

Capacity by Numbers

Compare ecosystem limits with data.

HIGH SCHOOL • HS-LS2-1

HS-LS2-1 "Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales..."

NAME _____

DATE _____

COMPARE CAPACITY DENSITY

Divide carrying capacity by area to find capacity density. Compare densities when ecosystems have different boundaries, then use changes in resources, climate, or competition to explain changes in total capacity.

WORKED EXAMPLE

A 15-hectare reserve can support 165 rabbits. Its boundary expands to 20 hectares, with the same resources per hectare. What capacity is predicted?

1. $165 / 15 = 11$ rabbits per hectare

2. $20 \times 11 = 220$ rabbits

Answer: 220 rabbits

PRACTICE 5 problems

- 1** A 9-hectare meadow can support 72 voles. What is its carrying-capacity density?

ANSWER _____

- 2** A 16-hectare meadow can support 112 voles. Compare its capacity density with Problem 1.

ANSWER _____

- 3** A dry season changes a lizard habitat's carrying capacity from 200 to 150. What is the percent decrease?

ANSWER _____

- 4** A lake's food supply supports 135 fish. Competition reduces available food by $\frac{1}{3}$. What is the new carrying capacity?

ANSWER _____

- 5** An island is 8 km². At 7 nesting pairs per km², what is its carrying capacity?

ANSWER _____

APPLY IT Show your work

- 1** At a school garden, Plot A has 4 equal beds and can support 36 caterpillars. Plot B has 6 beds and can support 42 caterpillars. New nectar plants add capacity for 12 caterpillars in Plot B. Find each starting density, Plot B's new density, and whether the plots then have equal densities.

WORK SPACE

ANSWER _____

- 2** A 12-hectare sunny creek zone supports 96 frogs in spring. Summer heat reduces its capacity by 24 frogs. An 18-hectare shaded zone supports 126 frogs. Find the sunny zone's summer density and the shaded zone's density. Which factor best explains the difference?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Forest Fragment A is 24 hectares and supports 10 owls per hectare. Fragment B is 18 hectares and supports 12 owls per hectare. A drought cuts each total capacity by 25%. Calculate each new capacity. Which fragment supports more owls, and why can it do so even with lower density?

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	A 9-hectare meadow can support 72 voles. What is its carrying-capacity density?	8 voles per hectare
2	A 16-hectare meadow can support 112 voles. Compare its capacity density with Problem 1.	Both meadows have a density of 8 voles per hectare.
3	A dry season changes a lizard habitat's carrying capacity from 200 to 150. What is the percent decrease?	25% decrease
4	A lake's food supply supports 135 fish. Competition reduces available food by $\frac{1}{3}$. What is the new carrying capacity?	90 fish
5	An island is 8 km ² . At 7 nesting pairs per km ² , what is its carrying capacity?	56 nesting pairs

PART 2 • APPLY IT

- Plot A: 9 caterpillars per bed. Plot B: 7 caterpillars per bed at first, then 9 caterpillars per bed. Yes, the final densities are equal.** Divide each capacity by its number of beds. Plot B's new capacity is 54 caterpillars, and $54 / 6 = 9$.
- Sunny summer zone: 6 frogs per hectare. Shaded zone: 7 frogs per hectare. Cooler, shaded climate can preserve water resources and raise carrying capacity.** The sunny zone has 72 frogs after the decrease, so $72 / 12 = 6$. The shaded zone has $126 / 18 = 7$ frogs per hectare.

CHALLENGE

Fragment A: 180 owls. Fragment B: 162 owls. Fragment A supports more because its larger boundary gives it a greater starting total capacity.

Accept equivalent unit wording, such as owls/hectare. For explanations, accept responses that connect a larger boundary to greater total capacity and connect resource or climate changes to capacity changes.