

Ecosystems

Ecosystems

8.L.3 Understand how organisms interact with and respond to the biotic and abiotic components of their environment.

8.L.3.1 Explain how factors such as food, water, shelter, and space affect populations in an ecosystem.

8.L.3.2 Summarize the relationships among producers, consumers, and decomposers including the positive and negative consequences of such interactions including:

- coexistence and cooperation
- competition (predator/prey)
- parasitism
- mutualism

8.L.3.3 Explain how the flow of energy within food webs is interconnected with the cycling of matter (including water, nitrogen, carbon dioxide, and oxygen).

The Web of Life

How are all living things connected?

- Organisms need energy and matter to live.
- Interactions between organisms cause an exchange of energy and matter, creating a web of life.
- **Ecology** is the study of how organisms interact with one another and with the environment.

How are all living things connected?

- Each individual organism has a role to play in the flow of energy and matter.
- In this way, organisms are connected to all other organisms, and their relationships affect each one's growth and survival.
- A **biotic factor** is an interaction between organisms in an area.

How are all living things connected?

- All organisms rely on the nonliving environment for survival.
- An **abiotic factor** is a nonliving part of an environment, such as water, nutrients, soil, sunlight, rainfall, or temperature.
- Abiotic factors influence where organisms can survive.

Stay Organized!

What are the levels of organization in the environment?

- The environment can be organized into different levels, ranging from a single organism to all of the organisms and their surroundings in an area.
- The levels of organization get more complex as more of the environment is considered.

What are the levels of organization in the environment?

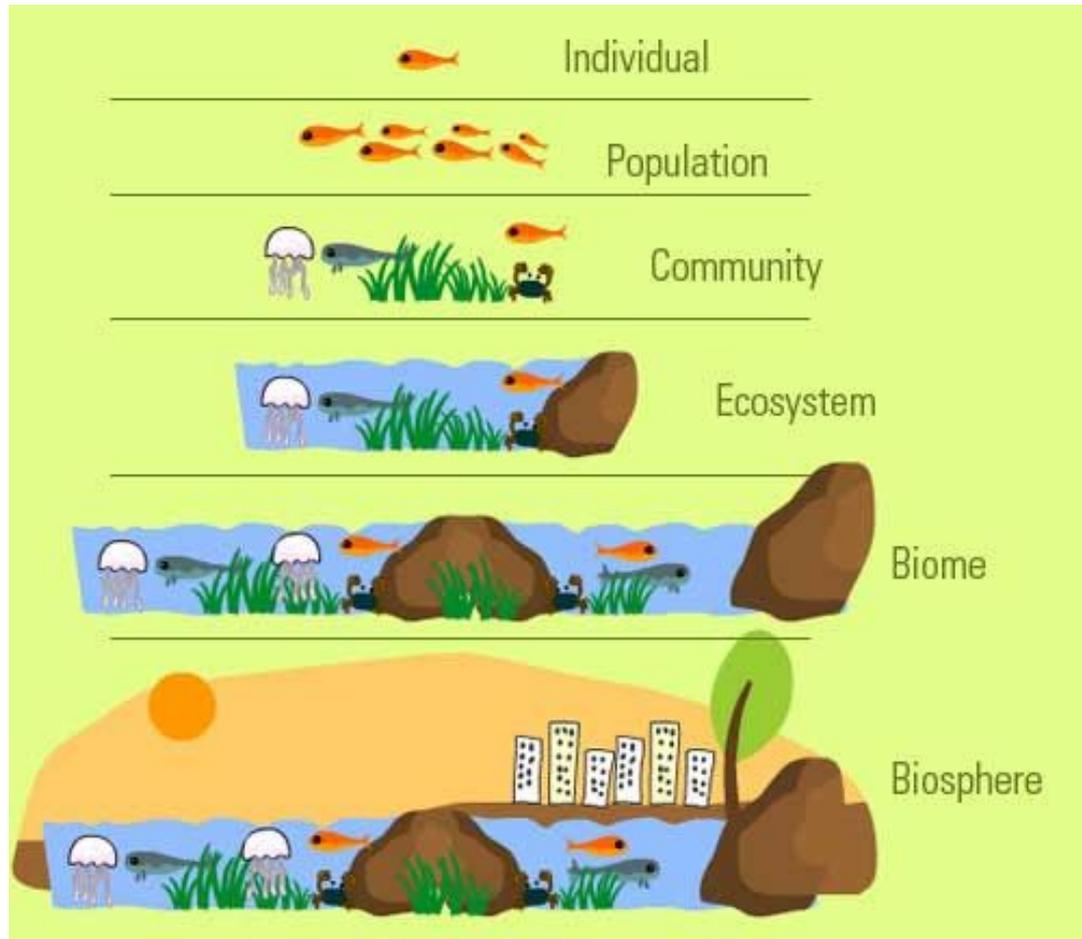
- A **population** is a group of individuals of the same species that live in the same place at the same time.
- A **species** includes organisms that are closely related and can mate to produce fertile offspring.
- Individuals within a population often compete with each other for resources.

What are the levels of organization in the environment?

- A **community** is made up of all the populations of different species that live and interact in an area.
- The species in a community depend on each other for many things, such as shelter and food.
- Organisms in a community also compete with each other for resources, just as members of a population do.

What are the levels of organization in the environment?

- An **ecosystem** is a community of organisms and their nonliving environment.
- In an ecosystem, organisms and the environment exchange energy and other resources.
- All abiotic and biotic factors make up an ecosystem.



Think Globally

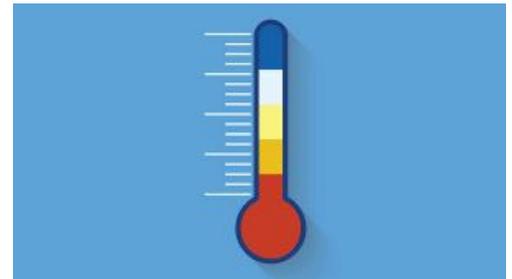
What is a biome?



- Large regions characterized by climate and communities of species are grouped together as **biomes**.
- A biome can contain many ecosystems.
- Major land biomes include tropical rain forest, tropical grassland, temperate grassland, desert, temperate deciduous forest, temperate rain forest, taiga, and tundra.

