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**Lesson 1: Intro to Ecology**

1. How are living things connected?
	1. Organisms need energy and matter to live.
	2. Interactions between organisms cause an exchange of energy and matter, creating a web of life.
	3. **Ecology** is the study of how organisms interact with one another and with the environment
	4. Each individual organism has a role to play in the flow of energy and matter.
	5. In this way, organisms are connected to all other organisms, and their relationships affect each one’s growth and survival.
	6. A **biotic factor** is an interaction between organisms in an area.
	7. All organisms rely on the nonliving environment for survival.
	8. An **abiotic factor** is a nonliving part of an environment, such as water, nutrients, soil, sunlight, rainfall, or temperature.
	9. Abiotic factors influence where organisms can survive.
2. What are the levels of organization in the environment?
	1. The environment can be organized into different levels, ranging from a single organism to all of the organisms and their surroundings in an area.
	2. The levels of organization get more complex as more of the environment is considered.
	3. A **population** is a group of individuals of the same species that live in the same place at the same time.
	4. A **species** includes organisms that are closely related and can mate to produce fertile offspring.
	5. Individuals within a population often compete with each other for resources.
	6. A **community** is made up of all the populations of different species that live and interact in an area.
	7. The species in a community depend on each other for many things, such as shelter and food.
	8. Organisms in a community also compete with each other for resources, just as members of a population do.
	9. An **ecosystem** is a community of organisms and their nonliving environment.
	10. In an ecosystem, organisms and the environment exchange energy and other resources.
	11. All abiotic and biotic factors make up an ecosystem.
3. What is a biome?
	1. Large regions characterized by climate and communities of species are grouped together as **biomes**.
	2. A biome can contain many ecosystems.
	3. Major land biomes include tropical rain forest, tropical grassland, temperate grassland, desert, temperate deciduous forest, temperate rain forest, taiga, and tundra.
4. What characteristics define a biome?
	1. Temperature is an important climate factor that characterizes biomes. For example, taiga and tundra have cold temperatures all year.
	2. Biomes also differ in the amount of precipitation they receive. For example, tropical biomes have a lot of rainfall, but deserts have little precipitation.
	3. Biomes contain communities of living things that have adapted to the climate of the region.
	4. Thus, ecosystems within the same biome tend to have similar species across the globe.
	5. Only certain types of plants and animals can live in extreme climate conditions, such as in the tundra or the desert.
5. What determines where a population can live?
	1. A population’s **niche** is the role the population plays in the ecosystem, such as how it gets food and interacts with other populations.
	2. A **habitat** is the place where an organism usually lives and is part of an organism’s niche.
	3. The habitat must provide all of the resources that an organism needs to grow and survive.
	4. Abiotic and biotic factors influence whether a species can live in a certain place.
	5. In general, two populations cannot occupy exactly the same niche.
	6. Small differences in habitats, roles, and adaptations can allow similar species to live together in the same ecosystem.

**Lesson 2: Roles in Energy Transfer**

1. How do organisms get energy?
	1. All living things need a source of chemical energy to survive.
	2. Chemical energy is stored in the bonds of molecules and holds molecules together.
	3. The energy from food is the chemical energy in the bonds of food molecules.
	4. A **producer**, also called an autotroph, uses energy to make food.
	5. The food made by producers supplies the energy for other living things in an ecosystem.
	6. Most producers use sunlight to make food through photosynthesis.
	7. All green plants, algae, and some bacteria are producers.
	8. An organism that gets energy and nutrients by breaking down the remains of other organisms is a **decomposer**.
	9. Decomposers are nature’s recyclers. They move matter through the ecosystem.
	10. Decomposers make water and nutrients available to other organisms.
	11. A **consumer** is an organism that eats other organisms.
	12. Consumers must eat other organisms for energy and nutrients.
	13. A consumer that eats only plants is called an **herbivore**.
	14. A **carnivore** eats other animals.
	15. An **omnivore** eats both plants and animals.
	16. A *scavenger*, such as a turkey vulture, is a specialized consumer that feeds on dead organisms.
2. How is energy transferred among organisms?
	1. If an organism is eaten or decomposes, the consumer or decomposer takes in the energy stored in the original organism.
	2. Only chemical energy that an organism has stored in its tissues is available to consumers.
	3. In this way, energy is transferred from organism to organism.
	4. A **food chain** is the path of energy transfer from producers to consumers.
	5. The arrows in a food chain represent the flow of energy from the body of the consumed organism to the body of the consumer of that organism.
	6. Producers form the base of food chains.
	7. Producers transfer energy to the first, or primary, consumer in the food chain.
	8. The secondary consumer consumes the primary consumer.
	9. A tertiary consumer eats the secondary consumer.
	10. Finally, decomposers recycle matter back to the soil.
3. How do food webs show energy connections?
	1. In nature, energy and nutrient connections are more complicated than a simple food chain.
	2. A **food web** is the feeding relationships among organisms in an ecosystem. Food webs are made up of many food chains.
	3. Many different energy paths lead from the producers to the top predators.
4. How are organisms connected by food webs?
	1. All living organisms are connected by global food webs, which include webs that begin on land and webs that begin in the water.
	2. Many organisms have feeding relationships that connect the land- and water-based food webs.
	3. Because global food webs are connected, removing even one organism can affect many organisms in other ecosystems.

