

Name \_\_\_\_\_

Date \_\_\_\_\_

**Materials**

weigh boat  
deck of Changing  
Ecosystems game  
cards  
deli cup and lid  
medicine cups, 8  
set of colored pencils

**Overview**

In the Prelab investigation, ecological interactions occurring on a *Piper* plant species known to support dynamic insect community were considered. During today's investigation, your group will play the Changing Ecosystems game, in which you simulate a forest ecosystem undergoing changes that affect its biodiversity.

**Background**

**Biodiversity** refers to the number, variety, and populations of species within a particular geographic area. A decrease in biodiversity refers mainly to a loss of **species**. A **population** decrease indicates the potential for a species' disappearance from a **community**. A species that has disappeared from a particular community is said to be **extirpated**, or locally extinct. A species no longer found on earth is **extinct**. Species whose populations have dwindled such that they might easily become extinct are termed **endangered species**.

**Guided Investigation**

As you play the Changing Ecosystems game, you will simulate a forest ecosystem undergoing changes that affect its biodiversity. Your group begins with a plastic weigh boat of assorted beads, each color representing a different organism in a deciduous forest community. Each round represents one year. At the beginning of each year, draw an event card, which represents a condition or action that poses a threat to various organisms. If the drawn card corresponds with a threat to an organism, remove the corresponding beads, symbolizing the population loss caused by that threat. Each bead represents a percentage of the population. Keep track of the number of beads and the species of organisms that are removed from the community over the course of 15 rounds. At the end of the game, graph the populations over the 15-year period and then answer the Analysis Questions.

**Procedure**

1. Fill a medicine cup with 1 TBS (~15 mL) of red colored beads found at the centralized lab station.
2. Carefully count 25 red beads, returning extra beads to the centralized lab station if needed.
3. Return these 25 red beads to a single medicine cup and place to the side for later use.
4. Repeat Steps 1 and 2 for the remaining 9 colored beads. With the exception of red, add 25 of each color bead to your plastic weigh boat. The plastic weigh boat will represent your ecological community and should contain 225 beads: 25 each of 9 colors.
5. Review the Data Table below, and note the color of bead that represents each of the native species. The red beads represent the invasive species.

6. Mix all beads except the red beads in the plastic weigh boat.
7. Shuffle the game cards and lay them face-down in a stack.
8. Draw the top card and read it aloud.
9. Remove or add the corresponding beads, as indicated by the instructions on the card. Place the card into a discard pile. Place the removed beads into the deli cup. Additional beads may be obtained from the centralized lab station as needed to satisfy the conditions of a particular game card.
10. Record how many of each bead remains in the data table. Remember that you start with 25 of each of the 9 native species and no invasives.
11. Keep track of the names and number of each invasive species introduced to the community. In the data table, write these names under "Invasive Species" and record the numbers added during each year.
12. Repeat steps 8–11 until you have completed 15 rounds (years) of the game. **Note:** If a population is extirpated, disregard that species in any following rounds that refer to it.
13. Use the data table to graph the populations of the various species (include the invasives collectively as one group) over time. Graph "Year" on the *x*-axis and "Population Size" on the *y*-axis. Use a colored pencil corresponding to the color of each species, and create a key to indicate the color that represents each species.

**Data Table**

Organism	Color	Year														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
American toad	blue	25														
Grasshopper	black	25														
Red-tailed hawk	brown	25														
Oak	orange	25														
Sedge	light green	25														
Cottontail rabbit	pink	25														
Field mouse	yellow	25														
Red-headed woodpecker	white	25														
Black rat snake	dark green	25														
Invasive species	red															

This image shows a full page of blank graph paper. The grid consists of small, equal-sized squares formed by thin black lines. There are 20 columns and 20 rows of squares, creating a total of 400 square units. The paper is otherwise completely empty, with no margins, text, or other markings.

**Carolina EcoKits® Changing Ecosystems**

Name \_\_\_\_\_

Date \_\_\_\_\_

**Analysis Questions**

1. Examine the discarded stack of cards and categorize the cards according to the factors that contributed to the loss of biodiversity of the forest community. List the factors in order of how frequently they occurred over the 15 years, beginning with the most frequent and ending with the least.
2. Which event had the most devastating immediate consequence to a population? Which event caused a population to decline the most over the long term?
3. Based on the game's results, calculate the percent change in each species' population in the ecosystem.  
$$\text{percent change} = \left[ \frac{(\text{initial population} - \text{final population})}{\text{initial population}} \right] \times 100\%$$
4. Provide specific examples of the human activities that contributed to a loss of biodiversity.
5. The Changing Ecosystems game addresses only some consequences of biodiversity decline. Describe at least one consequence not addressed in the game.
6. Using what you have learned from the Guided Investigation, make a claim regarding the categories of what can impact ecosystem stability.