Chapter 1 Review Questions

Knowledge

1. *Competition*, *transpiration*, *habitat*, *mutualism*, *population*, *trophic level*, and *producer* were terms introduced in this chapter. Determine what term best matches each of the following definitions.

a. a group of organisms all of the same species
b. a division of organisms with a similar nutrition source
c. a symbiotic relationship in which both organisms benefit
d. a loss of water vapour from a plant through its leaves
e. an organism that uses solar energy to make food
f. an area in which an organism lives out its life
g. a struggle between organisms for limited resources

2. For each pair of terms, explain the differences in their meanings.

a. biodiversity, biomass
b. abiotic, biotic
c. food chain, food web
d. producer, consumer
e. habitat destruction, habitat fragmentation

3. Identify three abiotic factors and three biotic factors that describe a forest ecosystem.

4. Why is a food web more realistic than a food chain?

5. Explain the importance of sunlight to an ecosystem.

6. What is a biogeochemical cycle?

7. Identify reasons why the transfer of energy and matter in a food chain is only about 10% efficient.

Applying Concepts

8. The "Interactions Between Species" table summarizes the interactions and relationships between organisms. Complete this table by adding the required information to the missing boxes. Note that the following system is used to describe the effects on a species:

- + means the species benefits from the interaction
- – means the species is harmed by the interaction
- 0 means the species is neither harmed nor helped by the interaction

INTERACTIONS BETWEEN SPECIES

Type of Interaction	Effect on Species #1	Effect on Species #2	Description	Example
	+	+		butterflies and purple coneflowers
	+	0		cowbirds and bison
				tapeworms and bison
predation				
			• interaction where two or more organisms compete for limited resources	

Use the following information to answer questions 9 to 14.

Lemmings

A lemming is a small rodent. It is about 150 mm long with a mass of approximately 80 g. It resembles a hamster. Lemmings live in the high Arctic where permafrost prevents them from digging burrows, so they use natural ridges and depressions in the ground for burrows and travel routes. It is amazing that these tiny animals remain active throughout the Arctic winter, foraging for food in spaces between the ground and the snow cover. As lemmings eat grasses and sedges, they generate wastes that are consumed by bacteria, fungi, and insect larvae, which then return key nutrients to the soil. Lemmings play a significant role in the Arctic ecosystem because they are the main food source for Arctic foxes and snowy owls. Other than human trappers, no animals prey on Arctic foxes.

Other members of this ecological community include musk-oxen and caribou, which both feed on lichens and other small plants. Mosquitoes, black flies, and a number of migratory birds also belong to the group. Musk-oxen and caribou encounter natural predators outside the tundra ecosystem when they migrate south in search of food.

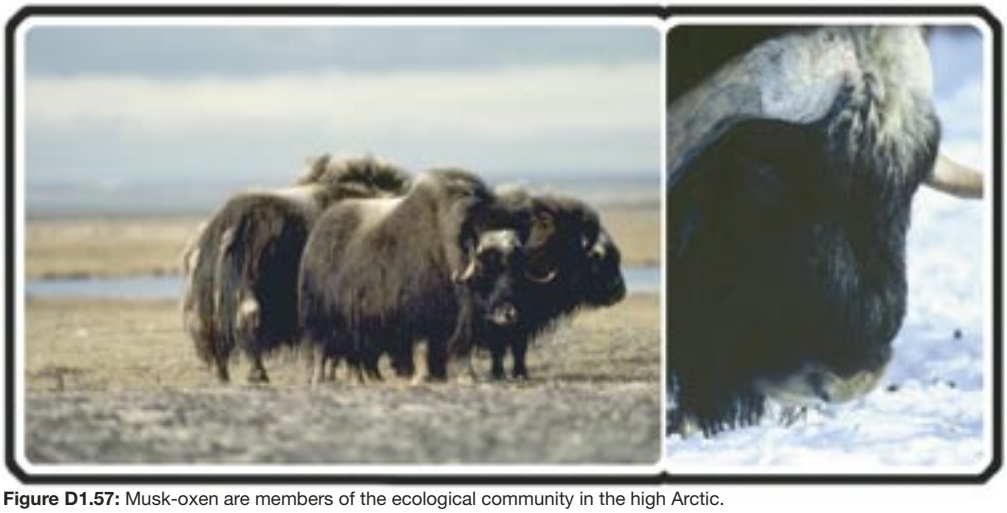


Figure D1.57: Musk-oxen are members of the ecological community in the high Arctic.

