

# Population Fluctuations in an Ecosystem

Grade 6

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**Science Content Standards:** Grade 6, 5e — *Students know* the number and types of organisms an ecosystem can support depends on the resources available and on the abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.

**Lesson Concept:** Populations within an ecosystem fluctuate over time.

## Conceptual Flow:

- ▶ Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis.
  - Energy from producers is transferred from organism to organism through food webs.
  - A food chain is the flow of energy through one part of a food web.
- ▶ Energy and matter are transferred from one organism to another organism through consumption.
  - Plants are eaten by primary consumers (herbivores); most herbivores are eaten by secondary consumers (carnivores); and those consumers are eaten by tertiary consumers.
  - Energy is transferred from organisms to the physical environment through heat loss.
- ▶ Populations within an ecosystem fluctuate over time.
  - Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.
  - When resources are abundant, a population increases.
  - When resources are scarce, a population decreases.
  - Altering the population of one species affects the ecosystem.
  - Introducing a new predator or prey will have an effect on populations in an ecosystem – either positive or negative.
  - Limiting factors for plants are: sunlight, water, nutrients, and space.

## Teacher Background:

There is a greater variety of types of organisms in temperate or tropical environments than in deserts or polar tundra; more different types of organisms can thrive in temperate temperatures with plenty of water.

The number of organisms supported by any ecosystem varies from season to season. More organisms thrive during temperate summers than can survive icy winters. More organisms multiply during a desert's cooler, wetter winters than can live through its hotter, drier summers.

Richness of plant growth depends on abiotic factors, such as water, sunlight, moderate temperatures, temperature ranges, and composition of the soils. The number of plant eating animals in an ecosystem depends directly on available edible plants, and the number of predators in a system depends on the available prey.

(Adapted and excerpted from the *Science Framework for California Public Schools: Kindergarten Through Grade Twelve*. Sacramento: California Department of Education, 2003. p 99)

Populations expand in an ecosystem until abiotic or biotic factors become limiting. If populations get too large, competition for resources will cause some to die. Limiting factors can change over time such as the amount of yearly rain which can determine the amount of plant/food resources. (*Glencoe Science*, 6<sup>th</sup> grade).

## Materials Needed for the Lesson:

### Teacher Materials

- "Directions for the Population Fluctuations in an Ecosystem Activity"
- "Population Fluctuations in an Ecosystem Data Chart"
- 2 large stickers; or arm bands; or bright colored shirts to identify the "Mountain Lions"
- Hula hoop or large rope to make "predator's den"
- Optional: 6-8 cones for marking the game area (or use string, chalk)

### Student Handouts

- "Population Fluctuation Factors"
- "Population Fluctuations in an Ecosystem Data Chart"

Directions for this game were adapted from the "Oh, Deer" activity in *Project WILD*.





Teacher Does	Student Does	Concept
<p>Follow “Directions for the Population Fluctuations in an Ecosystem Activity” and record the numbers of deer and resources on the “Population Fluctuations in an Ecosystem Data Chart.”</p> <p>When the chart is completed (after 13 rounds), return to the classroom.</p>	<p><b>ESR:</b> Students make the needed resource sign or resource to be and make the “sign” and participate in the game.</p>	
<p><b><u>EXPLAIN:</u></b></p> <p>In the classroom, distribute to each student a copy of the “Population Changes in an Ecosystem”.</p> <p>Show the numbers you have recorded (or write these the numbers from each of the years on a large chart in front of the class) and have students copy the data onto their own data table.</p> <p>Using the data table, facilitate a class discussion:</p> <ul style="list-style-type: none"> <li>▶ <i>When there were a lot of resources, was it easy to find, food, shelter and water?</i></li> <li>▶ <i>Explain what happened to the resources when the deer population increased.</i></li> <li>▶ <i>What happened when the resources went down?</i></li> <li>▶ <i>When the predator was introduced into the ecosystem, how did that affect the deer population? How did it affect the resources?</i></li> <li>▶ <i>What happened when the predators died?</i></li> <li>▶ <i>How do these resources affect competition within a species?</i></li> <li>▶ <i>Using the data gathered during the game/simulation, answer question #2 on “Population Fluctuation Factors” paper.</i></li> </ul> <p>Have students discuss their answers in groups. Then ask one group member to share with the class one of the group's responses to the question. Each group should share a different factor.</p> <p>Collect papers and assess students' written answers.</p>	<p><b>ESR:</b> Students copy the data on their data table.</p> <p><b>ESR:</b> Yes</p> <p><b>ESR:</b> The number of resources went down.</p> <p><b>ESR:</b> Many deer died.</p> <p><b>ESR:</b> More deer died and the number of resources went up.</p> <p><b>ESR:</b> The deer population started to go up.</p> <p><b>ESR:</b> The stronger healthier deer get the resources; the slower and weaker deer do not get resources and they die.</p> <p><b>ESR:</b> More resources, more deer; less resources less deer; predators came and there were even less deer, but then the resources went up and then the deer population increased.</p>	<p>Populations within an ecosystem fluctuate over time.</p>