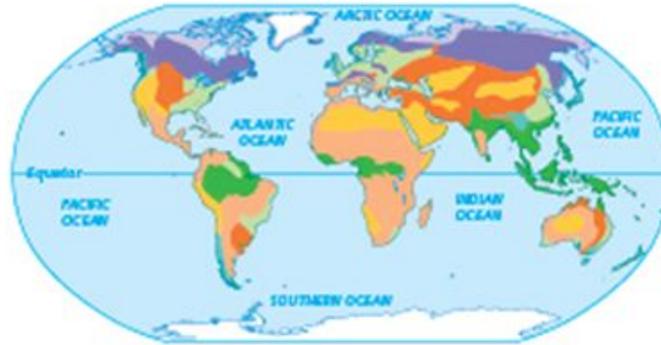
What characteristics define a biome?

- Temperature is an important climate factor that characterizes biomes. For example, taiga and tundra have cold temperatures all year.
- Biomes also differ in the amount of precipitation they receive. For example, tropical biomes have a lot of rainfall, but deserts have little precipitation.



What characteristics define a biome?

- From this map of land biomes, can you identify the biome where you live?



What characteristics define a biome?

- Biomes contain communities of living things that have adapted to the climate of the region.
- Thus, ecosystems within the same biome tend to have similar species across the globe.
- Only certain types of plants and animals can live in extreme climate conditions, such as in the tundra or the desert.

Home Sweet Home



What determines where a population can live?

- A population's **niche** is the role the population plays in the ecosystem, such as how it gets food and interacts with other populations.
- A **habitat** is the place where an organism usually lives and is part of an organism's niche.
- The habitat must provide all of the resources that an organism needs to grow and survive.

What determines where a population can live?

- Abiotic and biotic factors influence whether a species can live in a certain place.
- In general, two populations cannot occupy exactly the same niche.
- Small differences in habitats, roles, and adaptations can allow similar species to live together in the same ecosystem.

Lizard Invasion

- The habitat of South Florida's green anoles was invaded by a similar lizard, the brown anole.
- The lizards avoid occupying the same habitat by the way they share a tree. Green anoles move to the higher branches, and brown anoles occupy the ground branches.
- There is competition between the anoles. Brown anoles eat the young of the green anoles.



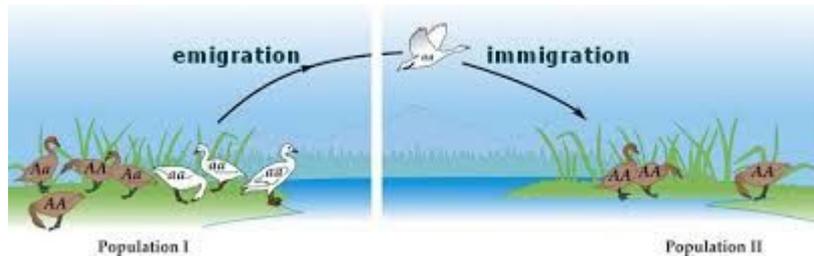
Movin' Out

How can a population grow or get smaller?

- If new individuals are added to the population, it grows.
- If individuals are removed from a population, it gets smaller.
- 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.

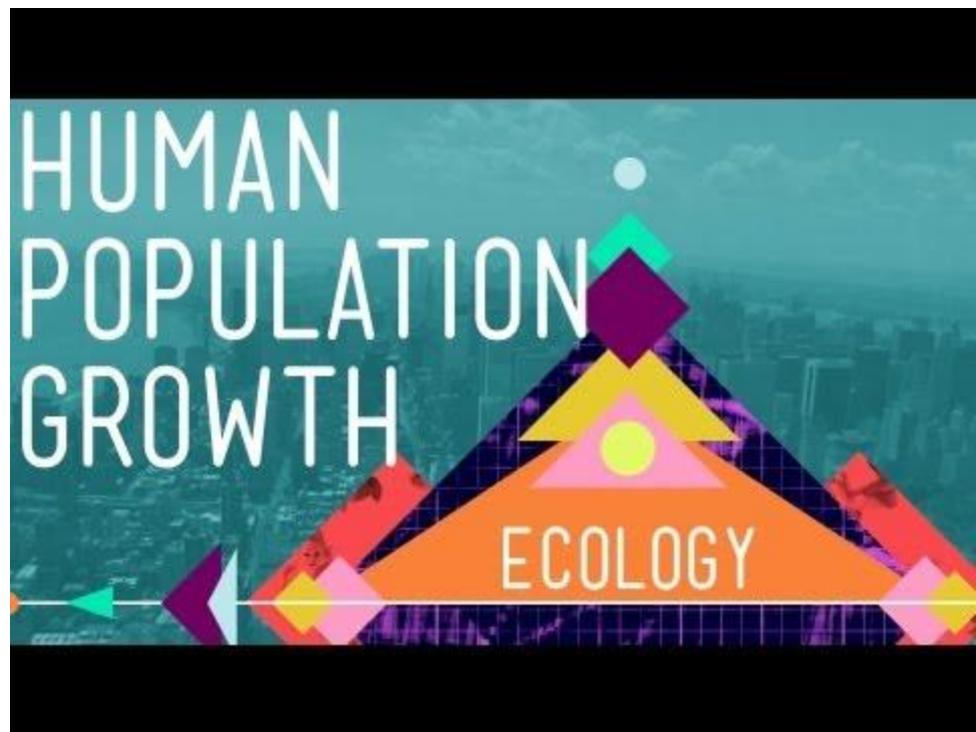
How can a population grow or get smaller?

- Populations change in size when individuals move to new locations.
- *Immigration* occurs when individuals join a population.
- *Emigration* occurs when individuals leave a population.



