

A Valley of Grass, a Dozen Deer, One Mountain Lion

Learning target: I can describe a pattern in how much living matter each feeding level of an ecosystem holds, connect it to an animal that eats far more than it gains, and write a first explanation to test.

Phenomenon exploration

About 30 min

Individual

MS-LS2-3 · supports

discussion

writing

data analysis

Name _____

Date _____

Period _____

Directions

Read both observations slowly. Study the bar chart and the weigh-in table; the numbers are a teaching estimate, not a real survey. Write what you notice before you write what you wonder. Your explanations in Part C are first drafts: it is fine to be unsure, but you must give a reason for every idea. Keep this sheet; you will come back to it at the end of the chapter.

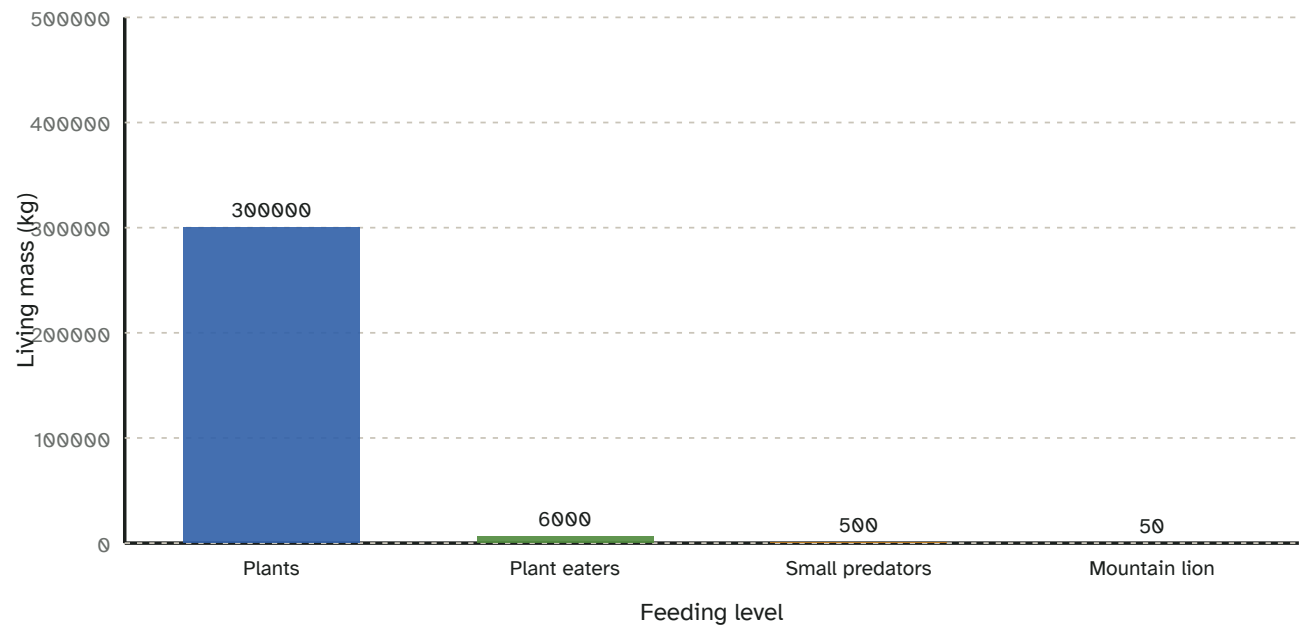
You will need: This worksheet, Pencil, Calculator (optional)

Observation 1: Counting a square kilometer

Imagine a park ranger who is asked to estimate the mass of every living thing in one square kilometer of foothill grassland in central California. She cannot weigh everything, so she samples small plots and scales up. Grasses and scattered oaks cover almost the whole square, so their mass is enormous. Grasshoppers, voles, rabbits and about a dozen mule deer eat the plants. A few coyotes, bobcats, snakes and hawks eat the plant eaters. One mountain lion passes through, and its hunting range is far larger than this one square. The bar chart shows her estimate for each feeding level.

Living mass in one square kilometer of foothill grassland

simulated data



Teaching estimate of the living mass (biomass) at each feeding level in one square kilometer of foothill grassland. The values are invented to show a realistic pattern; they are not a measured survey.

Observation 2: The goat that never gets heavier

The ranger's neighbor keeps one adult dairy goat. The goat eats about 2 kilograms of hay every day, which adds up to roughly 14 kilograms each week. The neighbor weighs the goat every Monday on a livestock scale. Her records for four weeks are below.

Four weeks of hay and weigh-ins for one adult goat (teaching dataset)

Simulated teaching dataset: the numbers are invented to be realistic, not measured.

Week	Hay eaten that week (kg)	Goat's mass on Monday (kg)
0	0	55.2
1	14	55.4
2	14	55.1
3	14	55.3
4	14	55.2

Simulated data for teaching. The goat is a healthy adult that is no longer growing.

Part A: Notice and wonder

1. Write three things you **notice** in the bar chart. At least one must use a number.

2. Write three questions you **wonder** about after reading both observations. Start each with *why*, *how* or *what would happen if*.

3. How many times more living mass is there in the plants than in the plant eaters? Show the division.

4. Add up all the hay the goat ate in weeks 1 to 4. Then find the change in the goat's mass from week 0 to week 4. Write both numbers with units and compare them in one sentence.

Part B: What you already know

5. From earlier lessons: where do plants get the matter they are made of, and what do all organisms do with the sugar they take in? Use the words *photosynthesis* and *cellular respiration* if you can.

Part C: Your first explanation

6. The goat ate about 56 kilograms of hay in four weeks and ended up at the same mass. Matter cannot just vanish. Write your best explanation of where the hay's matter went. Name at least two places.

7. Use your answer to q6 to explain the bar chart. Why might each feeding level hold so much less living mass than the level it eats from? Why would a square kilometer that feeds 300,000 kg of plants hold only one mountain lion?

8. What is one measurement the ranger or the neighbor could make to test your explanation? Say what result would support it.

Keep this page — At the end of the chapter you will reread your answers to q6 and q7 and mark what you would keep, change or add. A first explanation that changes is a sign of learning, not a mistake.

Sentence starters for Part C

If you are stuck on q6, try finishing these: 'Some of the hay leaves the goat as ____.' 'Some of the hay is used by the goat's body to ____, and what is left over leaves as ____.' For q7, try: 'The plant eaters cannot turn all the grass into their own bodies because ____, so the next level up has even less to eat because ____.'

A different kind of pyramid

The bar chart shows mass. Now think about *numbers* of individuals instead. Would a chart of how many organisms live at each level have the same shape? Consider a single oak tree covered with thousands of caterpillars. Write a short paragraph arguing whether counting individuals or weighing them gives a better picture of how much food each level offers to the next, and give one case where the two charts would disagree.