

CHAPTER 35

Population and Community Ecology

Summary of Key Concepts

Concept 35.1 A population is a local group of organisms of one species. (pp. 766–769)

Members of the same species living in a specific area make up a population. For example, all the alligators in a swamp make up a population. The size of a population can change over time. Factors that affect a population’s size include the availability of food and space, weather conditions, and breeding patterns.

Ecologists often calculate *population density*, or the number of individuals of a particular species in a given unit of area or volume. For example, a population of 1000 birch trees in a forest measuring 50 square kilometers (km²) has a population density of 1000 birches/50 km². In most cases, it is too difficult to directly count every member of a population. Instead, scientists use sampling techniques to estimate the population’s size. These techniques include quadrats, indirect counting, and the mark-recapture method. All of these techniques involve making some assumptions about the population. These assumptions affect how accurate the estimate is.

1. How do biologists define a population? _____

2. Contrast the terms *population density* and *population*. _____

3. List three methods of sampling. _____

Concept 35.2 There are limits to population growth. (pp. 770–773)

A population’s growth depends partly on how quickly its members reproduce. For example, bacteria can reproduce as often as every 20 minutes. In contrast, elephants reproduce only every few years. With unlimited food, space, and water, a population may undergo *exponential growth*, in which the population multiplies by a constant factor at constant time intervals. This growth pattern resembles a J-shaped curve when graphed. In nature, however, one or more *limiting factors* usually slow a population’s growth. When such a factor limits a population’s growth, the population has reached its *carrying capacity*. This growth pattern resembles an S-shaped curve when graphed. Some limiting factors, such as disease, are *density-dependent factors*, meaning they limit a population more as population density increases. Other factors, such as fires or storms, are unrelated to population density and are called *density-independent factors*. Some populations grow in “boom-or-bust” cycles consisting of periods of rapid growth followed by rapid decreases.

4. Under what conditions might a population undergo exponential growth?

5. Give an example of a density-dependent limiting factor and an example of a density-independent limiting factor. _____

Concept 35.3 Biologists are trying to predict the impact of human population growth. (pp. 774–776)

For thousands of years, the human population grew very slowly. But starting in about 1650 C.E., the human population has grown so rapidly that it resembles exponential growth. The reasons for this rapid growth include improvements in nutrition, sanitation, and health care. These factors have enabled more people to live longer and have healthy offspring.

Scientists use many models to predict future growth. Some predictions are based on *age structure*, or the proportion of people in different age groups in a population. An age-structure graph shows these proportions on a bar graph. There is much debate about human population predictions and about the possible impact of continued growth on Earth's resources.

6. What are some reasons that the growth rate of the human population increased dramatically after about 1650 C.E.? _____

7. What is an age-structure graph? _____

Concept 35.4 Species interact in biological communities. (pp. 777–780)

A community is a group of species living in the same geographic area. *Interspecific competition* occurs when two or more species rely on the same limited resource, such as grass for grazing. In some situations, competition may result in one species succeeding over another, which is a process called *competitive exclusion*. Within a community, each species has a unique *niche* that includes its living place, its food sources, the time of day it is active, and other aspects of its way of life.

Species within a community interact in different ways. In *predation*, one organism (the predator) eats another organism (the prey). *Symbiotic relationships* are close interactions in which one species lives on or in the other. In *parasitism*, one organism (the parasite) obtains its food at the expense of another organism (the host). In *mutualism*, both organisms benefit from the close interaction. In *commensalism*, one organism benefits while the other is neither harmed nor helped significantly.

8. Are species that occupy different niches likely to compete? Explain. _____

9. How is a symbiotic relationship different from predation? _____

Concept 35.5 Disturbances are common in communities. (pp. 781–783)

Communities tend to be constantly changing. Some disturbances are natural, such as volcanic eruptions and storms. Other disturbances are caused by human activities, such as clearing a forest. Some disturbances have positive effects, such as providing new habitats. Others have negative effects, such as destroying food sources or nesting areas. A significant disturbance may result in a process of community change called *ecological succession*. The appearance of a new community in an area with no soil, such as on a newly formed island, is called *primary succession*. The change in a community after a disturbance that leaves the soil intact, such as in an abandoned farm field, is called *secondary succession*. One human activity that often has a negative effect on existing communities is bringing *introduced species* to a new geographic area.

10. Give two examples of disturbances to a community. _____

11. Explain the term *ecological succession*. _____

12. How might an introduced species have a negative effect on a community?

Reading Skills Practice

Summarizing information in a graph Use the information provided in the graphs in Figure 35-5 on page 770 and Figure 35-6 on page 771 to compare and contrast two growth patterns in populations.

Vocabulary Review and Reinforcement

In 1–7, write the letter of the correct definition on the line next to each term.

- | | |
|------------------------------------|---|
| _____ 1. population density | a. a sampling technique in which organisms are captured, marked, and released for later counting |
| _____ 2. mark-recapture method | b. the proportion of people in different age groups within a population |
| _____ 3. quadrat | c. the number of individuals of a particular species in a given unit of area or volume |
| _____ 4. indirect counting | d. counting nests, burrows, or tracks rather than organisms |
| _____ 5. limiting factor | e. what occurs when two or more species rely on the same limited resource |
| _____ 6. age structure | f. a condition of the environment that slows or stops a population's growth |
| _____ 7. interspecific competition | g. a boundary in which ecologists count a sample of a population |

In 8–16, fill in the blanks with the appropriate terms from the chapter.

8. Fire and drought are examples of density-_____ factors.
9. The largest population an environment can support is called its _____.
10. Grasses and shrubs growing in an untended field are an example of _____ succession.
11. Availability of food and space are examples of density-_____ factors.
12. When one species succeeds over another that requires the same limited resource, the outcome is called _____.
13. A population that multiplies by a constant factor at constant time intervals is undergoing _____ growth.
14. Alternating periods of rapid growth and rapid decrease are referred to as a(n) _____ cycle.
15. A community arising on bare rock left behind by a glacier is an example of _____ succession.
16. An organism carried by humans into a new geographic area is called a(n) _____.

WordWise

Find and circle nine Key Terms from the chapter in the puzzle below. Words may appear horizontally, vertically, or diagonally. Then, write a definition for each Key Term on a separate sheet of paper.

c o m p e t i t i o n
o e f a n p h o s t s
m a p r x n a t y p i
m y c a v i i b m p p
e o e s h c t o b r r
n s m i e h f g i a e
s t i t w e a t o t d
a y h i p m t c s y a
l l s s d r y f i t t
i e n m r e e r s e o
s m t e x y p y o r r
m u t u a l i s m o n