

Chapter 2

Populations and Sustainable Ecosystems

What You Will Learn

In this chapter, you will learn how to...

- **explain** that populations tend to increase until they reach a natural limit
- **explain** how factors affect the carrying capacity of an ecosystem
- **describe** how no two species have exactly the same function in an ecosystem
- **explain** the value of ecological processes, known as ecosystem services

Why It Matters

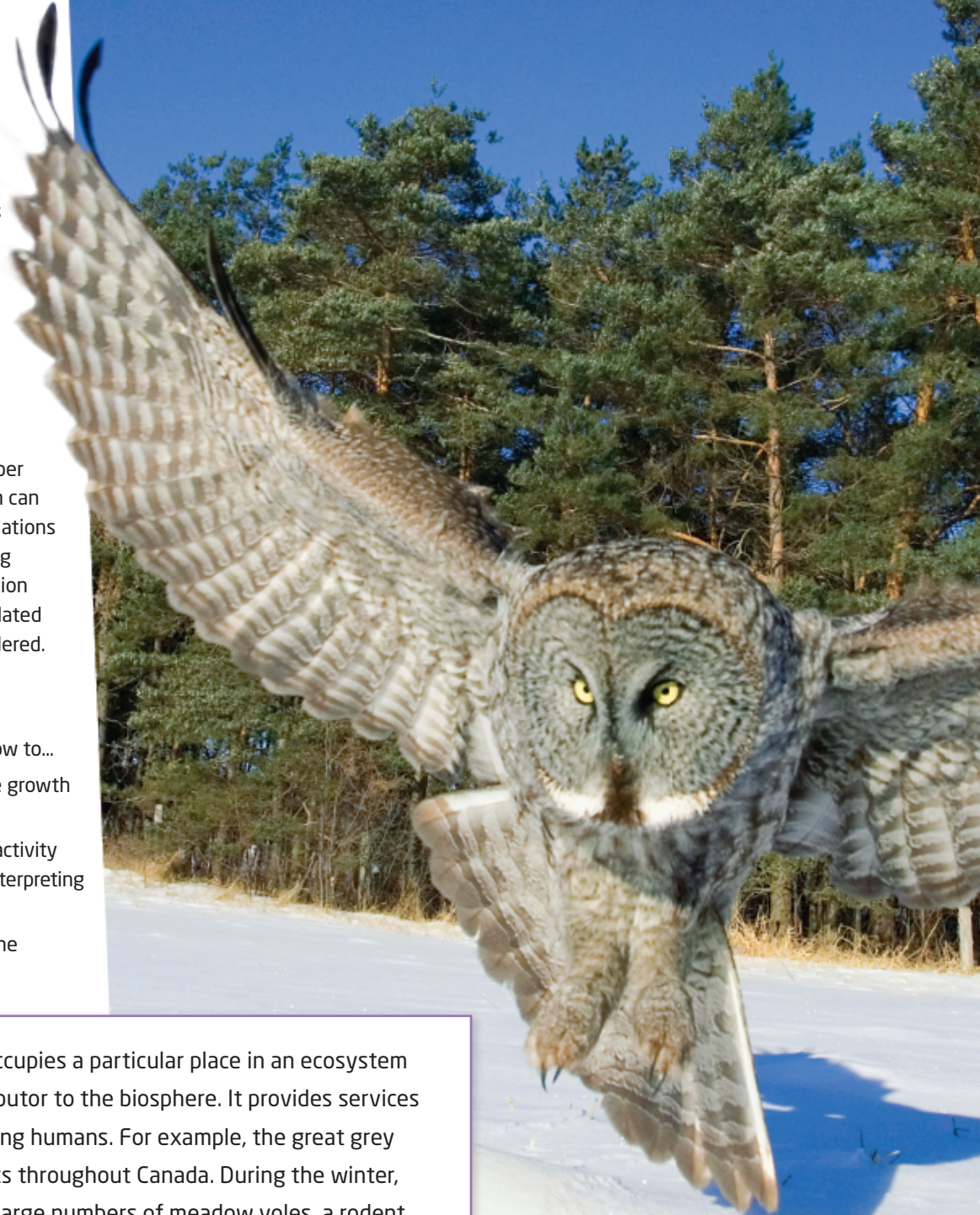
For any given species, the number of organisms that an ecosystem can support is limited. Human populations are not exempt from this limiting principle. As the human population continues to increase, issues related to sustainability must be considered.

Skills You Will Use

In this chapter, you will learn how to...

- **monitor** and **manipulate** the growth of populations of organisms
- **analyze** the effect of human activity on the population of fish by interpreting data and generating graphs
- **assess** your own impact on the ecosystems that sustain you

