Section 1.2 Ecosystems

Comprehension

Parts of an ecosystem

Page 10

1. An ecosystem has abiotic components that interact with biotic components, while a habitat is the place in which an organism lives.
2. Three main abiotic components of ecosystems are (any three of) oxygen, water, nutrients, light, and soil.
3. A population refers to all the members of a particular species within an ecosystem, while a community is all the populations of different species within an ecosystem.
4. Symbiosis is the interaction between members of two different species that live together in a close association.
5. Commensalism is a symbiotic relationship in which one species benefits and the other species is not helped or harmed.
6. Mutualism is a symbiotic relationship in which both organisms benefit, while parasitism is a symbiotic relationship in which one species benefits and the other is harmed.
7. Predation is where one organism eats all or part of another organism.

Interpreting illustrations

Biotic interactions in ecosystems

Page 11

1. I. organism
   II. ecosystem
   III. population
   IV. community
   V. biosphere
2. Largest — Biosphere
   Ecosystem
   Community
   Population
   Smallest — Organism
3. Lists will vary but should include a variety of plants and animals.

Applying Knowledge

Symbiotic relationships

Page 12

1. Term: Mutualism

   Explanation: Both organisms benefit. The ant gets its food and shelter while the plant is protected from insects.
2. Term: Competition

   Explanation: Harmful interaction between two or more organisms as they compete for the same resource. The knapweed prevents other species from populating the soil by releasing a chemical.
3. Term: Predation

   Explanation: One organism (predator) eats all or part of another organism (the prey). The lynx is the predator and the snowshoe hare is the prey.
4. Term: Commensalism

   Explanation: One species benefits and the other species is not helped or harmed.

   The Spanish moss captures nutrients and moisture from the air with no harmful effects on the trees.
5. Term: Parasitism

   Explanation: One species benefits and another is harmed. The pine beetle has its food source and the pine tree is destroyed.

Assessment

Ecosystems

Page 13

1. D **2.** E **3.** B **4.** F **5.** A **6.** C **7.** G **8.** B **9.** D **10.** C

Chapter 2 Energy flow and nutrient cycles support life in ecosystems.

Section 2.1 Energy Flow in Ecosystems

Cloze activity

Energy flow

Page 16

1. biomass
2. energy flow
3. photosynthesis
4. consumer
5. decomposition
6. biodegradation
7. decomposers
8. food chains; trophic
9. primary producers
10. primary consumers; secondary consumers
11. tertiary consumers
12. food webs; food pyramids

Interpreting Illustrations

Food chains, food webs, and food pyramids

Page 17

1. bunchgrass, algae

2. third trophic level
3. secondary consumers
4. primary consumer
5. secondary or tertiary consumer
6. earthworms, beetles, small insects, bacteria, fungi
7. a model that shows the loss of energy from one trophic level to another
8. producers, such as plants
9. carnivores, such as great horned owls

Illustrating Concepts

Modelling a local ecosystem
Page 19

1. Student should include 12 organisms and cover all four trophic levels.
2. Food chain: student should include four trophic levels: primary producers, primary consumers, secondary consumers, and tertiary consumers.
3. Food web: student should include interconnecting arrows between various organisms to demonstrate the feeding relationships.
4. Food pyramid: student should show a series of boxes decreasing in size from bottom to top. The pyramid should include producers, herbivores, carnivores, and top carnivores.

Assessment

Energy flow in ecosystems
Page 20

1. C **2.** F **3.** H **4.** A **5.** E **6.** G **7.** B **8.** D **9.** D **10.** A **11.** B **12.** C **13.** D **14.** D

