Topic: Population Ecology Lab

Summary: Students participate in an activity that models a population of rabbits. Students learn how density-dependent factors affect a population size.

Goals & Objectives: Students will be able to explain how exponential and logistic growth rates affect population size. Students will be able to predict how density-dependent factors like competition for resources and predators control population growth.

Standards: CA Biology 6c. *Students know* how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death. 6b. *Students know* how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.

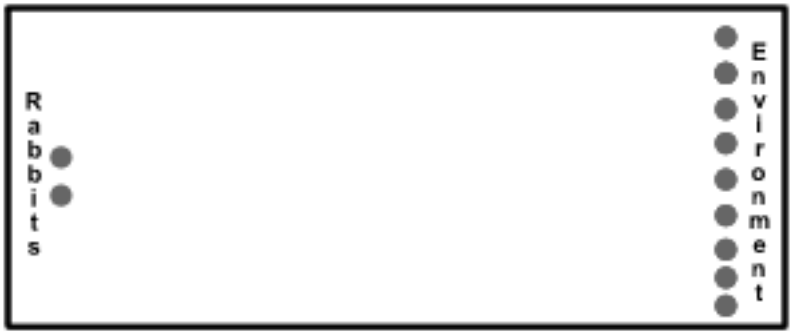
Time Length: 90 minutes

Materials:

- Grass field or blacktop with a distance of at least 30 meters
- Good weather for students to run
- Clipboard and lesson plan for recording data

Procedures:

1) The class is going to mimic how a population of rabbits grows based upon the resources in the environment and predators. On a grass field outside, *two* students will stand on one side and face students about 30 meters away. The side with two students will represent rabbits and the other side will represent resources in the environment. The teacher will stand on the side and will be the decomposing area.



2) The teacher will tell the predator to face away from the environment and the environment to face away from the rabbits. The teacher will then tell the environment group to choose the resource they want to be and the rabbit group which resource they are

searching for. Students choose their resource kinesthetically by making a triangle over their head (shelter), hand over their mouth (water) and hand over their stomach (food).

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

4) If a rabbit tags a resource, the rabbit survives and reproduces one offspring. The tagged environmental person will become a rabbit in the next generation. If a rabbit does not tag the resource they were searching for, they die and go to the decomposer section. Decomposers go to the environment after one generation. If a resource is not tagged, they stay where they are at for the next generation.

5. Students repeat this procedure for 10 generations. Count the number of rabbits/environment before you tell the students to "go." Record the numbers in the data table.

6. On the 9th generation, introduce a fox. Have one student from the decomposers become a predator of the rabbits. The fox stands were the teacher stands and goes on the same "go" as the rabbits. The fox then tries to tag as many rabbits as possible before they reach the environment. If the fox tags one rabbits, the fox lives. Each additional rabbit becomes a fox in the next generation (round). Record the number of foxes in the data per generation.

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, or not calculate the exponential and logistic growths for the populations.

Evaluation:
The graph is worth a total of 10 points including: title and labels, correct values, completed graph. The analysis questions are worth 10 points. The conclusion is worth 5 points. This assignment is worth a total of 25 points.

Name: _____ Row: _____

Date:_____ Period:_____

Population Ecology Lab

Problem Statement: You are going to create a population growth model for rabbits. The model will let you examine how density-dependent factors will affect the population size of rabbits.

Hypothesis: If a population is affected by density-dependent factors, then its rate of growth will represent a _____ growth curve.

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

Procedure Summary:
Rabbits: 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 rabbit 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 rabbit tags you, you will become a rabbit in the next generation. If no rabbits 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 rabbits as possible when the teacher says "go." If you tag one rabbit, you survive. If you tag more than one rabbit, they become a fox in the next generation.

Data Table:

Generation	Rabbit Population	Environment Amount	Fox Population
1	2		0
2			0
3			0
4			0
5			0
6			0
7			0
8			0
9			1
10			
11			
12			
13			
14			
15			
16			

Graphing:
Create a line graph with population size on the y-axis against number of generations on the x-axis. Use a legend and colored pencils to graph rabbit, environment and fox populations. Mark and label exponential growth and carrying capacity on your graph.

Analysis:

1) Independent variable: _____ Dependent variable: _____

Control variables: _____

There are two types of population limiting factors: dependent and independent.

2) In this lab, competition and predation were a _____

limiting factor for population size.

3) Which type of limiting factor includes weather, human activities, and seasonal cycles?

_____

4) Which type of limiting factor includes disease and parasites? _____

5) What happened to rabbits that did not tag their corresponding resources? _____

6) Why did a tagged resource become a rabbit in the next round? _____

_____

7) The largest number of rabbits able to survive in the provided environment is called the

_____.

8) What type of growth curve happened in the rabbit generations 1 through 4? _____

9) Why did the dead rabbits not become an environment in the next generation?

_____

10) Give 5 examples of decomposers? _____

_____

Conclusion:

Explain how the environment influenced rabbit populations and how the introduction of foxes affects the rabbit population growth.

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