Keystone Biology Remediation

B4: Ecology

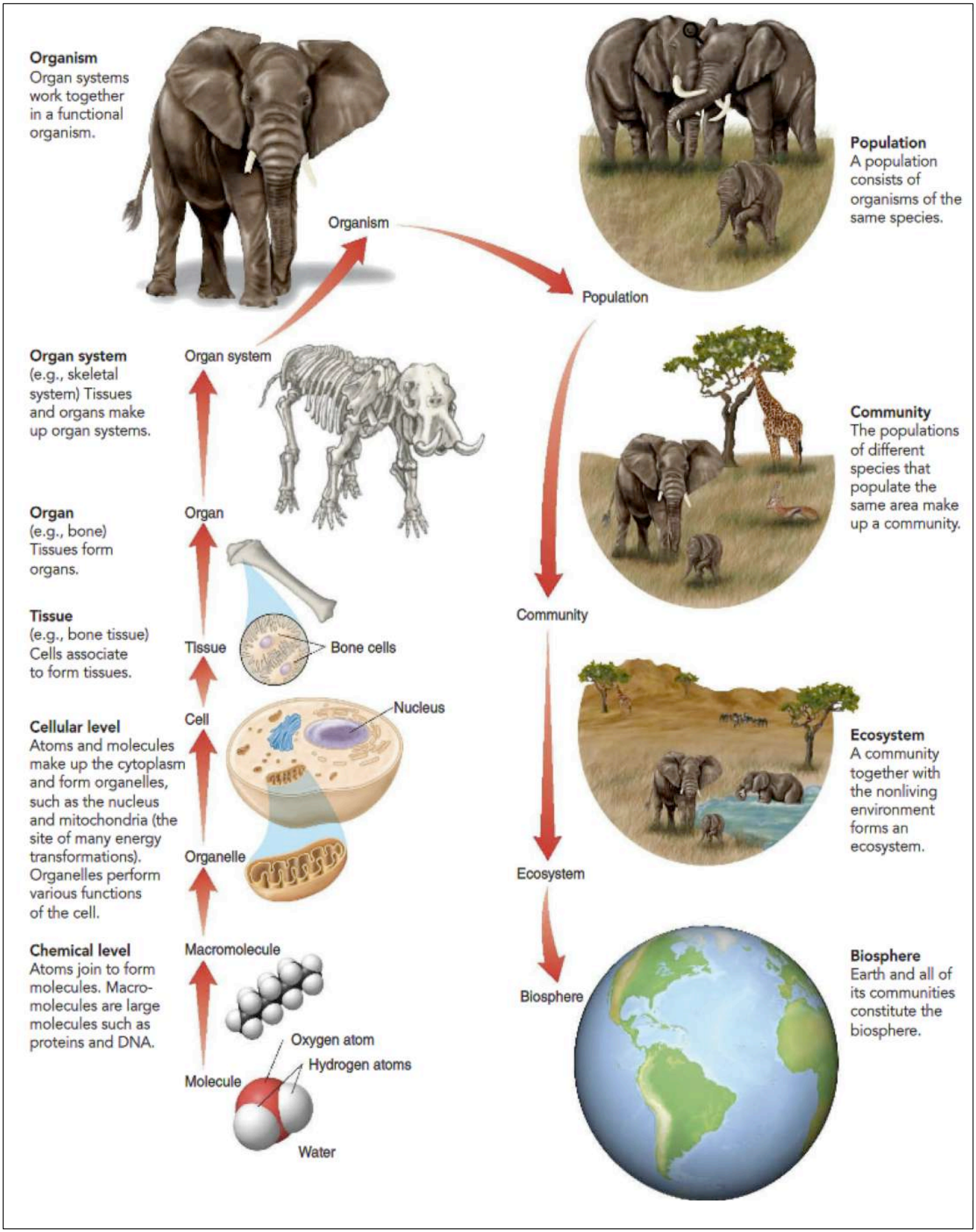
Assessment Anchors:

- to describe the levels of ecological organization (i.e. organism, population, community, ecosystem, biome, biosphere) (B.4.1.1)
- to describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems (B.4.1.2)
- to describe how energy flows through an ecosystem (e.g. food chains, food webs, energy pyramids) (B.2.3.1)
- to describe biotic interactions in an ecosystem (e.g. competition, predation, symbiosis) (B.4.2.2)
- to describe how matter recycles through an ecosystem (i.e. water cycle, carbon cycle, oxygen cycle, nitrogen cycle) (B.4.2.3)
- to describe how ecosystems change in response to natural and human disturbances (e.g. climate change, introduction of nonnative species, pollution, fires) (B. 4.2.4)
- to describe the effects of limiting factors on population dynamics and potential species extinction (B.4.2.5)

Unit Vocabulary:

abiotic
aquatic
biogeochemical cycles
biome
biosphere
biotic
community
competition
consumer
decomposer
ecology
ecosystem
endemic species
energy pyramid
environment
food chain
food web
habitat
limiting factor
nonnative species
organism
population
population dynamics
predation
producer
succession
symbiotic relationship
terrestrial
trophic level

Assessment Anchor: Describe the levels of ecological organization (i.e. organism, population, community, ecosystem, biome, biosphere) (B.4.1.1)



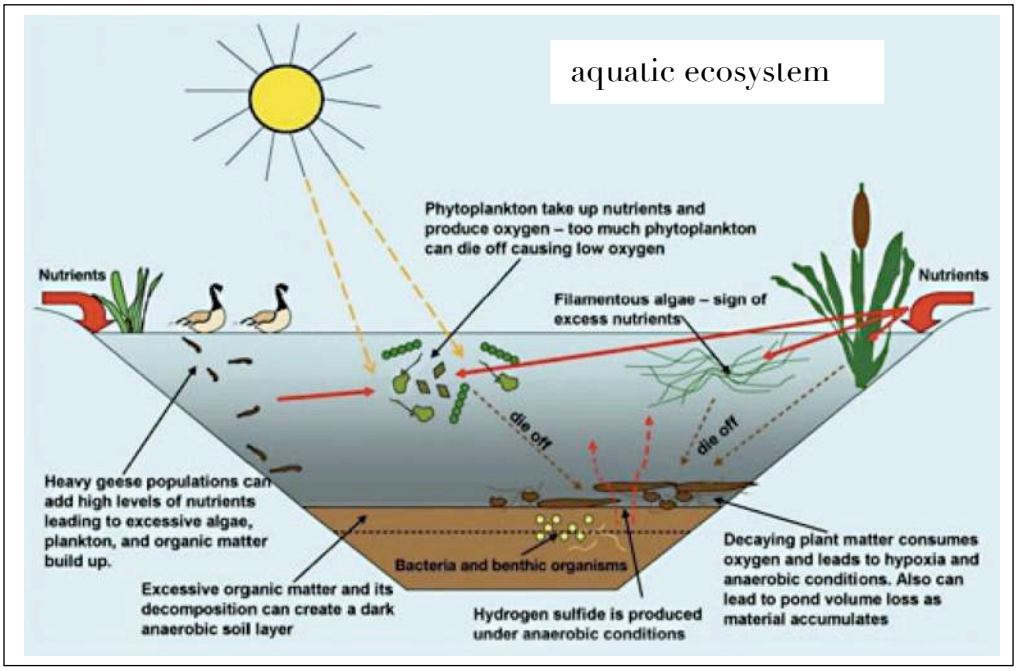
Assessment Anchor: to describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems (B.4.1.2)

biotic – an adjective that refers to a living or once living organism in an ecosystem

