

Interactions in Ecosystems

Key Ideas

Living things are connected to each other in complex interrelationships.

- Living things interact on several levels of organization: organism, population, community, ecosystem, and biosphere.
- A community of organisms and the non-living environment make up an ecosystem.
- Organisms can be producers, consumers, herbivores, carnivores, or decomposers in ecosystems.
- Predators and prey control each other's population size as they go through cycles in their relationship.
- Symbiosis describes complex relationships occurring between two species. The types of symbiotic relationships are mutualism, commensalism, and parasitism.



Biotic and abiotic factors are responsible for shaping a community of living things.

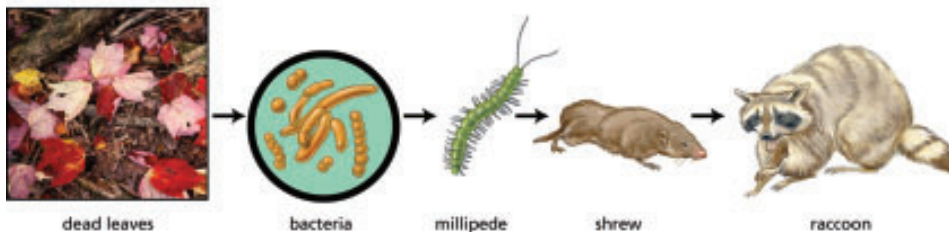
- Relationships between organisms and their environment include both living (biotic) and non-living (abiotic) components.
- Abiotic factors determine the types of organisms that can exist in a community and the characteristics of the environment.
- Biotic factors change continually in response to each other.

Vocabulary

ecology, p. 21
 organism, p. 21
 habitat, p. 21
 population, p. 21
 community, p. 22
 ecosystem, p. 22
 biosphere, p. 22
 biotic factors, p. 22
 abiotic factors, p. 22
 dynamic equilibrium, p. 23
 limiting factor, p. 23
 nutrients, p. 25
 producer, p. 25
 autotroph, p. 25
 phytoplankton, p. 25
 consumer, p. 26
 heterotroph, p. 26
 herbivore, p. 26
 primary consumer, p. 26
 zooplankton, p. 26
 carnivore, p. 26
 omnivore, p. 26
 detritivore, p. 27
 decomposer, p. 27
 biodegradation, p. 27
 predation, p. 28
 predator, p. 28
 prey, p. 28
 predator–prey cycle, p. 28
 symbiosis, p. 30

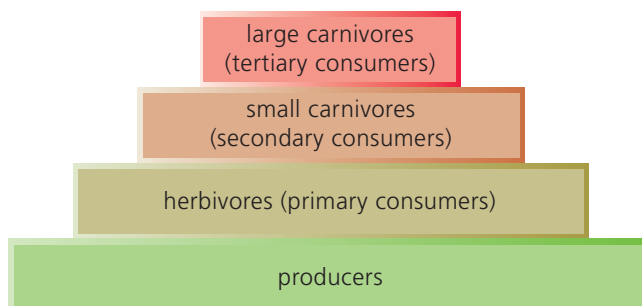
Nutrients cycle within ecosystems.

- Food chains and food webs show how nutrients cycle through ecosystems.
- Each type of organism is found at a trophic level in a food chain or web.
- Decomposers play an important role in recycling nutrients.



Energy flows through ecosystems.

- The primary source of energy for living things is the Sun.
- Producers are able to convert solar energy into a form that living things can use.
- Energy passes from producers to herbivores to carnivores.
- Most terrestrial ecosystems have only three or four trophic levels because energy transfer is inefficient.
- Only about 10 % of the energy at one trophic level is transferred to the next trophic level.



mutualism, p. 30
commensalism, p. 30
parasitism, p. 30
host, p. 30
parasite, p. 30
trophic level, p. 33
food chain, p. 34
food web, p. 36
ecological pyramid, p. 39
food pyramid, p. 39
pyramid of energy, p. 39
pyramid of numbers, p. 40
pyramid of biomass, p. 40

Many of these questions are in the style of the Science 10 Provincial Exam. The following icons indicate an exam-style question and its cognitive level.

K Knowledge **U** Understanding and Application **HMP** Higher Mental Processes

Review Key Ideas and Vocabulary

- Match the term on the left with the correct definition on the right.