Section 2.2 Nutrient Cycles in Ecosystems

Comprehension

Nutrient cycles
Page 24

1. Nutrients are stored in Earth's atmosphere, oceans, and land masses.
2. Biotic processes, such as decomposition, and abiotic processes, such as river run-off, can cause nutrients to flow in and out of stores.
3. Photosynthesis converts solar energy into chemical energy. Carbon, in the form of carbon dioxide, enters through the leaves of plants and, in the presence of sunlight, reacts with water to produce carbohydrates and oxygen.
4. Cellular respiration involves carbohydrates reacting with oxygen to form carbon dioxide, water, and energy.
5. Decomposers, such as bacteria and fungi, convert organic molecules, such as cellulose, back into carbon dioxide, which is then released into the atmosphere.
6. Nitrogen fixation is the process in which nitrogen gas is converted into compounds that contain nitrate or ammonium.
7. Denitrification is a process by which denitrifying bacteria, using a series of chemical reactions, convert nitrate back into nitrogen gas.
8. Eutrophication is the process by which excess nutrients result in increased plant production and decay in aquatic ecosystems.

Interpreting Illustrations

The cycling of nutrients in the biosphere
Page 25

1. Human activities that can affect a nutrient cycle could include land clearing, agriculture, urban expansion, mining, industry, and motorized transportation.
2. These human activities increase the amounts of nutrients in a cycle faster than natural biotic and abiotic processes can move them back into stores.
3. Terms and arrows could be similar to Fig 2.17 on page 70. Students may also add other facts or effects that they have thought of.
4. Changes in the carbon, nitrogen, and phosphorus cycles can affect the health and variety of organisms that live in an ecosystem.
5. Answers will vary but they should include a human activity, a description of the activity, and its impact on a specific part of the local ecosystem.

Applying Knowledge

The carbon, nitrogen, and phosphorus cycles
Page 26

The carbon cycle

Why is the carbon cycle important?	cellular respiration provides energy for living things
How is carbon stored?	short term: vegetation, land and marine animals, decaying organic material, carbon dioxide in its dissolved form long term: dissolved carbon dioxide in deeper ocean waters; coal, oil, and gas deposits; marine sediments and sedimentary rock
How is carbon cycled?	photosynthesis, respiration, decomposition, ocean processes, volcanic eruptions, forest fires

Name several human activities that affect the carbon cycle.	industry, motorized transport, land clearing, agriculture, urban expansion

The nitrogen cycle

Why is the nitrogen cycle important?	component of DNA, proteins, muscle function in animals; growth of plants
How is nitrogen stored?	nitrogen gas in atmosphere, oceans, organic matter in soil
How is nitrogen cycled?	nitrogen fixation, nitrification, uptake, denitrification
Name several human activities that affect the nitrogen cycle.	fossil fuel combustion, power plants, sewage treatment, motorized forms of transport, clearing forests, grassland burning, chemical fertilizers leading to eutrophication

The phosphorus cycle

Why is the phosphorus cycle important?	carries energy to plant cells and animal cells; root development in plants; bone development
How is phosphorus stored?	phosphate rock; ocean floor sediments as PO_4^{-3}, HPO_4^{-2}, $H_2PO_4^-$
How is phosphorus cycled?	chemical weathering, physical weathering
Name several human activities that affect the phosphorus cycle.	commercial fertilization and detergents negatively affect species, causing fish death

Assessment

Nutrient cycles in ecosystems

Page 29

1. F **2.** A **3.** E **4.** B **5.** D **6.** G **7.** C **8.** B **9.** A **10.** D **11.** C **12.** B

Section 2.3 Effects of Bioaccumulation on Ecosystems

Cloze activity

Bioaccumulation

Page 33

1. bioaccumulation
2. keystone species
3. biomagnification
4. producers
5. PCBs
6. half-life
7. persistent organic pollutants
8. parts per million
9. heavy metals
10. lead; cadmium; mercury
11. bioremediation

