LESSON MAKER PRO

What Sets the Limit?

Use resource data to investigate ecosystem carrying capacity.

HIGH SCHOOL · ENV.1

ENV.1 "Students will investigate the interdependence of diverse living organisms and their interactions with the components of the biosphere. Identify, investigate..."

NAME _____ DATE _____

THE LIMITING RESOURCE

To estimate carrying capacity, divide each available resource by the amount one organism needs during the same time period. Round down to a whole organism if needed. The smallest result sets the modeled carrying capacity because each organism needs every resource.

WORKED EXAMPLE

A habitat has 3600 kg of food and 7000 L of water available for one season. Each animal needs 30 kg of food and 50 L of water per season. Estimate the carrying capacity and identify the limiting resource.

1. Food can support 3600 / 30 = 120 animals.
2. Water can support 7000 / 50 = 140 animals.
3. Use the smaller result, 120.

Answer: The modeled carrying capacity is 120 animals. Food is the limiting resource.

PRACTICE 6 problems

1 A habitat has 2250 kg of food and 2800 L of water per season. Each rabbit needs 25 kg of food and 40 L of water. What is the modeled carrying capacity? Which resource limits it?

ANSWER _____

2 An area has 480 kg of insects and 90 nest sites per season. Each bird needs 8 kg of insects and one nest site. After a disturbance, insects drop to 320 kg, but nest sites do not change. What is the new carrying capacity, and what percent lower is it than the old capacity?

ANSWER _____

3 Use the table. Each animal needs 75 kg of prey and 60 L of water per year. What is the percent change in modeled carrying capacity from Year 1 to Year 2? Which resource limits capacity in Year 2?

RESOURCES AVAILABLE EACH YEAR

Year	Prey (kg)	Water (L)
1	1500	2400
2	2100	1800

ANSWER _____

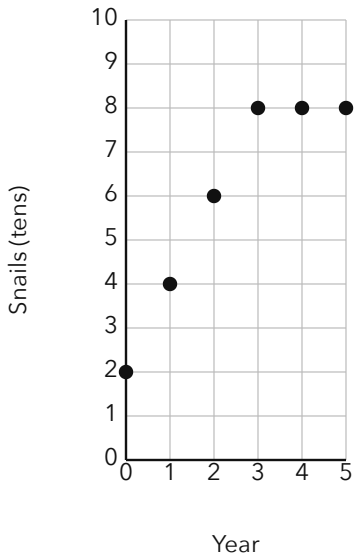
4 A park has 105 deer. For one week, it has 1680 kg of browse and 2520 L of water available. Each deer needs 20 kg of browse and 20 L of water that week. How many deer is the population above the modeled carrying capacity? What percent above capacity is it?

ANSWER _____

5 A habitat has 1800 kg of grass and 2400 L of water. Each grazer needs 18 kg of grass and 32 L of water. What is the current carrying capacity? How many more liters of water would raise the capacity to the number the grass can support?

ANSWER _____

6 The graph shows snail counts at a pond. Estimate the carrying capacity in snails. What was the percent increase in the snail population from Year 1 to Year 3?



ANSWER _____

APPLY IT Show your work

1 Students monitoring solitary bees near their school find that each bee needs 15 nectar units and one nest site per breeding season. Use the table to estimate carrying capacity before and after the field is mowed. What percent did capacity change, and which resource limits it after mowing?

SCHOOL FIELD RESOURCES

Season	Nectar units	Nest sites
Before mowing	1500	110
After mowing	900	110

ANSWER _____

2 Students track trout in a stream beside a skate park. Each trout needs 18 food units and one shelter site per season. Before restoration, the stream has 1800 food units and 75 shelter sites. After shelter is added, runoff leaves 1620 food units and there are 108 shelter sites. Find the carrying capacity before and after restoration. What is the percent change, and which resource limits the new capacity?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A park has 1800 kg of food and 2400 L of water per season. Each deer needs 18 kg of food and 24 L of water. Managers can add 450 kg of food, 600 L of water, or both. Which plan would raise the modeled carrying capacity to at least 125 deer? Explain using both resources.

WORK SPACE AND ANSWER

What Sets the Limit?

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A habitat has 2250 kg of food and 2800 L of water per season. Each rabbit needs 25 kg of food and 40 L of water. What is the modeled carrying capacity? Which resource limits it?	**70 rabbits; water**
2	An area has 480 kg of insects and 90 nest sites per season. Each bird needs 8 kg of insects and one nest site. After a disturbance, insects drop to 320 kg, but nest sites do not change. What is the new carrying capacity, and what percent lower is it than the old capacity?	**40 birds; 33 1/3% lower**
3	Use the table. Each animal needs 75 kg of prey and 60 L of water per year. What is the percent change in modeled carrying capacity from Year 1 to Year 2? Which resource limits capacity in Year 2?	**40% increase; prey**
4	A park has 105 deer. For one week, it has 1680 kg of browse and 2520 L of water available. Each deer needs 20 kg of browse and 20 L of water that week. How many deer is the population above the modeled carrying capacity? What percent above capacity is it?	**21 deer; 25% above capacity**
5	A habitat has 1800 kg of grass and 2400 L of water. Each grazer needs 18 kg of grass and 32 L of water. What is the current carrying capacity? How many more liters of water would raise the capacity to the number the grass can support?	**75 grazers; 800 L more water**
6	The graph shows snail counts at a pond. Estimate the carrying capacity in snails. What was the percent increase in the snail population from Year 1 to Year 3?	**About 80 snails; 100% increase**

PART 2 · APPLY IT

1. **Capacity falls from 100 to 60 bees, a 40% decrease. Nectar limits capacity after mowing.** Before mowing, nectar supports 100 bees and nest sites support 110. After mowing, nectar supports 60 while nest sites still support 110, so the decrease is (100 - 60) / 100 = 40%.
2. **Capacity rises from 75 to 90 trout, a 20% increase. Food limits the new capacity.** Before restoration, food supports 100 trout but shelter supports 75. Afterward, food supports 90 and shelter supports 108, so capacity rises by 15 / 75 = 20%.

CHALLENGE

Managers must add both resources. With both additions, food supports 2250 / 18 = 125 deer and water supports 3000 / 24 = 125 deer. Adding only one leaves the other resource able to support just 100 deer.

Accept equivalent forms of 33 1/3% and estimates near 80 snails for the graph. These capacities are estimates based on the listed resources, not predictions of exact future population sizes.