Term	Definition
(a) biosphere	I. A community as well as the physical environment
(b) community	II. All of the ecosystems on Earth
(c) ecology	III. All of the individual populations in a particular area
(d) ecosystem	IV. All of the organisms of one type that inhabit a particular area
(e) habitat	V. An individual life form of one specific type
(f) organism	VI. The place where an organism or population lives
(g) population	VII. The study of the interactions between organisms and between their environment

- Explain the term “interconnectedness” as it applies to ecology.
- Identify each of the following as a population, community, or ecosystem:
 - a pod of killer whales
 - a pack of wolves in a forest
 - all of the living and non-living things in a pond
 - all of the organisms living in a decomposing log
- List five abiotic factors that affect life in terrestrial ecosystems.
- Describe five ecosystems of differing size.
- What is the relationship between the first trophic level and a primary consumer?
- K** Which of the following terms does *not* represent a level within the biosphere that is studied by ecologists?
 - cell
 - ecosystem
 - population
 - community

- K** Which of the following processes could produce the energy necessary to support a community of organisms in a deep cave in the total absence of sunlight?
 - photosynthesis
 - biodegradation
 - decomposition
 - chemosynthesis

Use What You’ve Learned

- A student conducts an experiment to measure the effects of pH on the growth of bread mould (*Rhizopus nigricans*). The student moistened slices of bread with solutions of three different pH levels. The bread slices were incubated at a constant temperature and observed for a period of three days as recorded in Table 1.

Table 1

Day	Number of mould colonies		
	pH = 4.0	pH = 6.0	pH = 8.0
Start	0	0	0
1	0	7	1
2	1	15	3
3	2	27	3

- Graph the results of the experiment using three line graphs on the same set of axes.
- To which pH is the bread mould best adapted?
- What was the purpose of keeping the temperature constant throughout the experiment?
- List three other factors that must be kept constant in order to ensure that the experimental results are valid.
- List three other abiotic factors that might affect the growth of bread mould.
- What would be an appropriate control for this experiment?

- U** 10. Which of the following lists includes only abiotic factors?
- pH, height of trees, water temperature
 - temperature, annual precipitation, rock type
 - solar radiation, nutrient availability, number of decomposers
 - salt concentration, stream flow rate, migration pattern of reindeer
- U** 11. Which of the following characteristics distinguishes decomposers from other consumers?
- the ability to produce food
 - their position within a grazing food chain
 - the tendency to gain nutrition from dead organisms
 - the ability to chemically break down organic compounds
12. Name and define four different categories of consumers. Give two examples of each.

Think Critically

- U** 13. A scientist is interested in creating a conservation strategy at the ecosystem level. Which of the following would she have to consider for her strategy to be at the correct level?
- all regions of Earth where life exists
 - all members of a single species in an area
 - all living and non-living things in an area
 - all members of all of the species in an area
14. What type of food do organisms in the second trophic level eat? What type of food do organisms in the third trophic level eat?
15. Explain how changes in abiotic factors can influence the types of communities that develop in an area.
16. List three different abiotic factors and describe a way in which each of them has had a direct impact on your day so far.
17. Use the food chain shown in Figure 1 to answer the questions.

tree → beetle → spider → mouse → hawk

Figure 1

- What level of the biosphere is represented by the food chain?
 - Which of the organisms in the food chain is an autotroph?
 - Which of the organisms would belong to a population with the least biomass?
 - Which level contains the least energy?
- HMP** 18. Use your knowledge of ecological pyramids to construct an energy pyramid, biomass pyramid, and numbers pyramid for the food chain shown in Figure 1.
- HMP** 19. A wolf that eats an elk cannot digest the antlers, hooves, teeth, hair, and bones. What do these materials represent?
- matter available to omnivores
 - energy available to herbivores
 - energy not available to carnivores
 - matter not available to decomposers
20. What effect would spraying insecticides to kill beetles have on the size of a hawk population in the food chain shown in Figure 1? Explain your reasoning.

Reflect on Your Learning

21. Scientists study many different ecosystems. Some are small and some are large. Explain how a puddle and a mountain range are both valid ecosystems. What are the similarities and what are the differences between these ecosystems?

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www.science.nelson.com

