Population Growth
How is population growth naturally regulated?

Why?
The current world population is estimated to be over 7 billion. At present the number of births annually exceeds the number of deaths, which means that the population is increasing, and is estimated to reach 9 billion by 2040. In 1750 the world population was estimated at less than 800 million. How are growing populations such as ours controlled and supported, and can they continue to grow indefinitely?

Model 1 – Population Growth

1. Refer to Model 1.
   a. What is the term used for populations moving into an area?

   b. What is the term used for populations leaving an area?

   c. Name two factors that cause an increase in the population size.

   d. Name two factors that cause a decrease in population size.
2. Using Model 1 and the letters B, D, E, and I, write mathematical expressions to show the types of population described below. Note: The use of > and < may be needed.

a. A stable population (total number of organisms is not changing).

b. A declining population (total number of organisms is decreasing).

c. A growing population (total number of organisms is increasing).
9. Refer to Model 3.
   
   a. During what phase of the growth curves in each diagram is the population just beginning to colonize an area?

   b. Which type of population growth appears to continue unchecked?

10. The growth curves in Model 3 are often referred to using the letters of the alphabet they resemble. The logistic growth curve is sometimes referred to as an S-curve. What letter would you use to describe the exponential growth curve?

11. What causes the population to slow down during logistic growth?

12. The maximum population an environment can sustain is affected by environmental factors that cause the population to level out or become stable. What term is used to describe this level of logistic growth?
13. Propose some reasons why population growth is so rapid immediately after the lag phase in both diagrams of Model 3?

14. Exponential growth (diagram A) refers to the phenomena of populations that double in size every generation. If you start with a single bacterium capable of dividing every 20 minutes, how many bacteria would you have after just four hours?

15. In most natural populations rapid exponential growth is unsustainable. As populations increase, environmental resistance causes the growth rate to slow down, until carrying capacity is reached. With your group, brainstorm several factors that could be considered as environmental resistance.

16. Diagram B shows that the population size fluctuates around the carrying capacity. Considering what you know about interactions in the environment, discuss with your group some of the factors that could cause these fluctuations. In your answer you should relate these factors to the information from Model 1.
1.2B

Part II: Quality or Quantity?

1. As a team, discuss the items listed below. Decide whether each item is generally "good" for people and the environment or generally "harmful."

- If it is "good," place a green "+" in the space beside the item.
- If it is "harmful," place a red "−" in the space.
- If your team really can’t decide, place a black check in the space.

<table>
<thead>
<tr>
<th>Clean water</th>
<th>Energy</th>
<th>Noise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings</td>
<td>Overgrazing</td>
<td>Hunger</td>
</tr>
<tr>
<td>Material luxuries</td>
<td>Polluted air</td>
<td>Minerals</td>
</tr>
<tr>
<td>Space to live</td>
<td>Cars and roads</td>
<td>Unemployment</td>
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<td>Soil erosion</td>
<td>Forests</td>
<td>Food</td>
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<td>Wildlife</td>
<td>Acid rain</td>
<td>Garbage</td>
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<tr>
<td>Poverty</td>
<td>Oil spills</td>
<td>Crowded cities</td>
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<td>Opportunities for solitude</td>
<td>Endangered species</td>
<td>Contagious disease</td>
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<tr>
<td>Traffic congestion</td>
<td>Available housing</td>
<td>International conflicts</td>
</tr>
<tr>
<td>Recreational space</td>
<td></td>
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2. Now consider the effect of a significantly increased human population on each item. If increasing the human population would tend to increase the item, write the item inside the arrow pointing upward. If increasing the human population would tend to decrease it, write the item inside the arrow pointing downward.

- Use a red writing tool for the "harmful" things.
- Use a green writing tool for the "good" things.
1.3

1. Summarize the effect of exponential growth on a population.

2. In Part II of this activity, you saw some relationships between population and some parts of the environment. What sorts of things tend to increase with population increases? What sorts of things tend to decrease?

3. The United States has about 4.3 percent of the Earth’s human population and is responsible for about 30 percent of the annual resource use and pollution. What does this tell us about the lifestyle that is possible for the world’s population?

4. Which is more important, to halt population growth in rapidly growing, less developed areas such as Africa, or in more slowly growing developed areas such as the United States? Discuss your answer.

5. List some advantages of a reduced human population.

6. Discuss the relative importance of quantity of life versus quality of life.
Activity 1.3: Population—More Is Less (Continued)

7. How does human population growth affect the following?
   a. Extinction of other species
   b. Quality of air and water
   c. Space available for recreation
   d. Food available for people
   e. Stress and conflict
   f. Energy resources available per person
   g. Competition for jobs and housing
   h. The spread of contagious diseases
   i. Your lifestyle in the next forty years
   j. Your descendants’ lifestyles

8. Should governments enact and enforce laws to limit population? Explain your answer.

9. Should governments encourage population control through such measures as education, tax incentives for smaller families, and making birth control more available? Explain your answer.

10. What can you do, personally, to help with the overpopulation problem?