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Topic: Ecosystem Stability Lab

Summary: Students participate in an activity that models predator prey and how resilient a population can be when limiting factors are introduced or removed.

NGSS Standards:
HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2-6. Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Time Length: 90 minutes

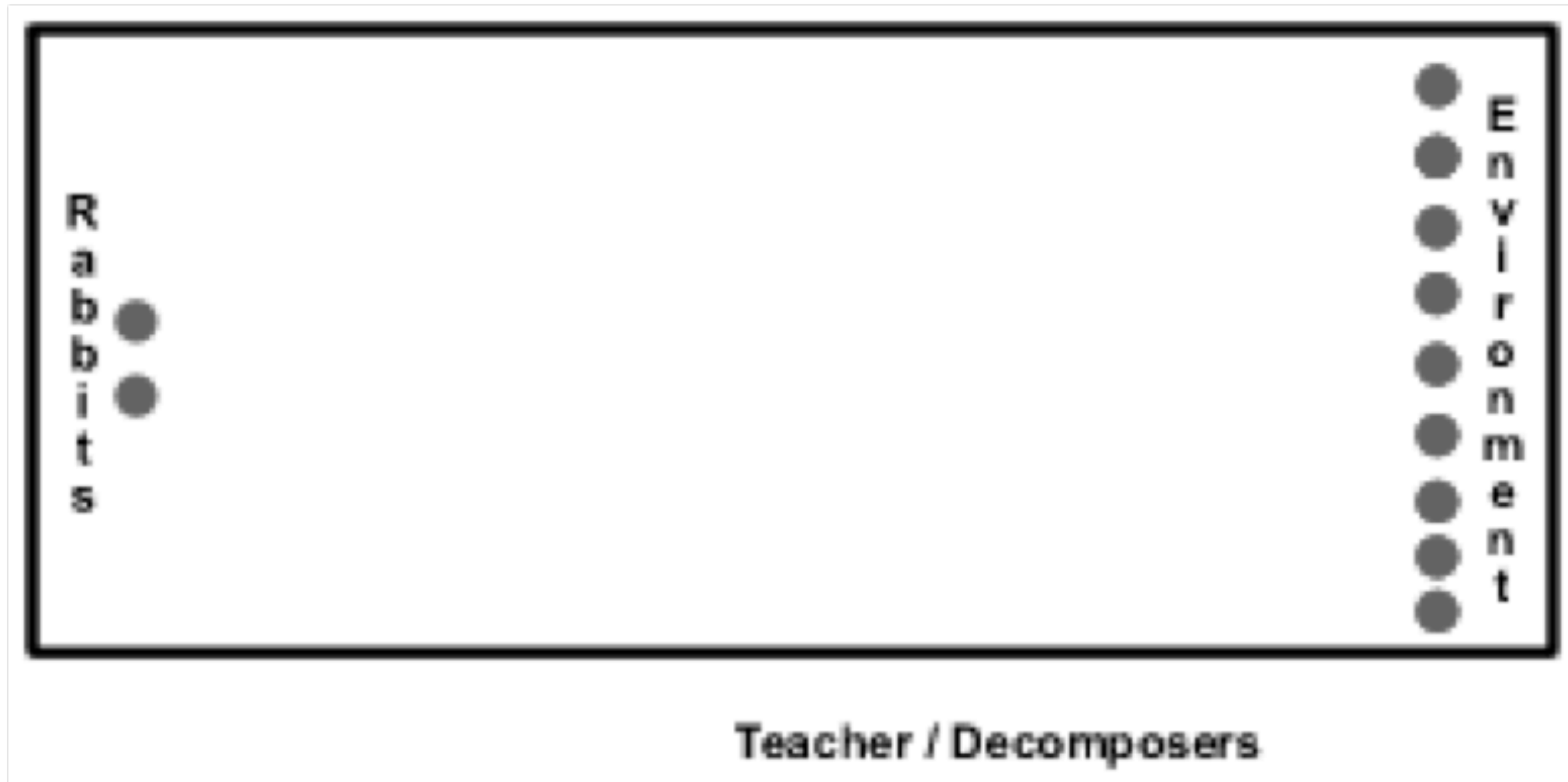
Prerequisite Knowledge: ecosystem stability, carrying capacity, limiting factors, growth rate calculations

$$\frac{\Delta n}{\Delta t} = \frac{\text{change in population size}}{\text{change in time}}$$

Materials:
- Grass field or blacktop with a distance of at least 20 meters
- Good weather for students to run
- Clipboard and lesson plan for you to record the data for the students

Procedures:
1) The class is going to mimic how a population of mice grows based upon the resources in the environment and predators. On a grass field outside, *six* students will stand on one side and face students about 20 meters away. The side with six students will represent mice and the other side will represent resources in the environment. The teacher will stand on the side and will be the decomposing area. One student will be the fox and will stand next to the teacher.

