Population Growth

Learning Outcomes

After completing this lesson, you will be able to:

- describe the carrying capacity of an ecosystem
- explain why a population cannot continue to increase in size indefinitely
- interpret graphs of population growth curves
- determine if a population is growing, stable, or declining
- predict the carrying capacity of an environment, based on a population growth curve

Key Words

carrying capacity

population growth curve

population

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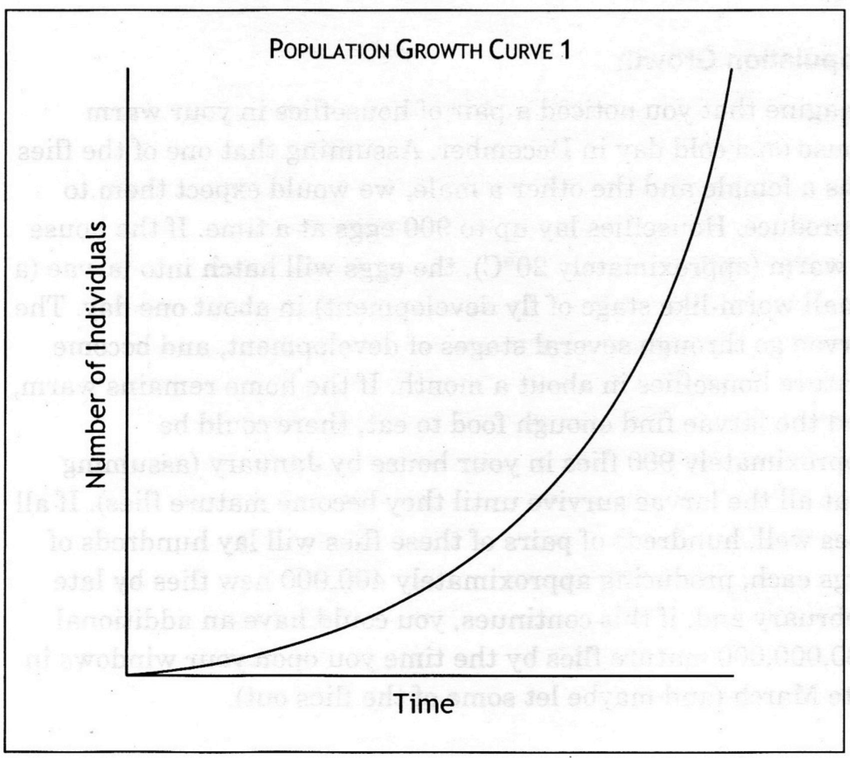
Imagine that you noticed a pair of houseflies in your warm house on a cold day in December. Assuming that one of the flies was a female and the other a male, we would expect them to reproduce. Houseflies lay up to 900 eggs at a time. If the house is warm (approximately 20°C), the eggs will hatch into larvae (a small worm-like stage of fly development) in about one day. The larvae go through several stages of development, and become mature houseflies in about a month. If the home remains warm, and the larvae find enough food to eat, there could be approximately 900 flies in your house by January (assuming that all the larvae survive until they become mature flies). If all goes well, hundreds of pairs of these flies will lay hundreds of eggs each, producing approximately 400,000 new flies by late February and, if this continues, you could have an additional 180,000,000 mature flies by the time you open your windows in late March (and maybe let some of the flies out).

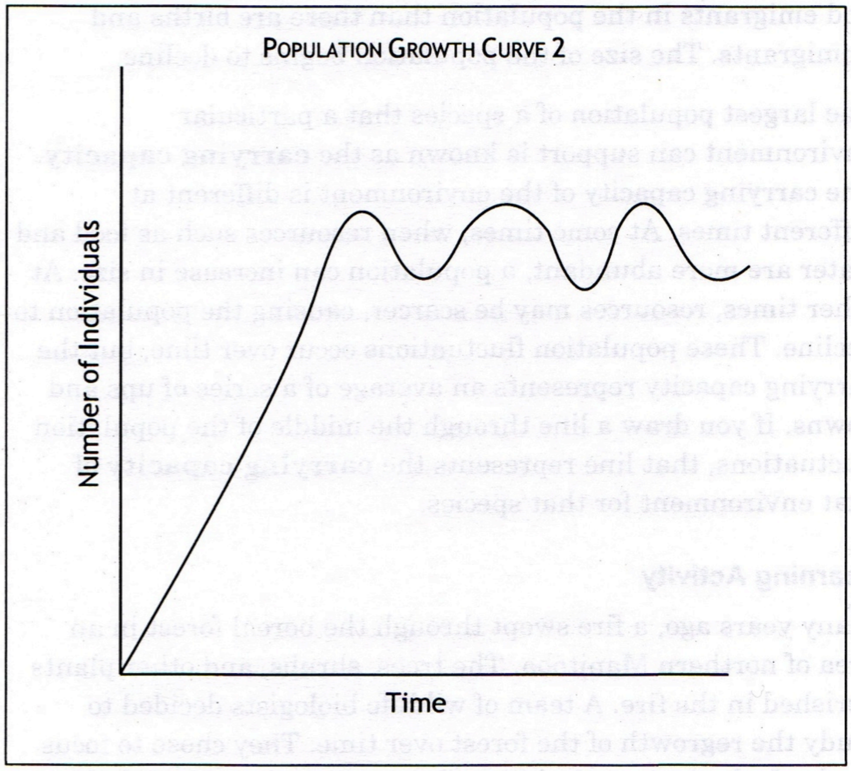
As you can see, the number of flies increases slowly at first (in this example, two flies become 900 flies in the first month), then very rapidly (900 flies became 400,000 flies in the second month and 180,000,000 by the third month). Finding a breeding pair of flies in a house in December is not uncommon. Having a few hundred million flies in your home in March is highly unlikely. Why is this so?