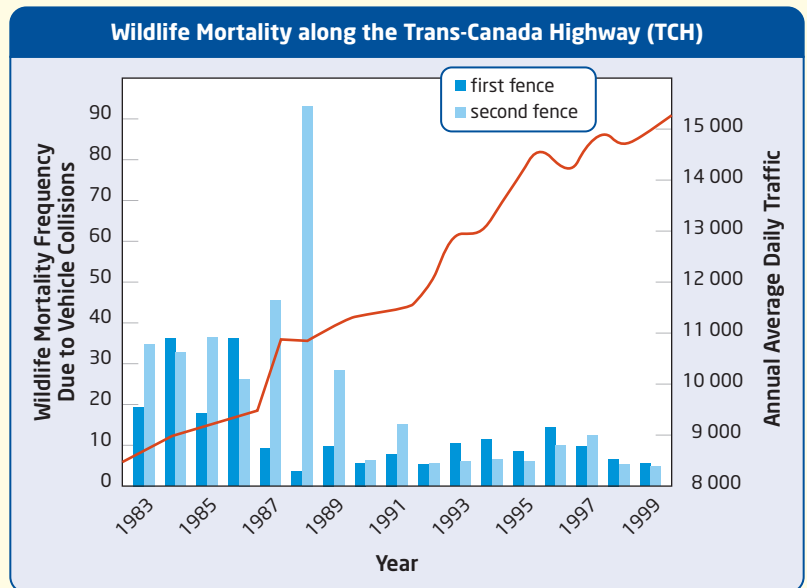
The way each species occupies a particular place in an ecosystem makes it a unique contributor to the biosphere. It provides services for other species, including humans. For example, the great grey owl lives in boreal forests throughout Canada. During the winter, the great grey owl eats large numbers of meadow voles, a rodent that can be a farm pest when its population grows too big.



Activity 2-1

Reducing Wildlife Mortality with Fences

As humans build more roads, the number of wildlife deaths due to vehicle collisions is increasing. These deaths can have a major influence on the population and status of a species. Some species that have been affected by deaths from vehicle collisions include the painted turtle, the white-tailed deer, and the black bear. The graph below shows the mortality rates of animals along sections of the Trans-Canada Highway (TCH).



Procedure

1. Study the graph above. The data were collected as part of an attempt to reduce animal deaths from vehicle collisions. Fencing was installed along sections of the TCH. Scientists collected data on the mortality rates of animals, as well as the amount of daily traffic along the fenced sections.

Questions

1. What wildlife mortality patterns does the graph show?
2. What happened to the amount of daily traffic between 1983 and 1999?
3. Did the fencing succeed in reducing wildlife mortality due to vehicle collisions? Explain your answer using data from the graph.
4. Why do you think it is important to monitor wildlife mortality due to vehicle collisions?

Study Toolkit

These strategies will help you use this textbook to develop your understanding of science concepts and skills. To find out more about these and other strategies, refer to the Study Toolkit Overview, which begins on page 561.

Preparing For Reading

Making Connections to Visuals

Textbook writers include visuals to clarify or expand on information in the text. Making connections to visuals will help you understand their purpose and meaning. When you look at a visual in a textbook, first read the caption. Then think about the answers to these questions:

1. What personal connections can I make to the photograph, based on my prior knowledge?
2. What do the accompanying text and the caption tell me about the photograph?
3. What else might be in the scene that the photograph does *not* show?
4. What questions do I have about the photograph that the text and caption do not answer?

Use the Strategy

With a partner, examine **Figure 2.1** on the opposite page. Discuss answers to the four questions above.

Word Study

Base Words

One strategy to figure out the meaning of a new word is to cut it down to its *base*. For example, follow these steps to figure out the meaning of *intensification*.

1. Cut the word down to *intensify*.
2. Cut *intensify* down to its base: *intense*. This means *strong* or *powerful*.
3. Now build the word back up from the base. Adding *-ify* changes the meaning to *become* or *make more intense*.
4. Adding *-ation* indicates a state of being or a process, so now you can figure out that *intensification* means *the process of becoming more intense*.

Use the Strategy

Follow the steps above to predict the meaning of *desertification*. Check your prediction as you read Chapter 2, or consult the Glossary at the back of this book.

Reading Graphic Text

Interpreting Line Graphs

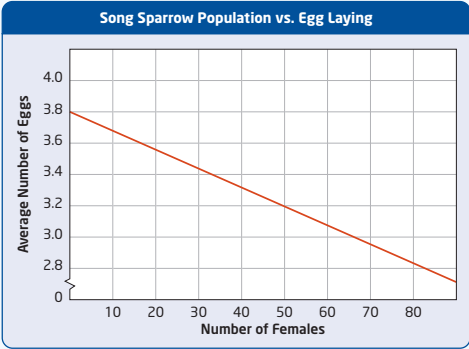
Line graphs are diagrams that show relationships between two sets of numbers. Before interpreting a line graph, first read its title, the labels on the x-axis and the y-axis, and the caption. Note metric units and how the sets of numbers are scaled.

To interpret a line graph, look for and describe patterns in the shape of the graph. For example, the graph on the right shows a steady decline in the number of eggs laid by female sparrows as the number of females increases. This pattern can be used to predict that the number of eggs laid will continue to decline as the number of female sparrows increases.

Use the Strategy

Examine the line graph in **Figure 2.5** on page 51.

1. Read the graph's title, axis labels, and caption.
2. Identify any patterns that define the relationship between the two sets of data.
3. Write a description of the pattern.
4. Use the pattern to make predictions about the future.



The graph shows a steady decline in the average number of eggs laid as the number of females increases. The x-axis is labeled 'Number of Females' and ranges from 0 to 80. The y-axis is labeled 'Average Number of Eggs' and ranges from 0 to 4.0. The data points are approximately (0, 3.8), (10, 3.6), (20, 3.4), (30, 3.2), (40, 3.0), (50, 2.8), (60, 2.6), (70, 2.4), and (80, 2.2).

Number of Females	Average Number of Eggs
0	3.8
10	3.6
20	3.4
30	3.2
40	3.0
50	2.8
60	2.6
70	2.4
80	2.2