9. Sketch a simplified energy pyramid for this ecosystem.

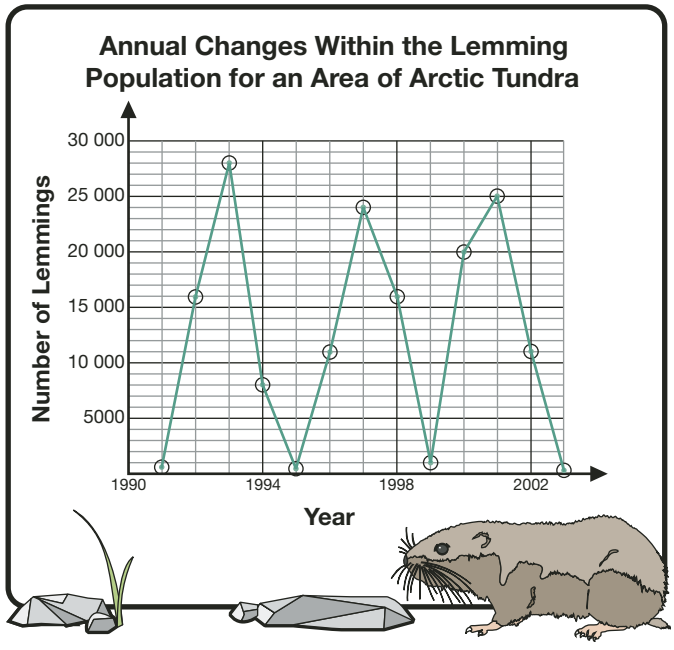
10. Sketch a food chain for this ecosystem that includes the Arctic fox.

11. Suggest a reason why there are no tertiary consumers in this ecosystem.

12. This graph shows how the population of lemmings changes in an area of the high Arctic.

a. A graph of the annual changes within the population of Arctic foxes is related to the graph in this question. Determine the years in which you would expect the population of Arctic foxes to peak. Support your answer.

b. No one really knows the reason for the four-year cycle within the lemming population. One theory has to do with the effect that the lemming population has on the available vegetation. Describe a possible mechanism for this theory.



13. Identify organisms that would be examples of mutualism, competition, and parasitism.

14. The low temperatures of Arctic soils mean that the rate of decomposition is very slow. This, combined with the high water content of ground in the summer, means that much of the tundra is covered in peat bogs or muskeg.

a. Concisely explain whether the tundra is considered to be a sink or a source for carbon.

b. If global warming occurs, explain how your answer to question 14.a. will change.

Use the following information to answer question 15.

Three people gather for lunch. Here's what each person eats.

- The first person eats a piece of chicken. The chicken was fed only plant material.
- The second person eats a vegetable salad. The salad contains no animal products.
- The third person eats tuna from a tin. The tuna was a high-level predator in its ocean environment.

For the purposes of this question, assume that this one meal allows you to categorize the ecological role and trophic level for each person.

15. **a.** Describe each person's ecological role.

b. Determine the trophic level for each person.

c. In reality, you can't accurately classify a person's ecological role based on just one meal. Explain why most people would be classified as omnivores. Refer to the food in a typical lunch to support your answer.

d. Concisely explain why it is not possible for someone at the lunch to have the ecological role of a producer.

16. Use an energy pyramid to explain why it would be very rare for an ecosystem to have a sixth or seventh trophic level.

Use the following information to answer questions 17 to 21.

Biogeochemical cycles typically involve four general steps:

step 1: assembling complex organic compounds from non-living or abiotic parts of environment through process of photosynthesis

↓

step 2: transferring essential elements and compounds to other organisms through trophic or feeding levels

↓

step 3: breaking down complex organic molecules into simpler organic and inorganic forms through process of decomposition

↓

step 4: supplying photosynthetic organisms with raw materials for photosynthesis so process can continue

17. Identify which type of organism assembles complex organic compounds from elements and simple compounds. Support your answer by providing two examples and by describing the process by which this happens.