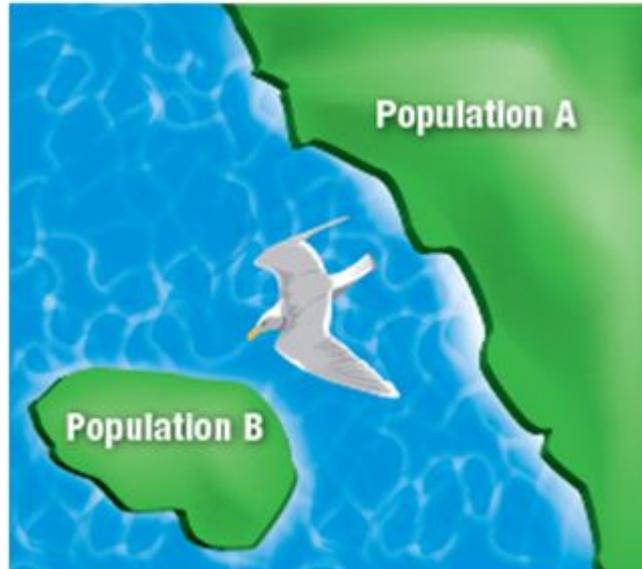
HUMAN
POPULATION
GROWTH

ECOLOGY



How can a population grow or get smaller?

- The bird emigrates from Population A. The bird immigrates to Population B.



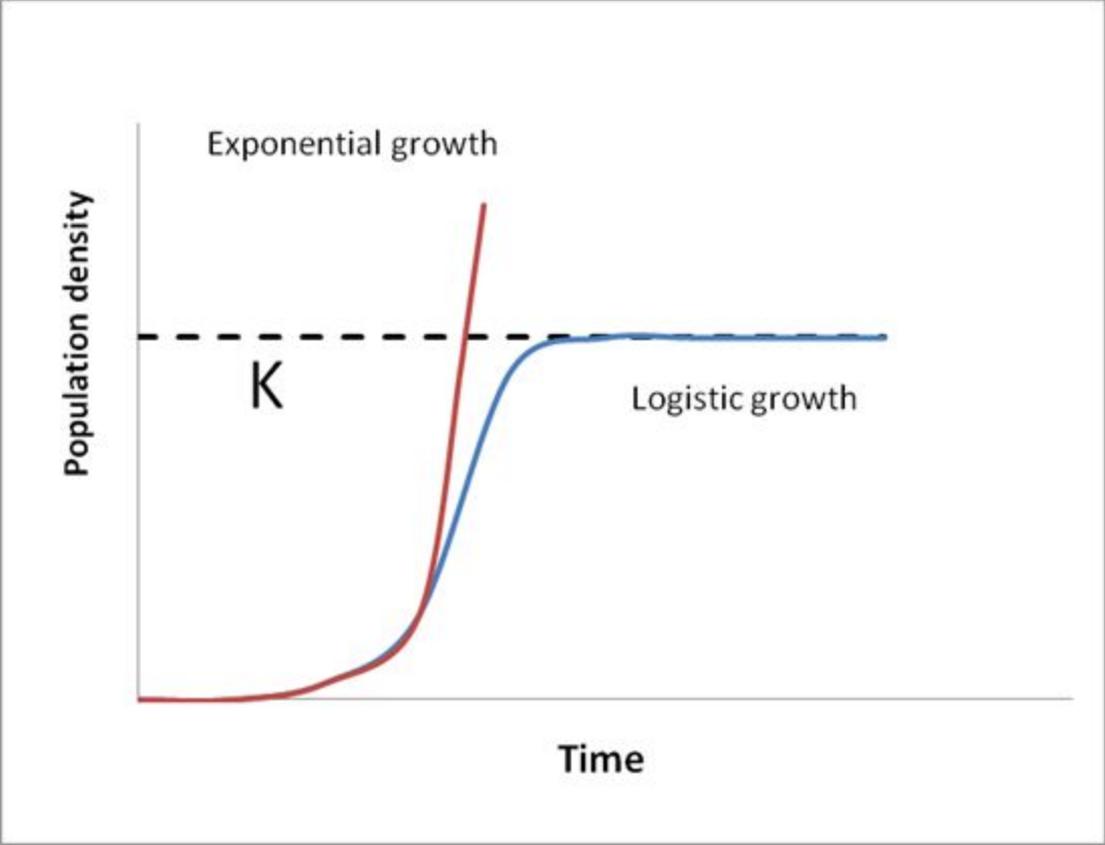
How can a population grow or get smaller?

- Populations increase as individuals are born.
- Populations decrease as individuals die.
- The number of births compared to the number of deaths helps determine if a population is increasing or decreasing.

Know Your Limits

What environmental factors influence population size?

- The amount of resources in an area influences the size of a population.
- A population may grow or shrink, depending on whether important resources are added to or lost from the environment.
- The **carrying capacity** is the maximum number of individuals of one species that the environment can support.



What environmental factors influence population size?

- The carrying capacity can change when the environment changes.
- After a rainy season, plants may produce a large crop of leaves and seeds, allowing an herbivore population to grow.
- 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.

Maximum Capacity

What factors can limit population size?

- A part of the environment that keeps a population's size at a level below its full potential is called a **limiting factor**.
- Limiting factors can be living or nonliving things in an environment.



Limiting Factors

- Limiting factors can include:
 1. Competitors
 2. Disease and parasites
 3. Weather
 4. Fires
 5. Available habitat
 6. Predators



What factors can limit population size?

- The nonliving parts of an environment are called *abiotic factors*. They include water, nutrients, soil, sunlight, temperature, and living space.
- Relationships among organisms affect each one's growth and survival. A *biotic factor* is an interaction between living things.

A Fungus Among Us

- In many parts of the world, frog populations are shrinking because of infection by a chytrid fungus called Bd.
- Bd interferes with a frog's ability to take in oxygen through its skin, and it affects the frog's nervous system.
- After hiking in muddy places, wash and dry your boots to help stop Bd from spreading.



Teamwork

What interactions between organisms can influence population size?

- 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**.
- Competition can happen among individuals within a population.
- Competition also happens among populations.

What interactions between organisms can influence population size?

- **Cooperation** occurs when individuals work together.
- For example, some animals hunt in groups, others stay close together to stay warm, and others have a structured social order.
- Cooperation helps individuals get resources, which can make populations grow.

Feeding Frenzy!

How do predator and prey interact?

- The feeding relationships between organisms establish structure in a community.
- In a predator-prey relationship, one animal eats another animal for energy and nutrients.
- The **predator** eats another animal. The **prey** is the animal that is eaten by a predator.