abiotic – an adjective that describes a nonliving component of an ecosystem

terrestrial – an adjective that describes having to do with a land environment

aquatic - an adjective that describe having to do with a water environment

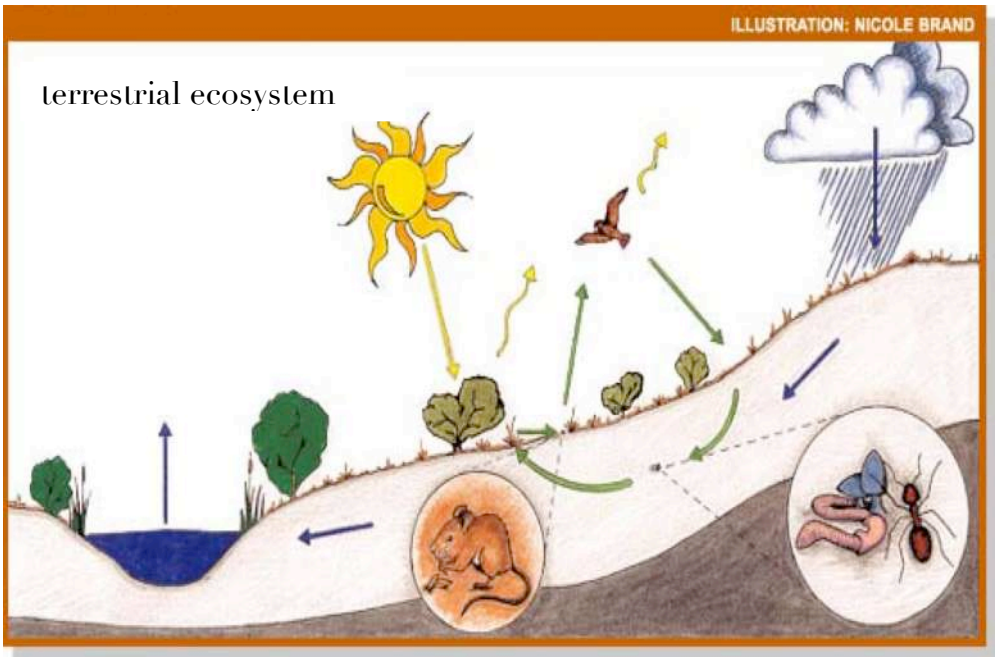


biotic factors:

- plants
- animals
- bacteria

abiotic factors:

- temperature
- pH
- dissolved nutrients
- dissolved oxygen
- flow rate (river)
- visibility



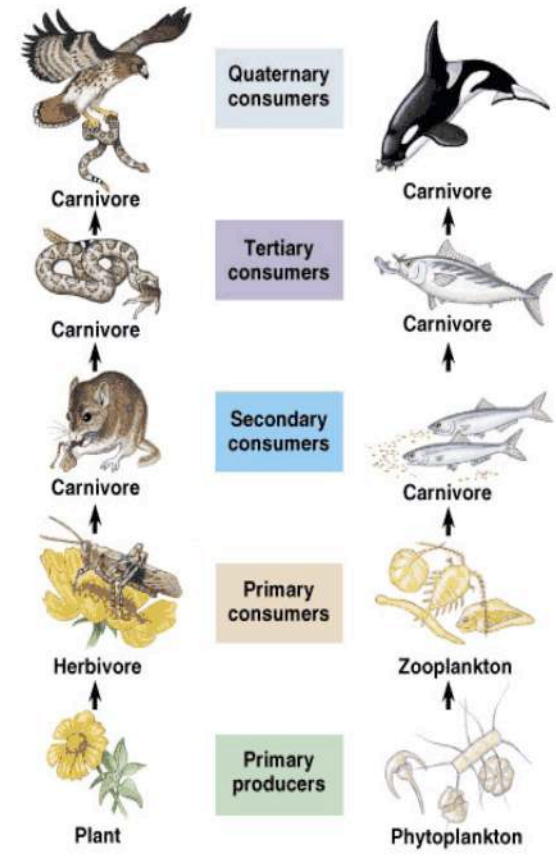
biotic factors:

- plants
- animals
- bacteria

abiotic factors:

- temperature
- precipitation
- soil nutrients
- sunlight

Assessment Anchor: to describe how energy flows through an ecosystem (e.g. food chains, food webs, energy pyramids) (B.2.3.1)



I. **Producers**: organisms that can produce their own food (usually by photosynthesis)

II. **Consumers**: organisms that cannot produce their own food

A. **Herbivores**: organisms whose diet consists mostly of plants

B. **Carnivores**: organisms whose diet consists mostly of animal matter

C. **Omnivores**: organisms who eat both plants and meat

D. **Detrivores**: organisms that eat dead organisms, especially dead plant matter

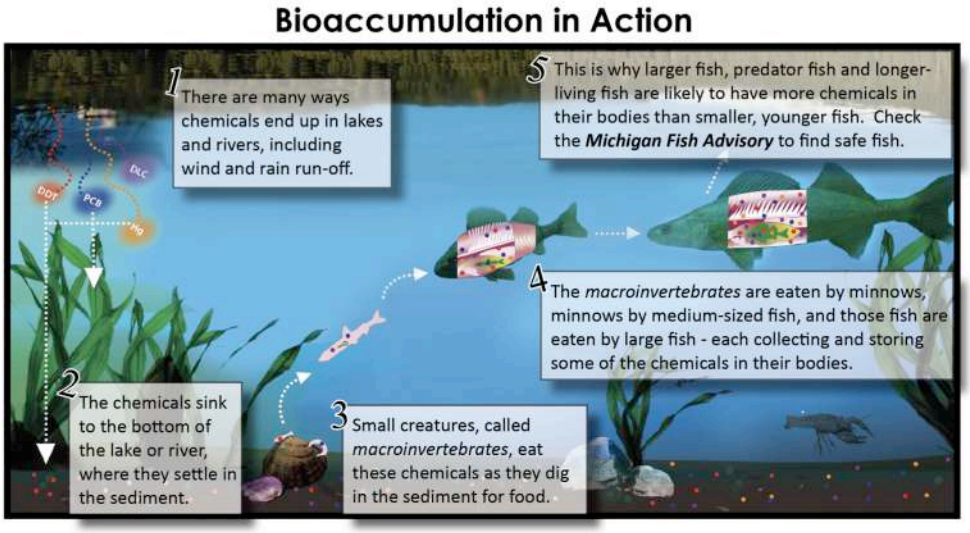
E. **Decomposers** – organisms who obtain energy by breaking down dead organisms; these include bacteria and fungi. These organisms are very important for recycling elements in the environment.