**Lesson 3: Dynamic Populations**

1. How can a population grow or get smaller?
	1. If new individuals are added to the population, it grows.
	2. If individuals are removed from a population, it gets smaller.
	3. The population stays at about the same size if the number of individuals that are added is close to the number of individuals that are removed.
	4. Populations change in size when individuals move to new locations.
	5. *Immigration* occurs when individuals join a population.
	6. *Emigration* occurs when individuals leave a population.
	7. Populations increase as individuals are born.
	8. Populations decrease as individuals die.
	9. The number of births compared to the number of deaths helps determine if a population is increasing or decreasing.
2. What environmental factors influence population size?
	1. The amount of resources in an area influences the size of a population.
	2. A population may grow or shrink, depending on whether important resources are added to or lost from the environment.
	3. The **carrying capacity** is the maximum number of individuals of one species that the environment can support.
	4. The carrying capacity can change when the environment changes.
	5. After a rainy season, plants may produce a large crop of leaves and seeds, allowing an herbivore population to grow.
	6. A population crash occurs when the carrying capacity for a population suddenly drops, such as by natural disasters, harsh weather, or the entry of a new predator.
3. What factors can limit population size?
	1. A part of the environment that keeps a population’s size at a level below its full potential is called a **limiting factor**.
	2. Limiting factors can be living or nonliving things in an environment.
	3. The nonliving parts of an environment are called *abiotic factors*. They include water, nutrients, soil, sunlight, temperature, and living space.
	4. Relationships among organisms affect each one’s growth and survival. A *biotic factor* is an interaction between living things.
4. What interactions between organisms can influence population size?
	1. When two or more individuals or populations try to use the same limited resource, such as food, water, shelter, space, or sunlight, it is called **competition**.
	2. Competition can happen among individuals within a population.
	3. Competition also happens among populations
	4. **Cooperation** occurs when individuals work together.
	5. For example, some animals hunt in groups, others stay close together to stay warm, and others have a structured social order.
	6. Cooperation helps individuals get resources, which can make populations grow.

**Lesson 4: Interactions in Communities**

1. How do predators and prey interact?
	1. The feeding relationships between organisms establish structure in a community.
	2. In a predator-prey relationship, one animal eats another animal for energy and nutrients.
	3. The **predator** eats another animal. The **prey** is the animal that is eaten by a predator.
	4. Predators and prey have adaptations that can help them survive.
	5. Some predators have talons, claws, or sharp teeth.
	6. Some predators and prey have camouflage to help them blend in with the environment.
	7. Some prey animals, such as skunks, defend themselves with irritating chemicals
	8. The sizes of predator and prey populations are linked together very closely.
	9. If one population grows or shrinks, the other population is affected.
	10. As a predator population grows, the prey population may shrink. But if the prey population becomes too small, the predator population will shrink.
2. What are the types of symbiotic relationships?
	1. A close long-term relationship between different species in a community is called **symbiosis**.
	2. In symbiosis, the organisms in the relationship can benefit from, be unaffected by, or be harmed by the relationship.
	3. A symbiotic relationship in which both organisms benefit is called **mutualism**.
	4. An example of mutualism is the relationship between bees and flowering plants. The interaction benefits both organisms.
	5. A symbiotic relationship in which one organism benefits while the other is unaffected is called **commensalism**.
	6. For example, lichens use tree trunks for living space, and the trees are unaffected.
	7. A symbiotic relationship in which one organism benefits and another is harmed is called **parasitism**.
	8. The organism that benefits is the *parasite*, and the one that is harmed is the *host*.
	9. Some parasites live on the host’s surface and feed on its blood. Other parasites live in the host’s body. They can weaken their host so much that the host dies.
3. Why does competition occur in communities?
	1. In a biological community, organisms compete for resources.
	2. **Competition** occurs when organisms fight for the same limited resource, such as food, sunlight, shelter, and mates.
	3. Sometimes competition happens among individuals of the same species, such as different groups of lions competing for living space.
	4. Competition can also happen among individuals of different species, such as the competition between lions and cheetahs for the same food.