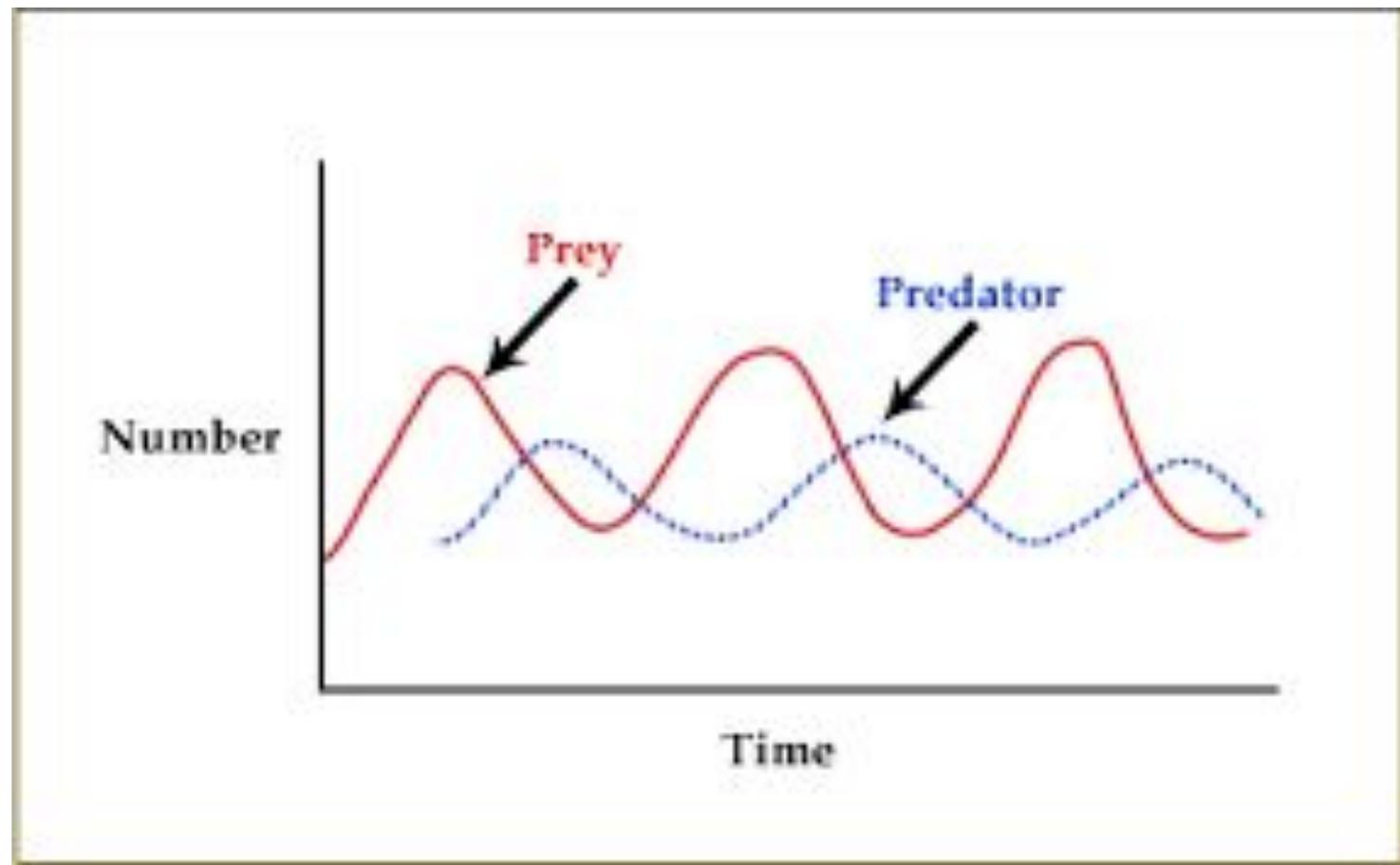


How do predator and prey interact?

- Predators and prey have adaptations that can help them survive.
- Some predators have talons, claws, or sharp teeth.
- Some predators and prey have camouflage to help them blend in with the environment.
- Some prey animals, such as skunks, defend themselves with irritating chemicals.

How do predator and prey interact?

- The sizes of predator and prey populations are linked together very closely.
- If one population grows or shrinks, the other population is affected.
- As a predator population grows, the prey population may shrink. But if the prey population becomes too small, the predator population will shrink.

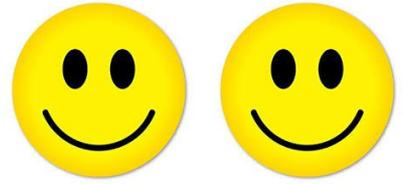


Living Together

What are the types of symbiotic relationships?

- A close long-term relationship between different species in a community is called **symbiosis**.
- In symbiosis, the organisms in the relationship can benefit from, be unaffected by, or be harmed by the relationship.

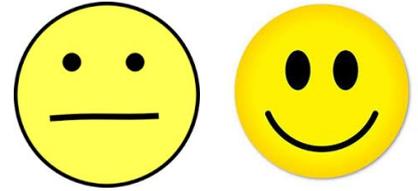
What are the types of symbiotic relationships?



- A symbiotic relationship in which both organisms benefit is called **mutualism**.
- An example of mutualism is the relationship between bees and flowering plants. The interaction benefits both organisms.



What are the types of symbiotic relationships?



- A symbiotic relationship in which one organism benefits while the other is unaffected is called **commensalism**.
- For example, lichens use tree trunks for living space, and the trees are unaffected.



What are the types of symbiotic relationships?

- A symbiotic relationship in which one organism benefits and another is harmed is called **parasitism**.
- The organism that benefits is the *parasite*, and the one that is harmed is the *host*.
- 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.