18. Identify which type of organism feeds on other living organisms as its source of essential elements and compounds. Support your answer by providing three examples.

19. Identify examples of micro-organisms that feed on dead and decaying organic matter as their source of essential elements and compounds. Support your answer by providing two examples.

20. Consider your answer to question 19. Micro-organisms that feed on dead and decaying organic matter return simple compounds to the soil, air, and water. Which group of organisms uses these simple compounds? Support your answer by providing two examples.

21. Describe the carbon cycle in terms of this four-step process.

22. You learned earlier in Chapter 1 that cowbirds lay their eggs in the nests of other birds. These other birds then unknowingly raise cowbird chicks at the expense of their own young, who usually starve or are kicked out of the nest by the larger and more aggressive cowbird chicks. Originally, cowbirds were found on the prairie landscape because they followed bison herds. Cowbirds prefer open spaces to dense forest.

a. Describe how the fragmentation of the boreal forest habitat could allow the population of cowbirds to expand their range farther north.

b. The fragmentation of the boreal forest habitat has reduced the number of songbirds that prefer the habitat of the forest interior to that of the forest's edge. This is because fragmentation creates more edge habitat. Concisely explain why there are also drops in the populations of songbirds that prefer edge habitat in forests where agricultural expansion has fragmented habitats.

23. Late one summer, ecologists discovered that fish were dying in a stream running through some farmland where nitrogen fertilizer was used to improve crop growth. Suggest an explanation for these events.

24. Compare and contrast the relationships of predation and parasitism.

25. Use your knowledge of the energy pyramid to describe the advantages to global ecosystems if more people switched to vegetarian diets.

Use the following information to answer questions 26 to 28.

Locate the video clip called "Career Profile: Rehabilitating Injured Wildlife" on the Science 20 Textbook CD. Play the video. Use the information provided to answer the following questions.

26. Define the word *raptor*. Support your answer with examples.

27. Describe the biomagnification of DDT through the food chain, and outline the resulting negative impact on the population of peregrine falcons.

28. Describe the potential impact on an ecosystem if the population of raptors within that ecosystem begins to decline.

Ecological Footprint Calculator

In order to live, people consume natural resources for food, transportation, and housing. How much biologically productive land and water is required to provide you with the resources you consume and to absorb the wastes that you generate? The answer to this question is called your ecological footprint.

The ecological footprint is measured in global hectares or hectares of biologically productive space with world average productivity. In 2001 it was estimated that there were 2.3 billion global hectares of biologically productive water surface, made up of ocean shelves and fresh water. At the same time, there were 9.0 billion global hectares of biologically productive land, made up of crop land, grazing land, forest land, and built-up land. Note that the total of 11.3 billion global hectares of biologically productive area on Earth does not include deserts, ice caps, and deep oceans.

The average number of global hectares available for each person is determined by dividing the total number of biologically productive global hectares on the planet by the total number of people. Using data from 2001, the world population was 6.15 billion people, so the average is about 1.8 global hectares per person. Even though this is an estimate—based on many approximations—it is a very useful indicator both for charting trends over time and for comparing the demands put on Earth by people living in different countries.

How does your footprint compare to this value? Are you taking more than you should? You can determine answers to these questions by using the Internet to find an ecological footprint calculator. The ecological footprint calculator is simply an online questionnaire that uses your responses to produce a rough estimate of your ecological footprint.

If you use the key words *ecological footprint calculator* and *Canada*, you should be able to use the Internet to find an ecological footprint calculator.

29. Determine your ecological footprint in global hectares.

30. How many times larger is your ecological footprint than the global value of 1.8 global hectares? If everyone lived like you, how many planet Earths would it take to support the world's population?

31. Return to the ecological footprint calculator. Experiment to see what lifestyle changes you can make to lower your ecological footprint.

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Legend: t = top, m = middle, b = bottom, l = left, r = right

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