To answer questions such as this, ecologists study populations. A **population** is a group of organisms that belong to the same species living in a certain area. For example, all the flies that live in your house are a population, as are all the people who live in the town of Gimli, Manitoba.

When conditions are ideal for growth and reproduction, a population will experience a rapid increase in size. Initially the population grows slowly, but the larger the population gets, the faster it grows. As more offspring survive and reproduce, even more offspring are born. The graph below illustrates a **population growth curve** of this nature.



Can a population continue to grow at this rate forever? The answer, of course, is no. The environment becomes limiting. Resources such as food and water become scarcer and the rate of population increase begins to slow. The graph below illustrates a population growth curve of this nature.



Compare Population Growth Curve 1 and Population Growth Curve 2 and note the similarities between the two graphs. In both cases, the population grows slowly at first, but the larger the population gets, the faster it grows. As more offspring survive and reproduce, even more offspring are born.

Contrast Population Growth Curve 1 and Population Growth Curve 2 and note the differences between the two graphs. The population growth on the second graph begins to slow. Perhaps resources such as food and water are becoming scarcer. Perhaps some of the population migrates to a new area to obtain resources. Eventually the population growth on this graph reaches zero, and the size of the population remains fairly stable. This is because the number of deaths in the population equals the number of births.

The formula for determining population growth is as follows:

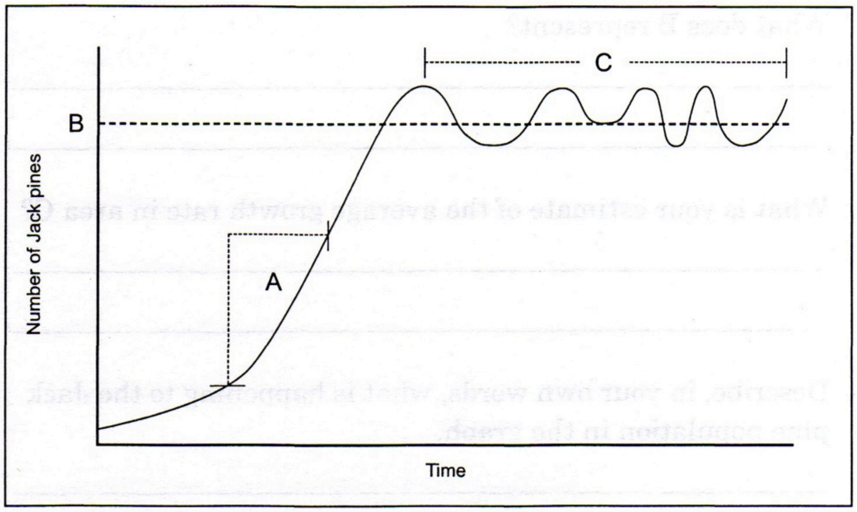
Population growth = (births + immigrants) – (deaths + emigrants)

If population growth is less than zero, there are more deaths and emigrants in the population than there are births and immigrants. The size of the population begins to decline.

The largest population of a species that a particular environment can support is known as the **carrying capacity**. The carrying capacity of the environment is different at different times. At some times, when resources such as food and water are more abundant, a population can increase in size. At other times, resources may be scarcer, causing the population to decline. These population fluctuations occur over time, but the carrying capacity represents an average of a series of ups and downs. If you draw a line through the middle of the population fluctuations, that line represents the **carrying capacity** of that environment for that species.

Learning Activity

Many years ago, a fire swept through the boreal forest in an area of northern Manitoba. The trees, shrubs, and other plants perished in the fire. A team of wildlife biologists decided to study the regrowth of the forest over time. They chose to focus on the Jack pine population as these trees are some of the first to grow back after a fire. A graph of the results of their study is shown below.



1. Why is the number of Jack pines increasing so rapidly in area A of the graph?

2. How do you account for the fluctuations in area C of the graph?

3. What does B represent?

4. What is your estimate of the average growth rate in area C?

5. Describe, in your own words, what is happening to the Jack pine population in the graph.

6. Predict how the graph would change if another forest fire swept through the region.

7. Predict how the graph would change if a forestry company began to log the area.