2) The teacher will tell the mice and environment to face away from each other so they can not see each other. The teacher will then tell the student to "choose your environment". Both the mice and the environment choose their resource kinesthetically by making a triangle over their head (shelter), hand over their mouth (water) and hand over their stomach (food).



3) The fox stands were the teacher stands and goes on the same "go" as the mice. The fox then tries to tag as many mice as possible before they reach the environment.

4) The teacher will then tell the environment group to turn around and face the mice. The environment group needs to maintain showing their resource. Once a student has chosen a resource, they cannot change it. The teacher will then say "go" and the mice turn around and run towards the environment, matching their particular the resource. Mice must run straight and once they reach the environment, they tag the resource they chose and stop. Mice may not run around in the environment area searching for their resource.

5) If a mouse tags a resource, the mouse survives and reproduces one offspring. The tagged environmental person will become a mouse in the next generation. If a mouse does not tag the resource they were searching for, they die and go to the decomposer section. Decomposers go to the environment section after one generation. If a resource is not tagged, they stay where they are at for the next generation. If the fox tags one mice, the fox lives. Each even number mouse that is tagged (2, 4, 6, etc) becomes a fox in the next generation (round). Each odd number mouse that is tagged decomposes in the next round.

6). Write the number of mice, environment, and foxes in the data table per generation.

7) Students repeat this procedure for 10 generations (as many as time allows). On the 7th generation, remove all foxes. Once you are back in your classroom, ask students to write the population numbers in the data table.

Accommodations: Students who are not able to participate can record the data and not participate in running or being a resource. Students with an IEP can take the handout home if they need extra time, not graph the data.

Editable DOCX File and Answer Key:

Available at www.ngsslifescience.com

Name: ______________________ Row: _______

Date:_____________ Period:______

Ecosystem Stability Lab

Driving Question: How resilient can a mouse population be when limiting factors are introduced or removed.

Materials: Grass field, graph paper, nice weather for students to run.

Procedure Summary:
Mice: Face away from the environment group and choose an environmental resource. Run and tag the corresponding resource on the environment side. If you tag the resource, you live and go back to the mouse section for the next generation. If you do not tag a resource, you die and decompose (stand next to the teacher).
Environmental Resource: Face away from the environment group and choose which resource you want to be (shelter, food or water). If a mouse tags you, you will become a mouse in the next generation. If no mice tag you, you stay as a resource for the next generation.
Decomposers: Stand next to the teacher for the next generation. Go to the environment side after one turn (generation).
Foxes: Stand next to the teacher. Run and tag as many mice as possible when the teacher says "go." If you tag one mouse, you survive. If you tag more than one mouse, they become a fox in the next generation.

Data Table:

Generation	Mouse Population	Environment Amount	Fox Population
1	6		1
2			
3			
4			
5			
6			
7			0
8			0
9			0
10			0

Graphing:
Create a three-line graph with population size on the y-axis against number of generations on the x-axis. Use a key and graph mice, environment and fox populations. Predict the carrying capacity of the mice and draw a dotted line to represent the carrying capacity.

Analysis:

1) What does it mean for an ecosystem to be resilient and what helps it be resilient?

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2) In generation 7, the fox population went to zero. Predict using a density independent factor, the cause of why the fox population went to zero. ________________________

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3) Would you say that the mouse was stable from generation 1 through 6? Explain why or why not using evidence (data). ____

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4) Explain how the fox in this activity affected the carrying capacity of the mice once it was removed. ____

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5) Explain how increasing the diversity of mice predators (ex. foxes and hawks) would have affected the mouse population. ____

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6) Predict what would happen to the environment population if a volcano erupted for 10 generations. What kind of evidence would you look for to say it was a new ecosystem?

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7) Predict and explain what would happen to the environment if you introduced 100 mice to a foreign habitat the size of the island of Hawaii. ________________________

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8) Continuing with the introduced 100 mice, predict what would happen to the native species already living in that habitat. ____

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Population growth rate = ΔN / ΔT *(change in population size divide by change in time). Use the data table for question 9. Show all your work.*

9) What was the mice population growth rate from generation 7 to generation 10?