Lesson 2.3: Limiting Factors of a Woodland

Student Sheet Lesson 2.3

Focus Question: How do limiting factors affect the growth of a population?

Materials:
- Masking tape
- Yard stick or measuring tape
- Pipe cleaners bent into 10 x 10 cm squares to represent the owls (included in module for modeling mitosis)
- Colored pencils
- Graph paper
- Corn or beans to represent the mice (included in module for monocot/dicot comparison)
- Student data sheet

Getting Started: In nature, populations of organisms rarely grow uncontrolled. Limiting Factors prevent the continuous growth of every population on Earth. 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 a woodland ecosystem, and their impact on population growth.

Procedure:
1. In your group of four, assign each of 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) Owl #1 – stands outside the wooded area, tosses the sampling square (to model the owl feeding), collects all beans (mice) located inside the square
   d) Owl #2 – same role as owl #1
2. Use masking tape to mark off an area (approximately 4 ft. square) on the floor. This represents a woodland area where the owls will hunt.
3. Scatter 80 beans over the grid. Each bean represents a mouse.
4. The two pipe cleaner squares represent two owls - red pipe cleaner represents owl #1 and the white pipe cleaner represents owl #2. “Owls” should stand about one foot from the grid and toss the square into the grid. This represents hunting; owl #1 will hunt first.
5. Remove any mice (beans) that are inside the square. Repeat. Each “owl” has two chances to “hunt” each day.
6. In nature, each owl hunts twice a day. In order to stay alive, each owl must eat at least four mice in a three day period! If fewer than four mice are eaten in any three-day period, the owl grows too weak to hunt and dies.
7. Your group will collect data for three simulations of different woodland scenarios. The three scenarios are described on the attached page.
8. You will then graph the data from each scenario ON THE SAME GRAPH. Be sure to include a key that clearly identifies each scenario.
9. Analyze and compare your data sets to answer the questions.
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Focus Question: How do limiting factors affect the growth of a population?

The three woodland scenarios are described below. In each scenario, different factors change in the owls’ environment.

Scenario 1: Woods in early spring

In early spring, the environment is usually favorable for mouse populations. Each owl hunts two times per day beginning with owl #1. Any mice caught must be removed before the next owl hunts. Enter the number of mice eaten by each owl in Data 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).

Scenario 2: Drought like conditions in the woods

There is a lack of rain which causes drought like conditions. The drought causes 25% of the mice (20 total) to die. Remove these mice from your area before the owls hunt. The owls will hunt following the same pattern as in Scenario 1. Enter the number of mice eaten by each owl in Data Table 2.

Scenario 3: A successful spring for the Eastern Garter Snake

The conditions are favorable for Eastern Garter snakes. The snake population has increased by 25% and the owls are in direct competition with the snakes for mice. To simulate this competition, remove 3 mice (beans) each day before each of the owls hunt (remove 6 mice total per day).
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Data Table 1: Scenario 1: Woods in early spring

<table>
<thead>
<tr>
<th>Mice Eaten</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
<th>Day 7</th>
<th>Day 8</th>
<th>Day 9</th>
<th>Day 10</th>
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</thead>
<tbody>
<tr>
<td>Owl #1</td>
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<td>Owl #2</td>
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</tbody>
</table>

Using graph paper, prepare a line graph using data from Table 3: owl #1 vs. owl #2.

a) Label the X (days) and Y axis (# mice)

b) Make a key for the graph

Data Table 2: Scenario 2: Drought like conditions in the woods

<table>
<thead>
<tr>
<th>Mice Eaten</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
<th>Day 7</th>
<th>Day 8</th>
<th>Day 9</th>
<th>Day 10</th>
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</thead>
<tbody>
<tr>
<td>Owl #1</td>
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<td>Owl #2</td>
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</table>

Using graph paper, prepare a line graph using data from Table 3: owl #1 vs. owl #2.

a) Label the X (days) and Y axis (# mice)

b) Make a key for the graph

Data Table 3: Scenario 3: Successful spring for Eastern Garter Snake

<table>
<thead>
<tr>
<th>Mice Eaten</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
<th>Day 7</th>
<th>Day 8</th>
<th>Day 9</th>
<th>Day 10</th>
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</thead>
<tbody>
<tr>
<td>Owl #1</td>
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<td>Owl #2</td>
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</tbody>
</table>

Using graph paper, graph the data you recorded in Data Table 1: Scenario 1

a) Label the X axis (days) and Y axis (# mice).

b) Make a key for the graph.
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Reflecting on What You’ve Done:

1. Name the limiting factors in EACH of the three scenarios that affect the owl population in this woodland. Identify each factor as abiotic or biotic.

2. How did the dry conditions in Scenario 2 affect the hunting success of the owls as compared with Scenario 1 (provide specific data as evidence to support your comparison).

3. What do you think would happen if the drought-like conditions had killed 50% of the mice? (provide data to support your thinking)

4. How did the addition of competitors affect the survival rate of the owls? (provide specific data as evidence to support your response)