Teacher Does	Student Does	Concept
<p><b><u>EXTEND:</u></b></p> <p>Give students graph paper and have them graph the population of the deer &amp; mountain lions over the years (using the data recorded from the “Population Fluctuations in an Ecosystem Data Chart”). Discuss what inferences we can make based on the evidence we gathered about deer populations, their predators, and available resources.</p> <p>Based on the results of the assessment, if needed, plan additional activities concerning factors that affect populations in an ecosystem.</p> <p>Ask students: Imagine that you were a park ranger and you notice that there are too many deer in your park. What could you recommend to a Park Advisory Board about how the deer population could be controlled?</p>	<p><b>ESR:</b> Using the data from the game/simulation, make a graph showing that as resources go up, so do populations; then as populations rise, then resources go down.</p>	<p>Abundant resources allow populations to increase in an ecosystem. As resources diminish, populations diminish.</p>

**Input Question:** Describe what factors you think might contribute to the deer population in Lake County to fluctuate over the years. (in Engage section)

**Process Question:** Explain what happened to the resources when the deer population increased. (in Explain section)

**Output Question:** Imagine that you were a park ranger and you notice that there are too many deer in your park. What could you recommend to a Park Advisory Board about how the deer population could be controlled? (in Extend section)

## Directions for the Population Fluctuations in an Ecosystem Activity

Adapted from the “Oh, Deer!” activity in *Project WILD*

### Materials:

- Cones or something to mark the “Zone” area for playing the game
- Hula hoop or large rope for predators den
- Chart for collecting data
- A way to identify the Mt Lions (large stickers, arm bands, bright shirts)

### Procedure:

Note: In the classroom, students would have already counted off by four. Outside, the playing zone should be identified with 2 parallel lines about 20 yards apart (these can be marked by chalk, a string, cones, or an imaginary line can be described to the students).

1. Lead students to the game area and tell them that all the ones will be deer and twos, threes, fours will be resources.
2. The deer line up behind one line and the rest of the students (resources) line up behind the other line (which is about 20 yards away). Both lines have their backs to each other.
3. Each deer must each choose what resource it is looking for: food (clamp hands over stomach; water (put hands over mouth); shelter (put hands over head, like a pointed hat). Students may NOT change the resource they are looking for until the next round of the game (which indicates one year).
4. All the resources are to choose which resource they will be during the year (the round). If they want to be food, put hands over stomach; for water, put hands over mouth; for shelter, put hands over head like a pointed hat.
5. Begin the year (round) by having students make their signs, each deer deciding what it is looking for, each habitat resource deciding which resource it will be.
6. When the students are ready say, “Time to go searching for resources”. Students turn around and face each other.
7. Deer search for the resource they need and run to it, lock arms with the resource needed and walk back to the deer line; there should be only one resource per deer. If a deer does not find its needed resource, it dies and becomes a resource in the habitat. A successful deer that gets its resource reproduces and this resource becomes a deer.
8. Note: When more than one deer reaches a resource, the deer that arrives there first, gets the resource. Resources stay in place until a deer chooses them. If no deer needs a certain resource, the resource stays in the habitat. Resources can choose to be a different resource at the beginning of each new year (new round).
9. Record the number of deer at the beginning of the game and at the end of each year (round).
10. At the end of 5 years (rounds), introduce two predators (mountain lions). Choose two of the resources to be the mountain lions. Put a hoola hoop or a large circle of rope to the side of the game zone for the predator. Provide a way for the mountain lions to be identified, such as a large sticker, arm band, or a colored shirt.
11. Explain to students that the game will continue as before, except there are now 2 mountain lions that have arrived in the habitat and are very hungry for deer.
12. The game will continue in the same manner, except the mountain lions will skip out into the habitat to capture a deer. The mountain lion can capture a deer as the deer moves towards the resources. If a deer gets its resource before it is captured by a mountain lion, then the deer is safe. A mountain lion can only capture one deer. The captured deer is now a mountain lion. Mountain lions that fail to capture a deer, die and become a “resource” in the habitat.
13. Play 5 more rounds of the game and record numbers of deer, resources, and predators after each round.
14. Return to the classroom.

Name: \_\_\_\_\_

**STUDENT HANDOUT**

# Population Fluctuation Factors

## Possible Ideas

1. What factors might contribute to the deer population in Lake County to fluctuate (change) over many years?

## My thoughts now

2. In the simulation/game, what factors caused the fluctuation (change) of the deer population over many years?

Name: \_\_\_\_\_

**STUDENT HANDOUT**

**Population Fluctuations in an Ecosystem  
Data Chart**

<b>Year</b>	<b># of Deer</b>	<b># of Resources</b>	
1			
2			
3			
4			
5			
<b>Year</b>	<b># of Deer</b>	<b>Resources</b>	<b>Predators</b>
6			
7			
8			
9			
10			
11			
12			
13			