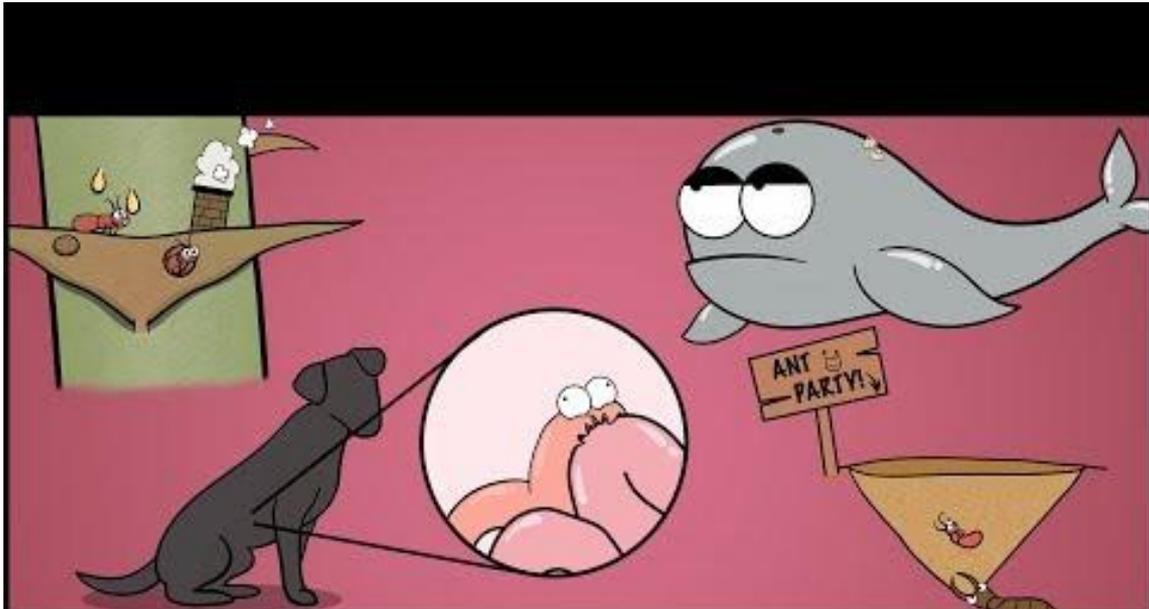
Let the Games Begin!

Why does competition occur in communities?

- In a biological community, organisms compete for resources.
- **Competition** occurs when organisms fight for the same limited resource, such as food, sunlight, shelter, and mates.

Why does competition occur in communities?

- Sometimes competition happens among individuals of the same species, such as different groups of lions competing for living space.
- Competition can also happen among individuals of different species, such as the competition between lions and cheetahs for the same food.



Ecological Relationships

with the Amoeba Sisters

Strange Relationships

- Organisms in an extreme cave community interact in ways that help them meet their needs.
- Predators have special adaptations that help them hunt their prey in the darkness of the cave.
- Some cave dwellers never have to leave the cave because they eat bird dung dropped by birds in the cave.

Get Energized!

How do organisms get energy?

- All living things need a source of chemical energy to survive.
- Chemical energy is stored in the bonds of molecules and holds molecules together.
- The energy from food is the chemical energy in the bonds of food molecules.

How do organisms get energy?

- A **producer**, also called an autotroph, uses energy to make food.
- The food made by producers supplies the energy for other living things in an ecosystem.
- Most producers use sunlight to make food through photosynthesis.
- All green plants, algae, and some bacteria are producers.



How do organisms get energy?



- An organism that gets energy and nutrients by breaking down the remains of other organisms is a **decomposer**.
- Decomposers are nature's recyclers. They move matter through the ecosystem.
- Decomposers make water and nutrients available to other organisms.

How do organisms get energy?

- A **consumer** is an organism that eats other organisms.
- Consumers must eat other organisms for energy and nutrients.



How do organisms get energy?

- A consumer that eats only plants is called an **herbivore**.
- A **carnivore** eats other animals.
- An **omnivore** eats both plants and animals.
- A *scavenger*, such as a turkey vulture, is a specialized consumer that feeds on dead organisms.

Energy Transfer

How is energy transferred among organisms?

- If an organism is eaten or decomposes, the consumer or decomposer takes in the energy stored in the original organism.
- Only chemical energy that an organism has stored in its tissues is available to consumers.
- In this way, energy is transferred from organism to organism.

How is energy transferred among organisms?

- A **food chain** is the path of energy transfer from producers to consumers.
- 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.
- Producers form the base of food chains.

Food chain



maize
producer



locust
primary
consumer



lizard
secondary
consumer



snake
tertiary
consumer

How is energy transferred among organisms?

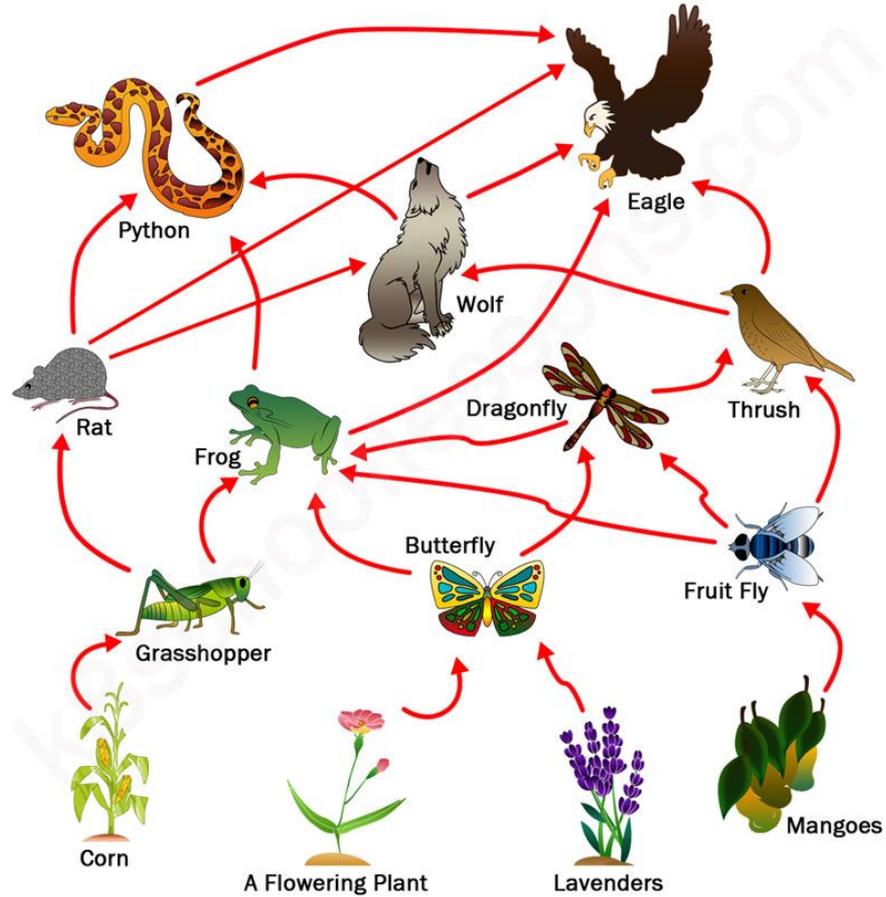
- Producers transfer energy to the first, or primary, consumer in the food chain.
- The secondary consumer consumes the primary consumer.
- A tertiary consumer eats the secondary consumer.
- Finally, decomposers recycle matter back to the soil.