Food Chain: describes the flow of energy through living things

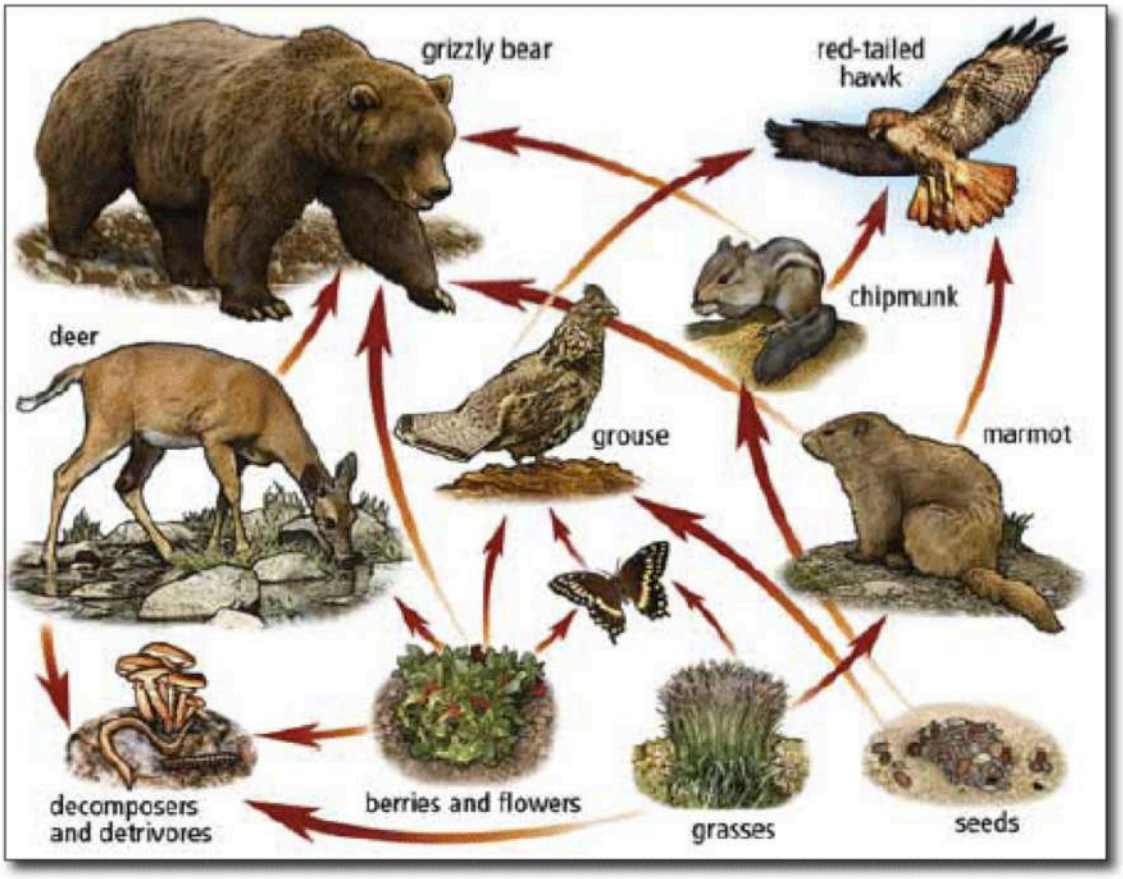
Trophic Level: a feeding level in a food chain; (In the diagram above, the trophic levels are in the boxes between the two food chains.)

Bioaccumulation:

when toxins are present in the environment, they are always most concentrated in the organisms at the top of the food chain.

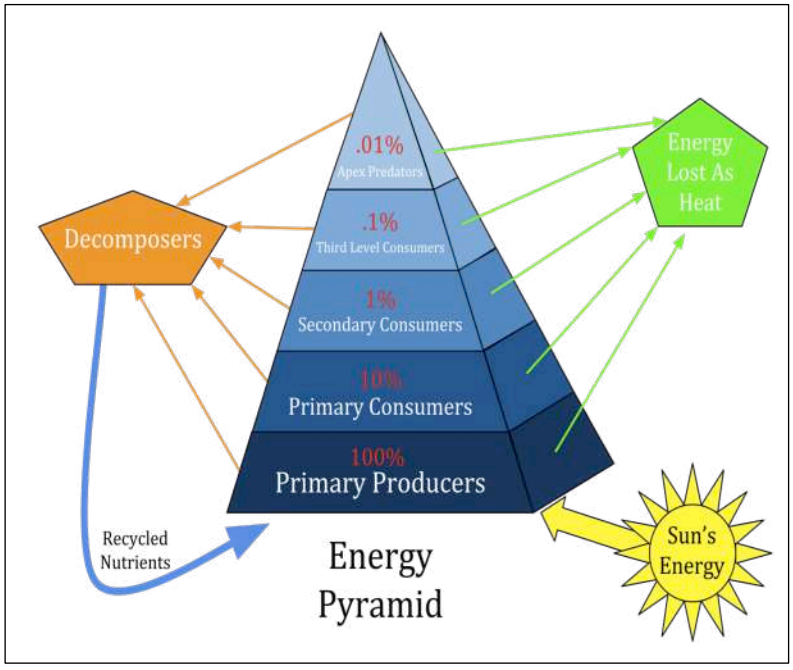


Food Web: describes the relationship among several food chains



Why does a food web provide a better picture of the energy flow situation in an ecosystem than a food chain?

