Throw the square

60 minutes • C4.1.1 to C4.1.3 • Chapters 1, 2

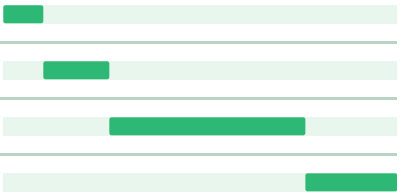
Populations as interbreeding groups in an area, why we sample at random, and estimating a sessile population with random quadrats

BY THE END, STUDENTS CAN

- [ ] Describe a population as an interacting, interbreeding group of one species in an area C4.1.1
- [ ] Explain why populations are estimated by random sampling, and what sampling error is C4.1.2
- [ ] Estimate a population of a sessile organism with random quadrats, and read its standard deviation C4.1.3

TIMING

0–6	6 min	**Do now: how many?**
6–16	10 min	**One population or two?**
16–46	30 min	**The buttercup meadow**
46–60	14 min	**Exit**
	60 min	**One lesson**



STARTER

6 min

Do now: how many?

A photo of a meadow full of buttercups. Pairs write down a guess of how many, then a way to find out without counting them all.

ON THE BOARD, FROM THE GUIDE

Open the guide on the projector at each chapter (the links work in this PDF). Every figure plays from its own buttons, and the lesson's slides have the same figures, step by step, in the order of this plan.

01 Who counts as one population?

CHAPTER 01 IN THE SLIDES

Switch the figure through One pond and Two ponds and a road, and have the class say what will change before each.

> **Predict box:** A student estimates the daisies on a field by placing quadrats wherever daisies look thickest. What will the estimate be? Hands up or mini whiteboards first.
>
> **Answer B: Too high, because the chosen quadrats hold more daisies than an average square metre of the field**

02 Throw the square

CHAPTER 02 IN THE SLIDES

Step through the figure (3 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. Two tape measures along the edges turn the meadow into a grid of 1 m squares.
2. Random numbers give the coordinates; a quadrat goes down at each.
3. Count the buttercups in each, take the mean and multiply by the area: close to the real number.

Show the figure: A meadow of buttercups, sampled by 1 m² quadrats at random coordinates. The mean count per quadrat, times the area, estimates the population.

> **Predict box:** In the bench below, throw 20 random quadrats, then switch to By eye and place 10 yourself. What do you expect? Hands up or mini whiteboards first.
>
> **Answer B: The by-eye estimate is much higher, because eyes are drawn to the yellow patches**

THE LESSON

10 min

One population or two?

Chapter 1 and its figure. Students decide whether frogs on either side of a new road are still one population, and say what would have to change for them to become two.

30 min

The buttercup meadow

Chapter 2 and its bench. Each pair throws ten quadrats at random, works out the mean per square metre and scales it to the meadow, then places ten by eye. The class pools its estimates on the board and compares the spread of the two methods with the true count.

ACTIVITIES

FIELDWORK

Quadrats on the school field

If there is a lawn with daisies or dandelions, mark out a grid with tape measures and pick coordinates from a random number table or a phone. Each group throws five 0.25 m² quadrats; the class pools its counts and estimates the population of the whole lawn, then compares it with the meadow bench.

Needs: tape measures, quadrats, a random number source.

PLENARY

14 min

Exit

Why does placing quadrats by eye give a biased estimate, even when the person is trying to be fair? Give one reason in a sentence.

WHAT STUDENTS GET WRONG

"A population is all the animals in an area." It is one species, and its members can interbreed.

"Random means wherever I like." Random means every spot has the same chance: coordinates from a random number source.

STRETCH AND SUPPORT

Support: give the captions of each figure and film as a cut-up storyboard to put in order, and use the key terms (tap the dotted words) as a glossary.

IN THE GUIDE

- 1 Who counts as one population?
- 2 Throw the square
- All The whole guide, with the figures that play
- PPTX This lesson's slides, in the order of this plan

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on C4.1 each time, marked as students go and saved to their Exam practice when they are signed in.

biologybybradford.com/exam-maker/sit?topics=C4.1&level=SL&paper=quiz&marks=15&src=ep

PRACTISE AND REVISE

BUILD FOR YOUR CLASS

- Tarsia puzzle, dominoes and picture reveal on C4.1, built from its key terms and ready to print
- A pub quiz with rounds on C4.1, to present or run with no projector
- An escape room built from the question bank on C4.1

ALREADY ON THE SITE FOR C4.1

- Lab: The Quadrat Pack
- Quiz: Populations & Communities
- Revision map: C4.1 Populations and communities, to fill in
- Exam questions: C4.1 in the exam maker, a paper with its markscheme

CARD SETS ON SPLYCR

Open a set to host it as a class game, or make a copy to edit.

- C4.1 Populations and Communities

How this was made. The course structure, the activities and the teaching choices come from my own classroom, my presentations and my years of teaching IB and AP Biology. I use Claude, an AI, to help write and build the interactive guides, lesson plans, slides and practice questions, and to draw the diagrams and code the interactives. I direct the work and review it against the IB and AP specifications before it goes live.