Name: _____ Date: _____ Period: _____

Exploration: Bunnies are taking over the world!

Introduction

In 1778 the First Fleet, a group of English citizens, arrived to establish a new settlement in Australia. They brought with them a number of rabbits, which were to be bred for food. In 1859, Thomas Austin, missing the rabbit hunting he was accustomed to in England, had 24 European rabbits shipped to him so that he could establish a rabbit population large enough that it could be used for hunting in Australia.

What these settlers did not realize is that Australia's mild winters allow rabbits to breed throughout the year and feed on the abundant low-lying vegetation. By 1886, the rabbit population exploded, despite the fact that over two million of them were shot every year.

The rabbits had become a pest species in their new habitat. Their ravenous appetites caused a drastic loss of native plant species, which in turn increased erosion. This wreaked havoc on both the aquatic and terrestrial ecosystems in the area.

The government finally had to resort to dealing with the rising population by promoting increased hunting and trapping, destroying the rabbits' holes, and introducing viruses that decreased the population by one sixth of its size. However, genetic resistance allowed the number to rise three-fold by the early 1990s. The government tried to use another virus to control the population. This grew out of the government's control and started infecting many pets around the country. Australia still struggles with rabbits as a pest species today.

Purpose

The purpose of this activity is to simulate the growth of a rabbit population in order to understand the role of limiting factors and variation in maintaining or destroying the population.

Things to note about this particular rabbit population:

- **Brown rabbits camouflage with their surroundings, which allow them to avoid being eaten by predators. White rabbits are easily spotted by predators.**
- **Short-toothed rabbits are not able to eat the food when provided. Only long-toothed rabbits can access the provided food source.**

Procedure

1. Navigate to http://phet.colorado.edu/en/simulation/natural-selection

2. Click on the "RUN NOW" button

3. Once you have the simulation window active, click the "PAUSE" button at the bottom to stop the simulation.

   NOTE: you can always start over by pressing the "RESET ALL" button

4. The simulation starts you off with only one bunny. When you "add a friend", the two bunnies will start to reproduce.

   Without changing any of the parameters within the simulation, write a prediction of what you think will happen to the bunny population when you "add a friend" in Table 1.

5. Press “Play” and then “Add a friend”. Let the simulation run for several generations. Record what actually happened to the bunny population (You may write “matches prediction” if you were right). Finally, write an explanation for what you observed.

6. Repeat steps 4-5 for each of the scenarios in Table 1. Be sure to write your prediction BEFORE pressing play! Also, allow the simulation to run long enough for you to actually see what will happen to the population.

Table 1: Predictions and Results

Scenario	What do you think will happen?	What actually happened?	Why did this happen?
#1: No selection factors or mutations			
#2: Introduce wolves after the population gets above 50, no mutations			
#3: Introduce food after the population gets above 50, no mutations			
#4: Introduce brown fur mutation, Introduce wolves after the total population gets above 50			
#5: Introduce long teeth mutation, Introduce food after the total population gets above 50			

Conclusions

1. Based on what you observed, what are some factors that you believe to be essential to keeping the size of a population in check?

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2. Compare scenarios #2 and #4 and #3 and #5. What happened when the bunnies were all the same compared to when there were two *different* types of bunnies?

3. Based on your response to #2, would you consider variation, or differences, within a population to be beneficial or harmful? Explain.

EXTRA CREDIT CHALLENGE

Manipulate the simulation so that it never stops, that is, the bunnies do not "take over the world" and the population never dies out.

When you figure out this challenge, describe the selection factors and mutations involved in creating this situation and explain why the simulation keeps going indefinitely.