### 4.2 Niches and Community Interactions

**Lesson Objectives**
- Define niche.
- Describe the role competition plays in shaping communities.
- Describe the role predation and herbivory play in shaping communities.
- Identify the three types of symbiotic relationships in nature.

**BUILD Vocabulary**

A. The chart below shows key terms from the lesson with their definitions. Complete the chart by writing a strategy to help you remember the meaning of each term. One has been done for you.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commensalism</strong></td>
<td>A relationship where one organism benefits and the other is neither helped nor harmed</td>
</tr>
<tr>
<td><strong>Competitive Exclusion Principle</strong></td>
<td>The rule that says that no two species can occupy exactly the same niche in the same habitat at exactly the same time</td>
</tr>
<tr>
<td><strong>Habitat</strong></td>
<td>The general place where an organism lives</td>
</tr>
<tr>
<td><strong>Herbivory</strong></td>
<td>Interaction in which one animal feeds on producers</td>
</tr>
<tr>
<td><strong>Keystone Species</strong></td>
<td>A species in which a change in its population causes a dramatic change in the structure of the community</td>
</tr>
<tr>
<td><strong>Mutualism</strong></td>
<td>A relationship between organisms in which both benefit</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Niche</td>
<td>What an organism does and how it interacts with the abiotic and biotic factors in the environment</td>
</tr>
<tr>
<td>Parasitism</td>
<td>A relationship in which one organism lives on or inside of another organism and harms it</td>
</tr>
<tr>
<td>Resource</td>
<td>Any necessity of life, such as water, nutrients, light, food and space</td>
</tr>
<tr>
<td>Symbiosis</td>
<td>Any relationship in which two organisms live closely together</td>
</tr>
<tr>
<td>Tolerance</td>
<td>The ability to survive and reproduce under a range of environmental conditions</td>
</tr>
</tbody>
</table>
BUILD Understanding

Concept Map: A concept map can help you organize information and show how ideas are connected.

As you read Lesson 2, place the terms from the box in the correct location in the concept map.

- commensalism
- mutualism
- parasitism
- competitive exclusion principle
- herbivory
- predation

- An organism
  - Habitat
    - Niche
      - Prey: one type is to hunt and kill prey called
      - Predator: another type is to eat plants
  - Resource
    - depends on available food
    - develops relationships with other organisms called Symbioses
      - mutualism: where both organisms benefit
      - Parasitism: where one organism benefits while one is harmed
      - Commensalism: where one benefits; other unaffected

- Tolerance
  - principle that states that two species cannot occupy the same niche
  - Competitive Exclusion principle
Inquiry Into Scientific Thinking

*Which Biome?* An ecologist collected climate data for one location. The graph below shows the monthly average temperature for that location. In this location, the total yearly precipitation is 11 cm.

![Average Monthly Temperatures Graph]

1. Look at the horizontal axis of the graph. Read the labels. What do the labels show? **The months of the year**
2. Now look at the vertical axis of the graph. What information does the vertical axis show? **The average temperature**
3. Does the graph show temperatures in degrees Fahrenheit or degrees Celsius? How do you know? **Celsius. Because of the °C**
4. In your own words, describe what this graph shows. **This graph shows how the average temperature changes during the months of the year.**
5. In this location, which two months have the highest temperature? **July and August have the highest averages.**
6. Look at the climate graphs in your textbook for the different biomes. Could the location shown in the graph above be found in a tropical rain forest? Explain your answer. **Because this temperature varies too much through the year, it would not be found in a tropical rain forest.**
### 4.3 Succession

**BUILD Vocabulary**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecological succession</td>
<td>A series of predictable changes that occur in a community over time</td>
</tr>
<tr>
<td>Pioneer species</td>
<td>The first species to arrive or colonize a barren area</td>
</tr>
<tr>
<td>Primary succession</td>
<td>A succession that begins in an area where there are no remnants of an older ecosystem</td>
</tr>
<tr>
<td>Secondary succession</td>
<td>A succession that occurs in an area where remnants of a previous ecosystem do remain</td>
</tr>
</tbody>
</table>

### 5.2 Limits to Growth

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density - Dependent</td>
<td>A limiting factor that only becomes limiting for a population when the population density reaches a certain level</td>
</tr>
<tr>
<td>limiting factor</td>
<td></td>
</tr>
<tr>
<td>Density - Independent</td>
<td>A limiting factor that affects all populations in similar ways regardless of population size and density</td>
</tr>
<tr>
<td>limiting factor</td>
<td></td>
</tr>
<tr>
<td>limiting factor</td>
<td>Something that controls the growth of a population</td>
</tr>
</tbody>
</table>
Density-Dependent Limiting Factors

Density-dependent limiting factors become important when the population density of an area reaches a certain level. The effect of predators on prey is one density-dependent limiting factor.