Organisms don't eat only one type of food, nor are they eaten by one type of predator. A food web gives a better description of the big picture.



Pyramid of Energy:

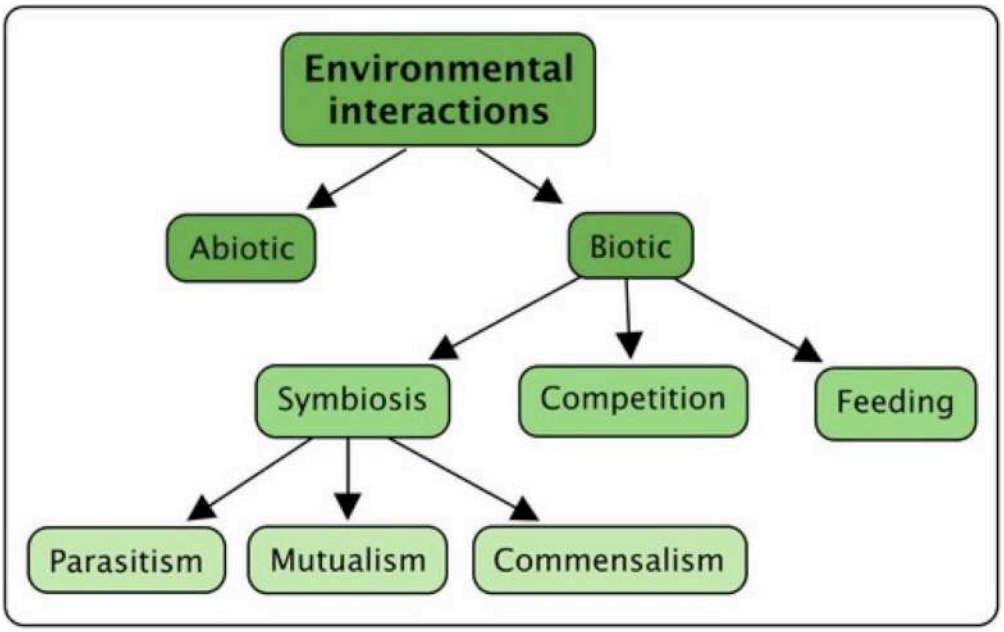
shows the amount of energy available at each trophic level; a larger rectangle represents more energy

10% rule: only 10 percent of the energy at any trophic level will be available to organism at the next trophic level. (Only 10% of the energy gets passed to the next trophic level.)

Why is only about 10% of the energy available at one trophic level passed to the next trophic level?

1. Organisms use energy for their own life processes.
2. Organisms excrete some of what they eat, making it unavailable to the next level.
3. Organisms frequently don't eat the entire organism (organisms that eat plants may not eat the roots.)

Assessment Anchor: to describe biotic interactions in an ecosystem (e.g. competition, predation, symbiosis) (B.4.2.2)



Competition:

when individuals or groups of organisms compete for similar resources such as territory, mates, water, and food in the same environment

Predation (feeding):