World Wide Webs

How do food webs show energy connections?

- In nature, energy and nutrient connections are more complicated than a simple food chain.
- A **food web** is the feeding relationships among organisms in an ecosystem. Food webs are made up of many food chains.
- Many different energy paths lead from the producers to the top predators.

A Food Web



How are organisms connected by food webs?

- All living organisms are connected by global food webs, which include webs that begin on land and webs that begin in the water.
- Many organisms have feeding relationships that connect the land- and water-based food webs.
- Because global food webs are connected, removing even one organism can affect many organisms in other ecosystems.

Ecology - Video 1



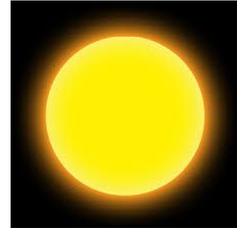
Food Webs and Energy Pyramids
with the Amoeba Sisters

Dangerous Competition



- Invasive species often compete with native species for energy resources.
- The invasive kudzu plant outgrows native plants and can completely cover houses and cars.
- The zebra mussel and walking catfish are so successful that they often leave little food for native species.

Soak Up the Sun



How do organisms get energy and matter?

- **Energy** is the ability to do work.
- **Matter** is anything that has mass and takes up space.
- All organisms need energy and matter to live, grow, and reproduce.

How do organisms get energy and matter?

- The sun is the original source of energy in most ecosystems.
- Organisms called *producers* make their own food.
- *Consumers* are organisms that cannot make their own food and eat producers or other consumers to get energy.

How do organisms get energy and matter?

- Most producers get energy from the sun, but some use chemical energy instead of light energy to make food.
- Producers get matter from soil and air.
- Consumers get both energy and matter from the foods they eat.

What happens to energy and matter in ecosystems?

- The **law of conservation of energy** states that energy cannot be created or destroyed; it only changes form.
- The **law of conservation of mass** states that mass cannot be created or destroyed.
- Matter moves through the environment in different forms.

What happens to energy and matter in ecosystems?

- Matter and energy can leave an ecosystem when organisms move.
- Also, matter and energy can leave an ecosystem in moving water and air.
- Although matter and energy enter and leave an ecosystem, they are never destroyed.

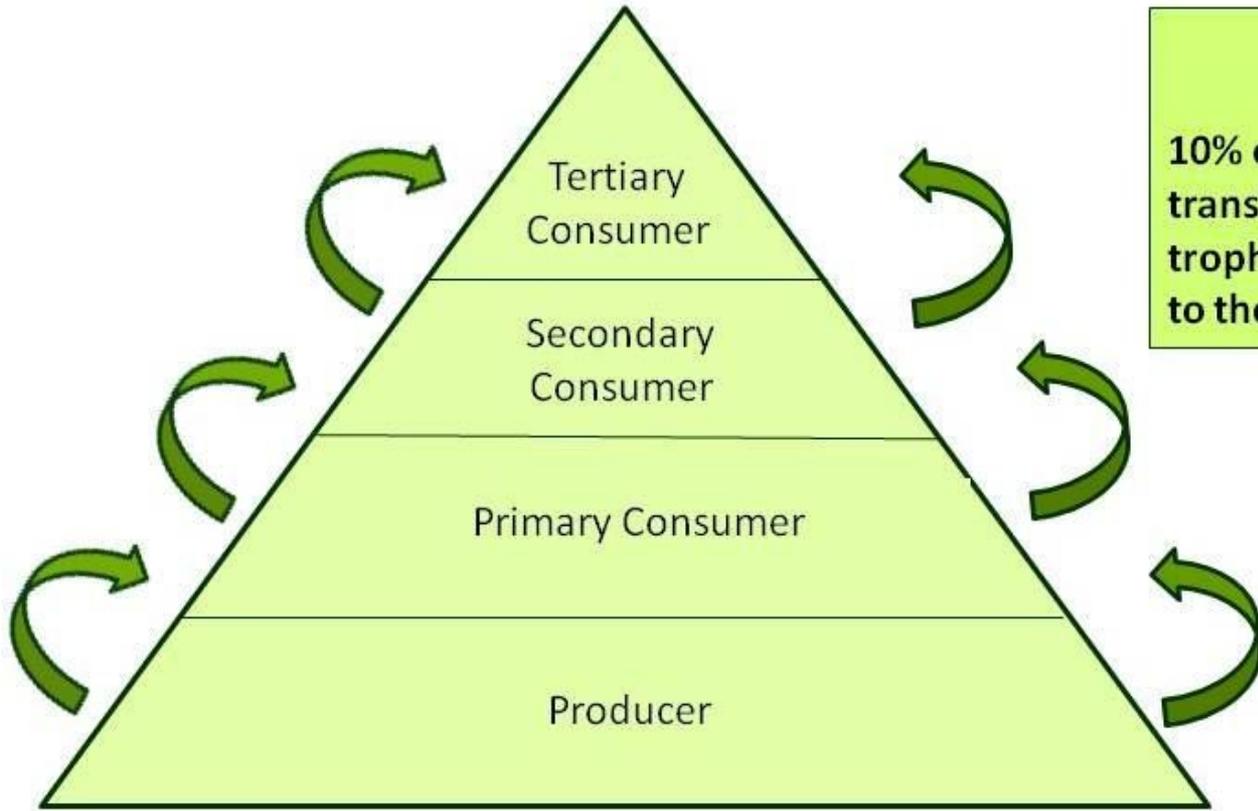
Cycle and Flow

How does energy move through an ecosystem?

