Pyramids of biomass

4.7.4.2 · Ecology · revision notes

A pyramid of biomass shows the relative amount of biomass at each trophic level of a food chain. You need to draw one accurately to scale from data and to describe and interpret its shape. This subtopic is in GCSE Biology only, not Combined Science.

Key facts

- Biomass = mass of living material (e.g. in g/m²)
- Bar width proportional to biomass; same scale for every bar
- Bars get smaller going up the pyramid
- Trophic level 1 (producers) at the bottom
- Bars equal in height, centred and labelled
- Bar width = biomass ÷ biomass per cm of the scale

Notes

What a pyramid of biomass shows

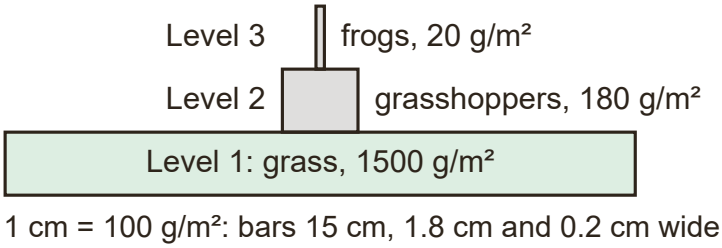
- **Biomass** is the mass of living material. In a pyramid it is usually given as mass per unit area, e.g. g/m².
- A **pyramid of biomass** is a stack of bars, one for each trophic level, showing how much biomass each level of a food chain contains compared with the others.
- Trophic level 1 (producers) is at the **bottom**. The other levels are stacked on top, in order.
- The bars get smaller going up, because only a small fraction of the biomass at each level is passed on to the next level.
- The shape is a pyramid even when the numbers of organisms are not: one large tree has a far greater biomass than all the insects feeding on it.

Drawing an accurate pyramid

- Use a ruler and draw one horizontal bar for each trophic level.
- Choose a **scale** so that the largest bar fits the space, e.g. 1 cm = 100 g/m². Use the same scale for every bar.
- The **width** of each bar is proportional to its biomass. Keep all the bars the same height.
- Centre each bar above the one below it.
- Label each bar with the organism or trophic level, and label the x-axis with biomass and its unit, e.g. biomass in g/m².

Worked example

- Biomass: grass 1500 g/m², grasshoppers 180 g/m², frogs 20 g/m². Scale: 1 cm = 100 g/m².
- Bar widths: grass 1500 ÷ 100 = 15 cm; grasshoppers 180 ÷ 100 = 1.8 cm; frogs 20 ÷ 100 = 0.2 cm (2 mm).



The worked example drawn to scale. The frog bar is tiny, and that is correct.

- A very narrow top bar is correct, not a mistake. Draw it anyway.

How to answer each type of question

Describe and explain the shape of a pyramid of biomass 2 marks **Grade 5**

1. Describe: biomass decreases at each trophic level going up.
2. Explain: biomass is lost at each level (e.g. in respiration and waste), so less is passed on to the next level.

Example. Explain why the bar for the secondary consumers in a pyramid of biomass is smaller than the bar for the primary consumers.

Model answer. Not all the biomass of the primary consumers is passed on to the secondary consumers (1). Much of it is lost, e.g. as carbon dioxide and water from respiration, in faeces and urine, or in parts that are not eaten (1).

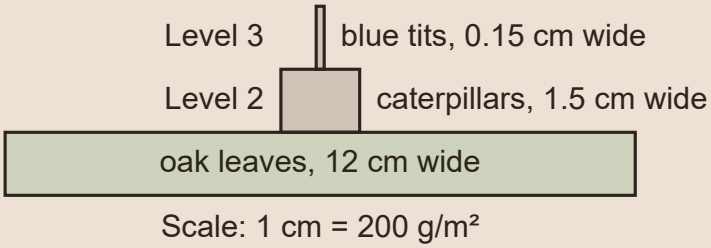
Draw a pyramid of biomass from data

3 marks | Grade 5

1. Choose a scale that uses most of the space and write it down.
2. Work out each bar width: biomass ÷ scale value.
3. Draw the bars to scale, centred, with the producers at the bottom.
4. Label each bar.

Example. The biomass at each trophic level of a woodland food chain is: oak leaves 2400 g/m², caterpillars 300 g/m², blue tits 30 g/m².
Draw a pyramid of biomass in a space 12 cm wide.

Model answer.



A suitable scale chosen and stated, e.g. 1 cm = 200 g/m² (1)

Bars drawn to scale: oak leaves 12 cm, caterpillars 1.5 cm, blue tits 0.15 cm (about 1.5 mm) (1)

Bars centred, in the right order with oak leaves at the bottom, and labelled (1)

Interpret a pyramid using its scale

2 marks | Grade 7

1. Measure each bar and convert it using the scale.
2. Do the calculation asked for (difference, ratio or percentage).
3. Include units where needed.

Example. A pyramid of biomass is drawn with a scale of 1 cm = 50 g/m². The producer bar is 9.0 cm wide and the primary consumer bar is 1.2 cm wide.
Calculate how many times greater the producer biomass is than the primary consumer biomass.

Model answer.

Producers: 9.0 × 50 = 450 g/m²; primary consumers: 1.2 × 50 = 60 g/m² (1)

450 ÷ 60 = 7.5 times (1)

Don’t lose marks

- Drawing bars that are not to scale, or using a different scale for different bars.
- Putting the producers at the top, or the bars in the wrong order.
- Leaving bars unlabelled or off-centre.
- Changing the height of the bars to show biomass. Only the width changes.

More tips

Memory tricks

- Producers are always at the bottom: plants prop up the pyramid.
- Check your drawing: measure a bar, multiply by the scale, and you should get back the data value.
- With the same scale, the ratio of two bar widths equals the ratio of their biomasses, so you can divide the widths directly.

Exam technique

- Use a sharp pencil and a ruler; accuracy is usually worth a mark.
- Write your scale next to the pyramid so the examiner can check your widths.
- If a bar is tiny, still draw it as a thin bar rather than leaving it out.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

Define biomass

The mass of living material, often given per unit area, e.g. in g/m².

Grade 4

Identify the trophic levels on a pyramid

Trophic level 1 (the producers) is always the bottom bar.

Grade 5

Describe the shape of a pyramid of biomass

Each bar is smaller than the one below, because biomass decreases at each trophic level.

Grade 5

Construct an accurate pyramid of biomass

Choose a scale, draw each bar with its width proportional to the biomass, and centre and label the bars.

Grade 7

Read values from a pyramid using its scale

Measure bars, convert with the scale and compare trophic levels by calculation.

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