Applying Knowledge

Impact of bioaccumulation on consumers

Page 34

CHEMICAL	EFFECTS ON PRODUCERS, PRIMARY CONSUMERS, AND SECONDARY CONSUMERS	EFFECTS ON HUMANS
toxic organic chemicals from red tide	Produces toxic chemicals that affect clams, mussels, and oysters. Toxins bioaccumulate in fish and mammals.	Can cause paralytic shellfish poisoning, leading to serious illness or death.
DDT	Bioaccumulates in plants and then in fatty tissue of fish, birds, and animals that eat the plants. Affects aquatic food chains.	Changed into a chemical form that is stored in fat tissue. Can cause nervous system, immune system, and reproductive disorders.
lead	In fish and birds it can cause nervous system damage, affect fertility rates, kidney failure, and impair mental development.	Harmful effects range from anemia, nervous system damage, sterility in men, low fertility rates in women, impaired mental development, and kidney failure.
cadmium	Plants take up cadmium from the soil and pass it on to the animals that eat them. Highly toxic to earthworms and other soil organisms. In fish, cadmium contributes to higher death rates, and lower reproduction and growth rates.	Accumulates in lung tissues, causing lung diseases, such as cancer. Leads to infertility and damage to central nervous system, immune system, and DNA.
mercury	Bacteria change mercury into methylmercury, a toxin that accumulates in the brain, heart, and kidneys of vertebrates. Levels of methylmercury in fish depend on how high they are on the food chain.	Methylmercury is absorbed in digestion and enters the blood and then the brain. It affects nerve cells, heart, kidney, lungs, and it suppresses the immune system.

Comprehension

PCBs and the orca

Page 36

1. PCBs are synthetic chemicals. Their full chemical name is polychlorinated biphenyl.
2. PCBs were used for industrial products, such as heat exchange fluids, paints, plastics, and lubricants for electrical transformers.
3. PCBs stay in the environment for a long time. Aquatic ecosystems and species that feed on aquatic organisms are especially sensitive to the effects of PCBs. PCBs bioaccumulate and biomagnify and also have a long half-life.
4. PCBs become concentrated in the orca's blubber.
5. When salmon stocks are low, the orca's blubber is burned for energy. The PCBs are released into the orca's bloodstream and interfere with its immune system making it more susceptible to disease.
6. Diagram should be similar to Fig. 2.55 on page 95 of the student textbook. The pyramid should include the food chain for orcas and demonstrate the total PCB load that the orca is exposed to.

Assessment

Effects of bioaccumulation on ecosystems

Page 37

1. F **2.** D **3.** E **4.** B **5.** C **6.** A **7.** C **8.** D **9.** B **10.** C **11.** A **12.** D

Chapter 3 Ecosystems continually change over time.

Section 3.1 How Changes Occur Naturally in Ecosystems

Cloze Activity

Change in ecosystems

Page 40

1. natural selection
2. adaptive radiation
3. ecological succession
4. primary succession
5. pioneer species
6. climax community
7. secondary succession
8. flooding
9. tsunami
10. drought
11. insect infestations

Analyzing Information

Primary and secondary succession

Page 41

1. Answer should include the following sequence:
   - Lichens begin to grow. This begins the process of soil formation.
   - Plants, such as mosses, begin to grow.
   - Insects, micro-organisms, and other organisms move in.
   - Grasses, wildflowers, and shrubs begin to grow. More insects and micro-organisms move in.
   - Tree seeds are transported by animals. Deciduous trees grow.
   - Coniferous trees germinate.
   - Mature community develops.
2. Answer should include the following sequence:
   - Exposed soil will contain micro-organisms, worms, and insects as well as the seeds of wildflowers, weeds, grasses, and trees.
   - Other seeds may blow in or be carried in by animals.
   - Deciduous trees grow.
   - Coniferous trees return.
   - Mature community may only take decades to establish.

Applying Knowledge

How natural events affect ecosystems

Page 42

NATURAL EVENT	EFFECTS ON MATURE COMMUNITY
Fire	• causes secondary succession • results in regrowth
Flooding	• causes soil erosion • results in soil and water pollution, leading to widespread disease
Tsunami	• water carries away or destroys plants and animals • disrupts habitats and foods webs • salt from salt water changes composition of soil
Drought	• destroys habitats • results in the death of plants and animals • leads to crop failures and livestock deaths
Insect Infestation	• results in losses to forest canopy • disrupts habitats and food webs

Assessment

How changes occur naturally in ecosystems

Page 43

1. B **2.** A **3.** D **4.** E **5.** C **6.** C **7.** D **8.** C **9.** B