A predator is an animal that eats other animals. Prey is the animal that is eaten. Predator-prey interactions can affect the population growth of both the predator and the prey. Populations of predators and prey cycle up and down over time. In the graph below, the wolves are the predators and the moose are the prey.

![Graph: Wolf and Moose Populations on Isle Royale]

**Answer the questions.**

1. Was the moose population increasing or decreasing from 1964 to 1974? Increasing.
2. Was the wolf population increasing or decreasing from 1969 to 1980? Increasing.
3. How might changes in the moose population from 1964 to 1974 relate to changes in the wolf population from 1969 to 1980? The increase in the moose population meant more food for the wolves; therefore, the population would increase.

5.3 Human Population Growth

**Events in human history have affected the size of the human population. The table below lists some of these events. It shows the approximate size of the human population at the time of each event.**

**Follow the directions.**

1. Plot the data from the table on the graph.
2. Connect the points on the graph with a line.

<table>
<thead>
<tr>
<th>Event</th>
<th>Approximate Date</th>
<th>Human Population Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start of farming</td>
<td>8500 B.C.</td>
<td>0.1 billion</td>
</tr>
<tr>
<td>Use of plowing and irrigation</td>
<td>3400 B.C.</td>
<td>0.2 billion</td>
</tr>
<tr>
<td>Spread of bubonic plague</td>
<td>1300 A.D.</td>
<td>0.4 billion</td>
</tr>
<tr>
<td>Industrial Revolution</td>
<td>1800 A.D.</td>
<td>1 billion</td>
</tr>
<tr>
<td>Modern day</td>
<td>2000 A.D.</td>
<td>6 billion</td>
</tr>
</tbody>
</table>
Circle the correct answer.

3. Which term best describes the human population growth trend shown in the graph?
   - exponential
   - logistic

4. After which event did the human population grow the most?
   - bubonic plague
   - Industrial Revolution

* The world's population is over 7 billion today!
BUILD Understanding

Concept Map A concept map can help you organize information and show you how ideas are connected.

- acid rain
- automobile emission standards
- crop rotation
- deforestation
- desertification
- drip irrigation
- greenhouse gases
- industrial chemicals
- nonpoint sources
- residential sewage
- smog

As you read the lesson, place the terms in the correct location in the concept maps.

- Negative human impacts on the environment
  - Soil erosion
    - Loss of trees (deforestation)
    - Poor soil productivity
  - Water pollution
    - resulting from unwise handling of DDT, etc.
    - Industrial Chemicals
    - Other sources
    - Nonpoint Source
    - Residential Sewage
  - Air pollution
    - Gray-brown haze
    - Smog
    - CO₂
    - Acid precipitation (acid rain)
    - Greenhouse gases
    - Nitrogen and phosphorous in

- Sustainable environmental practices
  - Water conservation and water quality
    - such as Drip Irrigation
  - Soil conservation
    - such as Crop rotation
  - Air quality
    - such as Automobile emission standards
BUILD Connections

Biological Magnification: Biological magnification is the process by which the strength of a pollutant increases as it moves up the levels of the food chain. The diagram below shows the biological magnification of the pollutant DDT.

Follow the directions:
1. Find the trophic level with the lowest concentration of DDT. Color it blue.
2. Find the trophic level with the highest concentration of DDT. Color it red.
3. Draw an arrow showing how the concentration of DDT increases in trophic levels.

Use the diagram to answer the questions.

4. Circle the organism that has the most DDT in its body.
   - zooplankton
   - small fish

5. Think about your answer to item 4. Select the choice below that best explains the reasoning behind your answer.
   - A. Zooplankton has DDT. Small fish eat lots of zooplankton. Therefore DDT builds up in the bodies of the small fish.
   - B. Large fish eat small fish, and large fish have more DDT than small fish. Therefore small fish have the most DDT.