Limiting Factors of the Cedar Glade

Adapted from the TN Gateway Institute-S2/ from Woodrow Wilson

OVERVIEW: Students will gain understanding of *limiting factors*, particularly limiting factors of the Cedar Glade ecosystem through a simulation activity.

GRADE LEVEL: 9 – 12

TIME: 1 to 2 class periods (55 minutes)

SETTING: Classroom

OBJECTIVES: Students will learn how an ecosystem may be affected by limiting factors; students will explain how carrying capacity can differ in various scenarios

LEARNING STANDARDS: Science CLE 3210.2.1; 3210.2.2; 3210.2.3; 3210.3.1; 3216.21; 3255.2.1; 3255.4.4; 3255.6.2; 3255.6.4; 3260.7.1

QUESTION: What types of factors limit the carrying capacity of the system in the cedar glade ecosystem?

MATERIALS:
masking tape
yard stick or measuring tape
pipe cleaners bent into 10 x 10 cm squares to represent the owls
colored pencils
graph paper
large bag of pinto beans (or other dried beans) to represent the mice
student data sheet

BACKGROUND: In nature, populations of organisms rarely grow uncontrolled. Each ecosystem has a carrying capacity or number of organisms it can sustain. *Limiting Factors* are **biotic** and **abiotic** factors that prevent the continuous growth of a population.

Because of limiting factors, the number of organisms in a population are often well below carrying capacity. This activity will look at limiting factors found in the Cedar Glade ecosystem, and their impact on population growth.

PROCEDURE:

1. Divide class into groups of four. Assign these roles:
    a) bean counter (mice counter) – scatters beans between rounds and records the number of beans caught. Beans represent mice.
    b) Recorder – reads directions for the activity and records the data
    c) female owl – stands outside the glade area, tosses the sampling square (to model the owl feeding), collects all beans (mice) located inside the square
    d) male owl – same role as female

2. With masking tape, mark off an area (approximately 4 ft. square) on the floor. This represents an area in the glade where the owls will hunt.

3. Scatter 80 beans over the grid. Each bean represents a mouse in the glade.

4. The two pipe cleaner squares represent a male and female owl, which separately hunt the area. Student should stand about one foot from the grid and toss the square into the grid.

5. Remove any beans that are inside the square. Repeat. Each "owl" has two chances to "hunt" (toss) each day.

6. Do the same thing with the other owl. This process represents hunting mice.

7. In nature, each owl hunts twice a day. *In order to stay alive, each owl must eat at least 4 mice in a three day period!* If fewer than 4 mice are eaten in any three-day period, the owl grows too weak to hunt and dies.

Name _____ Period _____ Date _____

Investigation 1: Glade in early spring-conditions usually favorable for mouse population

A. Each owl hunts 2 times per day beginning with the female. Any mice caught must be removed before the next owl hunts. Enter the numbers in Table 1. Continue as long as there is a surviving owl. Enter an X in the appropriate box on the table indicating the date of death (if it occurs).

Table 1:

Mice Eaten	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
Male Owl										
Female Owl										

1. Using graph paper, graph the data you recorded in Table 1: male vs. female
    a) Label the X and Y axis
    b) Make a legend for graph

Investigation 2: Lack of rain has led to drought like conditions in the glade. 25% of the mice die (20 total). Remove these 20 from your area before the owls hunt.

A. Complete Table 2 for 10 days as in Investigation 1.

Table 2:

Mice Eaten	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
Male Owl										
Female Owl										

1. Using graph paper, graph the data you recorded in Table 2: male vs. female
    a) Label the X and Y axis
    b) Make a legend for graph

2. How did the dry conditions affect the hunting success of the owls as compared with Investigation 1. (Use data to compare).

3. What do you think would happen if the drought-like conditions had killed 50% of the mice?

Investigation 3: The spring season this year has been a successful one for the Eastern Garter Snake. Its numbers have increased by 25% and the owls are in direct **competition** with the snakes for mice. Begin with 80 mice; remove 3 mice (beans) each day before each of the owls hunt (6 removed total each day for male and female).

Table 3:

Mice Eaten	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
Male Owl										
Female Owl										

1. Using graph paper, prepare a line graph using data from Table 4: male vs. female
   a) Label the X and Y axis
   b) Make a legend for the graph

2. How did the addition of competitors affect the survival rate of the owls?