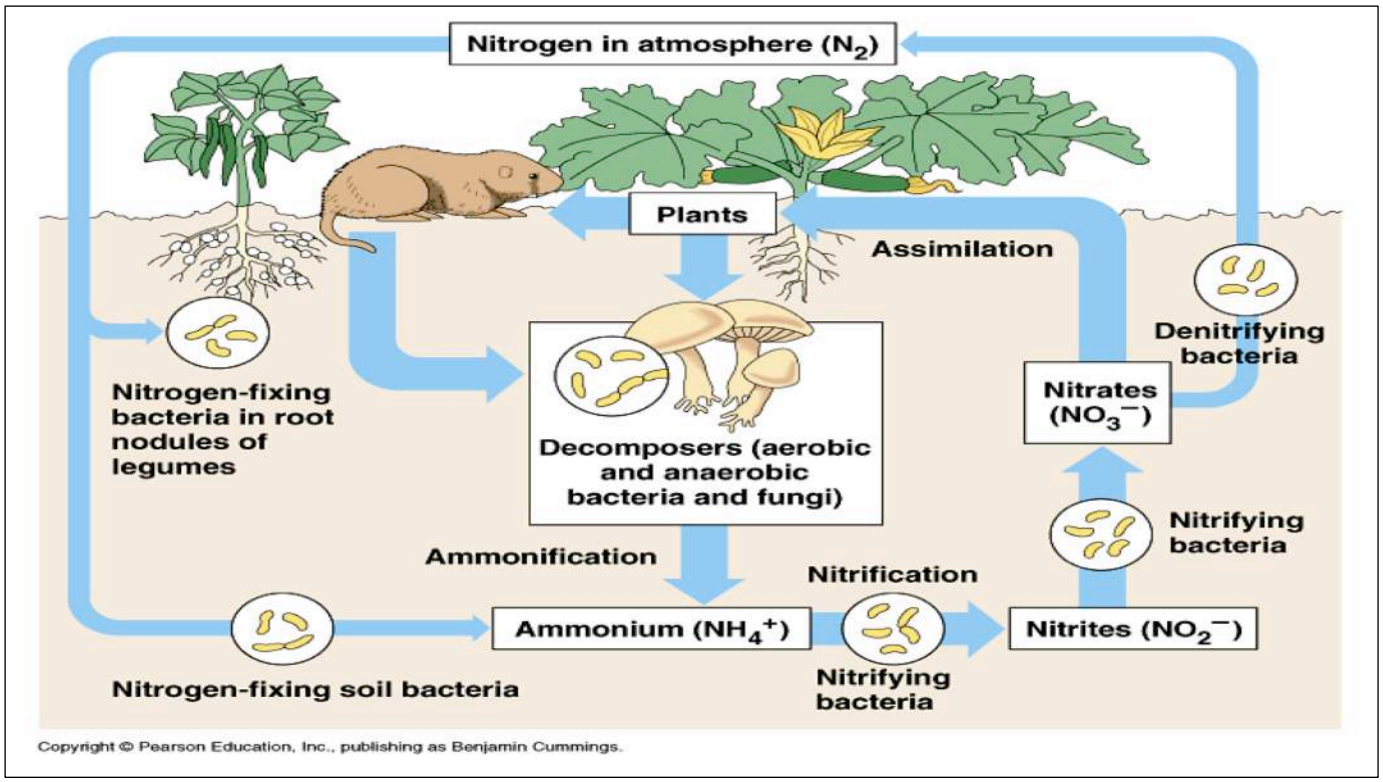
a relationship when one organism captures and feeds on another

Symbiosis: a long-term relationship between organisms of different species; classified as either parasitism, mutualism, or commensalism based on which organism(s) benefits.

