LESSON MAKER PRO

Resource Limits

Use resource data to predict changes in carrying capacity.

HIGH SCHOOL · ENV.1.7

ENV.1.7 "Analyze and interpret quantitative data to construct explanations of how the carrying capacity of an ecosystem may change as the availability of resources changes."

NAME _____ DATE _____

FIND THE LIMIT

In this simplified model, divide each available resource by the amount one animal needs for the same time period. Round down to a whole animal. The smallest result is the carrying capacity because every animal needs every resource.

WORKED EXAMPLE

A habitat has these resources for one week. What is its carrying capacity for rabbits?

RABBIT HABITAT, ONE WEEK

Resource	Available	Needed per rabbit
Plants	63 kg	7 kg
Water	55 L	5 L

1. Plants support 63 / 7 = 9 rabbits.
2. Water supports 55 / 5 = 11 rabbits.
3. Use the smaller result: 9.

Answer: 9 rabbits

PRACTICE 6 problems

1 How many rabbits can this habitat support for one week? Which resource limits the population?

HABITAT 1

Resource	Available	Needed per rabbit
Plants	48 kg	4 kg
Water	30 L	3 L

ANSWER _____

2 How many bird pairs can this habitat support for one season?

HABITAT 2

Resource	Available	Needed per pair
Food	60 units	6 units
Nest sites	8 sites	1 site

ANSWER _____

3 Plants increase, but water stays the same. What are the rabbit habitat's carrying capacities before and after the change?

HABITAT 3, ONE WEEK

Resource	Before	After	Needed per rabbit
Plants	36 kg	54 kg	3 kg
Water	48 L	48 L	4 L

ANSWER _____

4 Water availability falls. By how many rabbits does this habitat's carrying capacity decrease?

HABITAT 4, ONE WEEK

Resource	Before	After	Needed per rabbit
Plants	64 kg	64 kg	4 kg
Water	42 L	24 L	3 L

ANSWER _____

5 Water availability rises. Does the carrying capacity increase? State the capacity after the change and identify the limiting resource.

HABITAT 5, ONE WEEK

Resource	Before	After	Needed per rabbit
Plants	80 kg	80 kg	8 kg
Water	36 L	48 L	3 L

ANSWER _____

6 Plants decrease while water stays the same. What are the carrying capacities before and after the change?

HABITAT 6, ONE WEEK

Resource	Before	After	Needed per rabbit
Plants	96 kg	72 kg	6 kg
Water	28 L	28 L	2 L

ANSWER _____

APPLY IT Show your work

1 Your school's science club plants a courtyard garden that provides more food for nesting birds. Using the club's estimates for one season, how much does the carrying capacity change?

COURTYARD GARDEN

Resource	Before	After	Needed per bird pair
Food	84 units	120 units	6 units
Nest sites	18 sites	18 sites	1 site

ANSWER _____

2 At a pond beside a skatepark, fewer aquatic insects are available after a nearby area is paved. Using the estimates below, how does the carrying capacity for small fish change?

SKATEPARK POND

Resource	Before	After	Needed per fish
Insect food	72 units	48 units	4 units
Water volume	50 L	50 L	2 L

ANSWER _____

CHALLENGE One step up

Two connected pond habitats have a fixed amount of water. You may move a whole number of liters of water from A to B, but you cannot move food. What is the greatest combined carrying capacity, and exactly how many liters must move from A to B to reach it? Explain why in two sentences.

CONNECTED POND HABITATS

Habitat	Water available	Water needed per fish	Fish supported by food
A	48 L	2 L	18
B	12 L	2 L	12

WORK SPACE AND ANSWER

Resource Limits

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	How many rabbits can this habitat support for one week? Which resource limits the population?	**10 rabbits; water limits the population.**
2	How many bird pairs can this habitat support for one season?	**8 bird pairs**
3	Plants increase, but water stays the same. What are the rabbit habitat's carrying capacities before and after the change?	**Before: 12 rabbits. After: 12 rabbits.**
4	Water availability falls. By how many rabbits does this habitat's carrying capacity decrease?	**6 rabbits**
5	Water availability rises. Does the carrying capacity increase? State the capacity after the change and identify the limiting resource.	**No. The capacity remains 10 rabbits; plants are limiting.**
6	Plants decrease while water stays the same. What are the carrying capacities before and after the change?	**Before: 14 rabbits. After: 12 rabbits.**

PART 2 · APPLY IT

1. **The carrying capacity increases by 4 bird pairs, from 14 to 18 pairs.** Before planting, food supports 84 / 6 = 14 pairs; afterward, it supports 120 / 6 = 20 pairs. Nest sites support 18 pairs throughout, so the capacities are 14 and 18.
2. **The carrying capacity decreases by 6 fish, from 18 to 12 fish.** Insect food supports 18 fish before paving and 12 afterward. Water supports 25 fish in both cases, so insect food limits the capacity.

CHALLENGE

The greatest combined carrying capacity is 30 fish, reached by moving exactly 12 L from A to B. Habitat A then has 36 L for 18 fish, while B has 24 L for 12 fish; both food limits are reached, so no other transfer can reach 30.

Accept equivalent wording that identifies the smaller resource-supported population as the capacity. In the challenge, only a transfer of exactly 12 L allows both habitats to reach their food-supported limits.