- Energy enters most ecosystems as sunlight, which producers use to make food.
- Primary consumers get energy by eating producers. Secondary consumers get energy by eating primary consumers, and so on up the food chain.
- An organism uses most of the energy it takes in for life processes. Some energy is lost as heat, and some is stored in the organism's body.

How does energy move through an ecosystem?

- An **energy pyramid** is a tool that can be used to trace the flow of energy through an ecosystem.
- The bottom level, consisting of producers, has the largest population and the most energy. The other levels are consumers.
- Going up the pyramid, there is less energy and fewer organisms at each level. Consumers at the highest level have the smallest population.

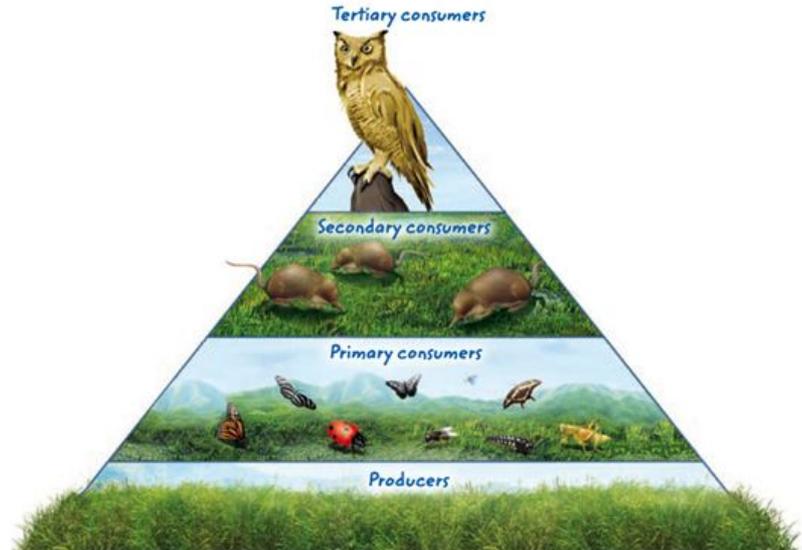


10% Rule

10% of the energy is transferred from one trophic level to the next trophic level.

How does energy move through an ecosystem?

- How does the size of a population change at each step in an energy pyramid?

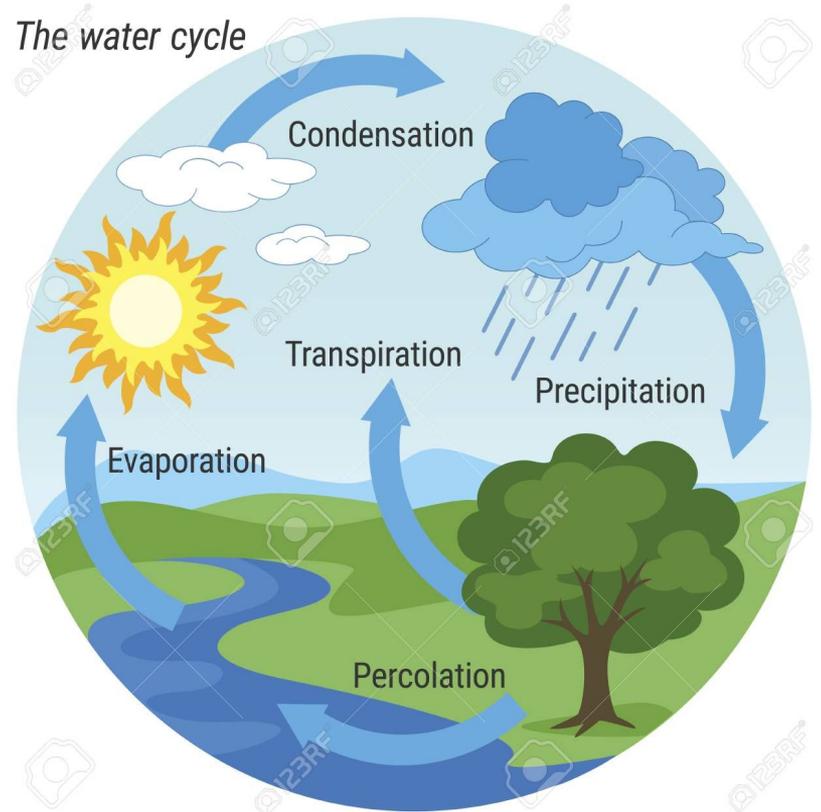


How does matter move through an ecosystem?

- Water evaporates from Earth's surface, enters the atmosphere, becomes clouds, and falls back to Earth's surface.
- Likewise, carbon and nitrogen cycle through an ecosystem, going from producers to consumers to decomposers and back to producers.
- Matter leaves some ecosystems and enters other ecosystems. Because matter can enter and leave an ecosystem, it is called an *open system*.

What is the water cycle?

- The movement of water between the oceans, atmosphere, land, and living things is known as the **water cycle**.
- Water can enter the atmosphere by evaporation, transpiration, and respiration.



What is the water cycle?

