape measures
- II. Quadrat
- III. Random number generator
- IV. Species identification key

Method:

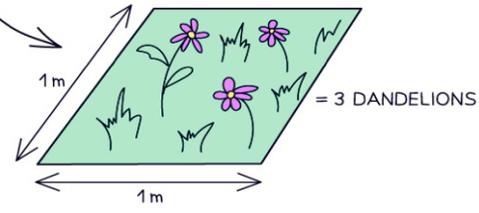
ESTIMATING POPULATION SIZE METHOD

1 USE TWO TAPE MEASURES TO LAY OUT A SURVEY AREA (e.g. 10 m x 10 m) IN YOUR CHOSEN HABITAT, SUCH AS THE SCHOOL FIELD.



2 USE A RANDOM NUMBER GENERATOR TO CREATE A SET OF COORDINATES TO PLACE YOUR FIRST QUADRAT. e.g. IF YOU GET A 4 AND A 5, PLACE YOUR QUADRAT 4 m ALONG THE x-AXIS AND 5 m ALONG THE y-AXIS.

3 COUNT THE NUMBER OF YOUR CHOSEN PLANT SPECIES (e.g. DANDELIONS) THAT ARE FOUND WITHIN THIS QUADRAT.



4 ESTIMATE THE POPULATION OF DANDELIONS IN YOUR 2 SURVEY AREAS USING THE EQUATION:

$$\text{ESTIMATED POPULATION SIZE} = \frac{\text{TOTAL AREA}}{\text{AREA SAMPLED}} \times \text{TOTAL NUMBER OF DANDELIONS COUNTED}$$

SURVEY AREA 1

TOTAL SURVEY AREA WAS 10m x 10m

$$= \frac{100}{10} \times 21$$

EACH QUADRAT IS 1m x 1m AND 10 QUADRATS WERE PLACED

$$= 210$$

SURVEY AREA 2

$$= \frac{100}{10} \times 12$$

$$= 120$$

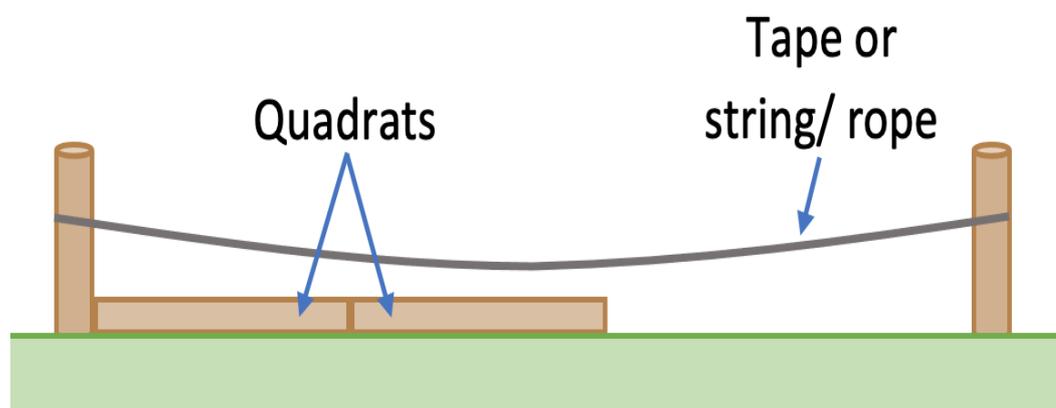
Results

- Once the results have been collected and the averages calculated, we can **compare the abundance of the study species** in each survey area.
- Species abundance is likely to be influenced by **biotic factors** such as:
 - I. Competition
 - II. Predator-prey relationships
 - III. Interactions with other organisms within the food chain or food web
- The abundance will also be influenced by **abiotic factors** such as:
 - I. Light intensity
 - II. Mineral availability
 - III. Water availability
 - IV. pH
 - V. Temperature
 - VI. Salinity

Using Transects

We can investigate the distribution of organisms across an area by using a transect.

- A transect is essentially a piece of tape or string/ rope that goes across an area.
- We use a transect to give us a line to investigate the distribution of organisms along. A transect is shown in the diagram below.



- There are two ways that we can use transects to investigate the distribution of organisms across an area.

1. One way is to count the number of each type of organism that are touching the transect (either the tape or the string/ rope).
2. The second way is to use quadrats. We place the quadrats either next to each other or at regular intervals along one side of the transect. We then count the number of each type of organism in each of the quadrats.

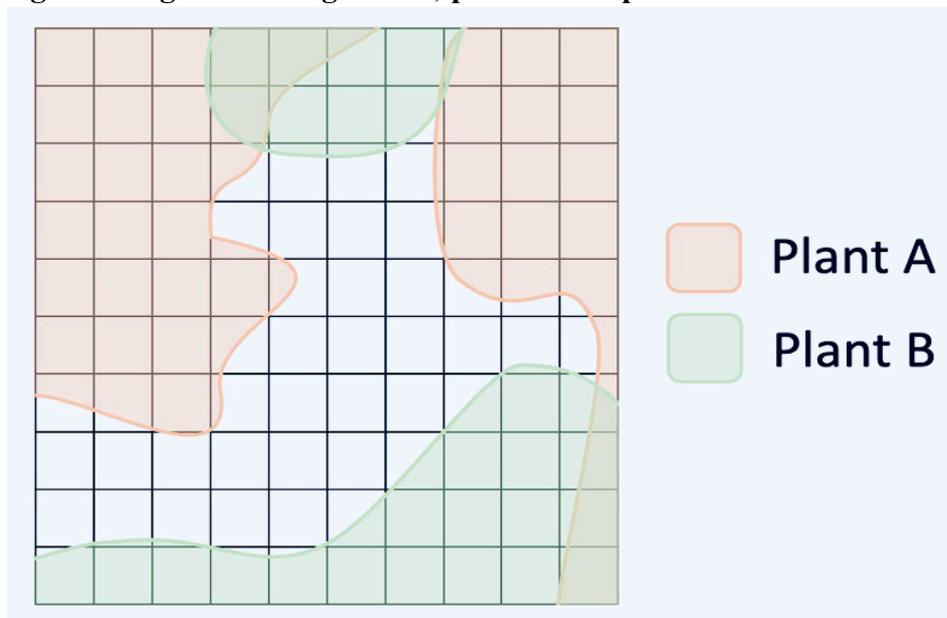
Percentage Cover:

- If it is difficult to count all the organisms in a quadrat (if there is grass) we can go with percentage cover.
- Percentage coverages is very useful if we are looking at an organism where there are loads of them and they cover a large area.
- Formula of finding percentage cover:

$$\% \text{ coverage} = \frac{\text{squares for organism}}{\text{total squares}} \times 100$$



I place a quadrat randomly in a field to investigate the percentage coverage of two organisms; plant A and plant B.



Plant A

In order to find the percentage coverage, we need to find how many smaller squares are covered by plant A. When we do this, we see that plant A covers 45 squares. There are 100 squares in total ($10 \times 10 = 100$). We now have everything that we need to calculate the percentage coverage for plant A.

$$\begin{aligned}\% \text{ coverage A} &= \frac{45}{100} \times 100 \\ &= 45 \%\end{aligned}$$

The percentage coverage for plant A is **45%**

Plant B

We now do the same for plant B. From the sketch, we see that plant B covers 29 squares. The total number of squares in the quadrat is still 100. We sub these values into the formula.

$$\begin{aligned}\% \text{ coverage B} &= \frac{29}{100} \times 100 \\ &= 29 \%\end{aligned}$$

The percentage coverage for plant B is **29%**.

Compare

When we compare the percentage coverage values, we see that the percentage coverage for plant A (45%) is greater than the percentage coverage for plant B (29%). This means that plant A is more abundant than plant B.