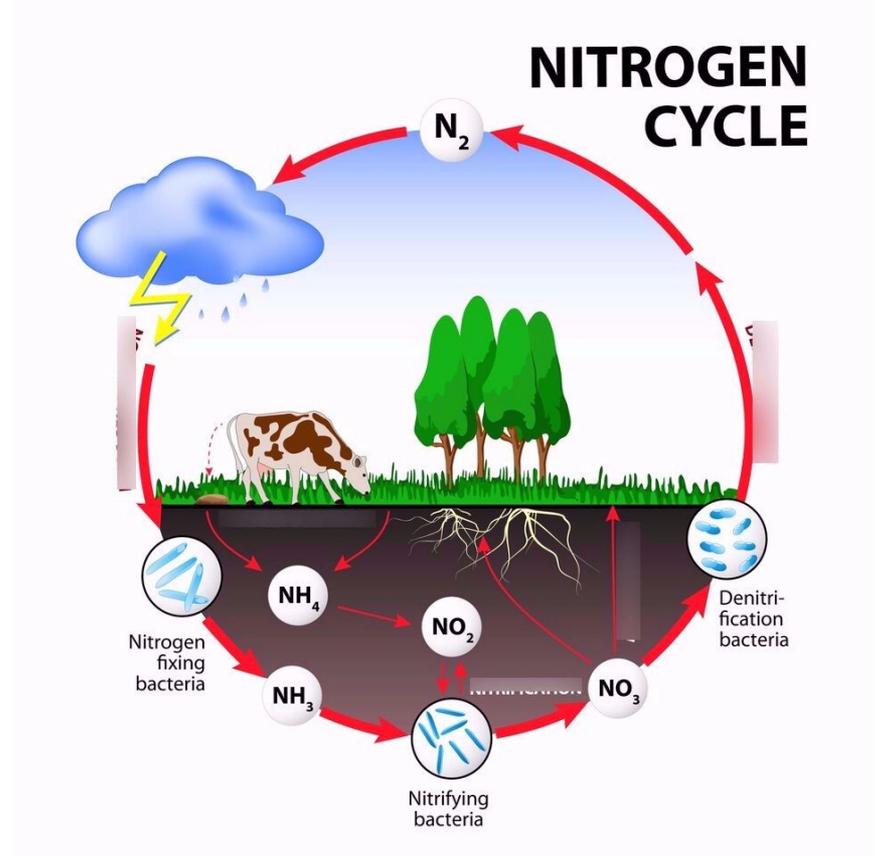
- During *evaporation*, the sun's heat causes water to change from liquid to vapor.
- Plants release water vapor from their leaves in *transpiration*.
- Organisms release water as waste during *respiration*.

What is the water cycle?

- In *condensation*, water vapor cools and returns to liquid. The water that falls from the atmosphere to the land and oceans is *precipitation*.
- The precipitation that falls on land and flows into streams and rivers is called *runoff*.
- The water that seeps into the ground and is stored underground is called *groundwater*. It will flow back into the soil, streams, rivers, and oceans.

What is the nitrogen cycle?

- The movement of nitrogen between the environment and living things is called the **nitrogen cycle**.
- Bacteria in the soil can change nitrogen gas from the air into forms that plants can use. This process is called *nitrogen fixation*.
- Plants take in and use fixed nitrogen. Consumers then get the nitrogen they need by eating plants or other organisms.

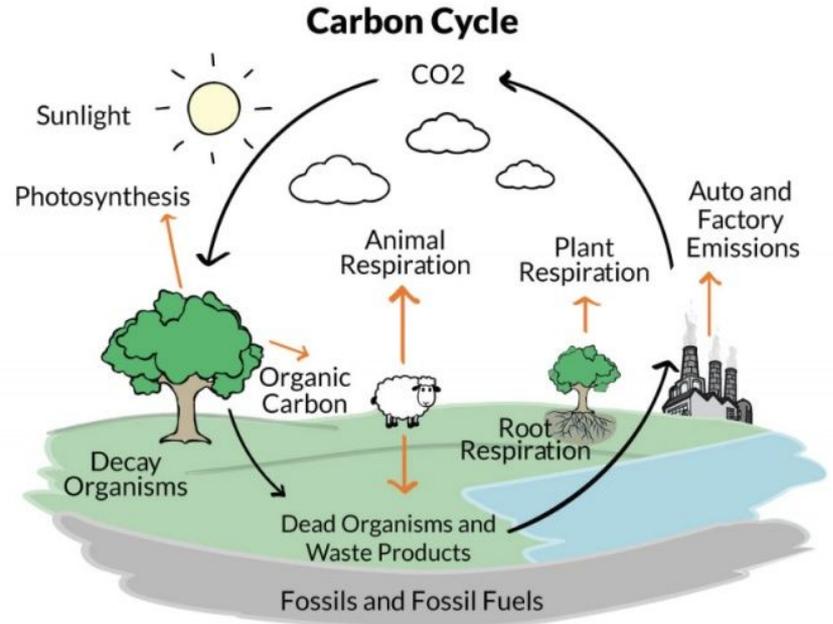


What is the nitrogen cycle?

- When organisms die, decomposers break down their remains and release a form of nitrogen into the soil that plants can use.
- Finally, certain types of bacteria in the soil can convert nitrogen into a gas, which is returned to the atmosphere.

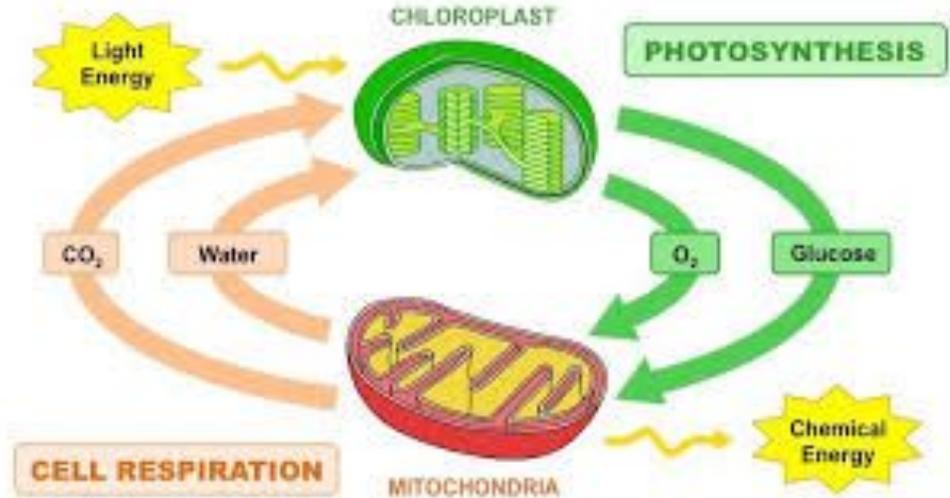
What is the carbon cycle?

- Carbon is an important building block of organisms.
- Carbon is found in food, the atmosphere, water, rocks, soils, organisms, and fossil fuels.
- Carbon moves through organisms and between organisms and the physical environment in the **carbon cycle**.



What is the carbon cycle?

- During photosynthesis, producers make sugars that contain carbon.
- During cellular respiration, sugars are broken down to release energy, carbon dioxide, and water.



What is the carbon cycle?

- Combustion is the burning of materials. The burning of once-living materials releases carbon dioxide, water, heat, and other materials.
- Decomposition breaks down dead organisms and waste. Decomposers get energy from this material by respiration.
- Decomposition returns carbon dioxide, water, and other nutrients to the environment.