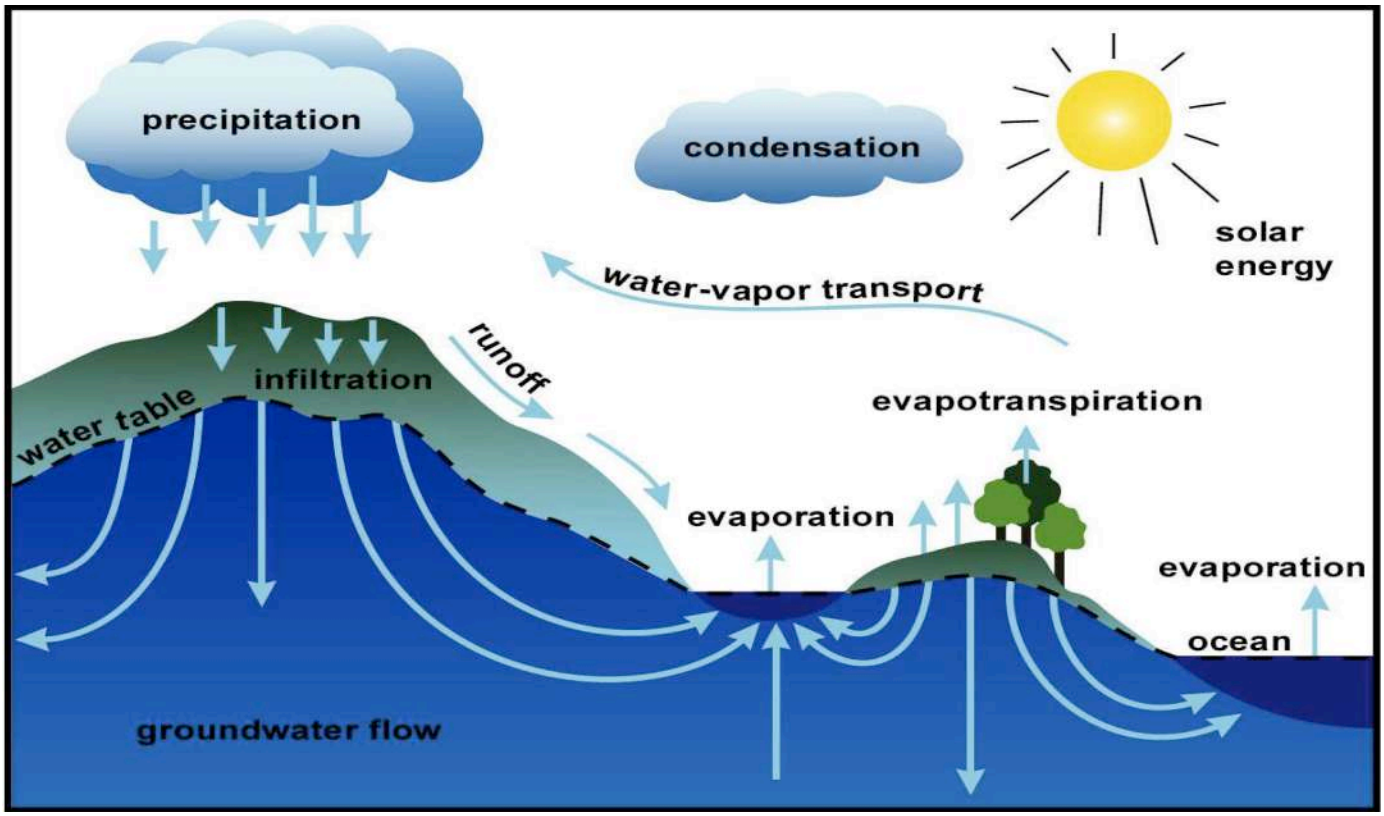
Type of Symbiosis	Who Benefits?	Example
Mutualism	Both organisms benefit from the relationship.	Oxpeckers (birds that eat insects off the backs of large mammals in Africa) benefit because they are obtaining food. The mammals benefit because the birds are eating insects that may cause disease.
Commensalism	One organism benefits; the other organism isn't harmed, not does it benefit from the relationship	Barnacle attach themselves to whales so that they can travel around the ocean and have more feeding opportunities. The whales are unaffected.
Parasitism	One organism benefits while the other is harmed. A good parasite does not kill its host (at least not right away).	A tapeworm benefits by living in the intestines of mammals. The tapeworm benefits by having nutrients constantly available. The mammal is harmed because it is deprived of nutrients.

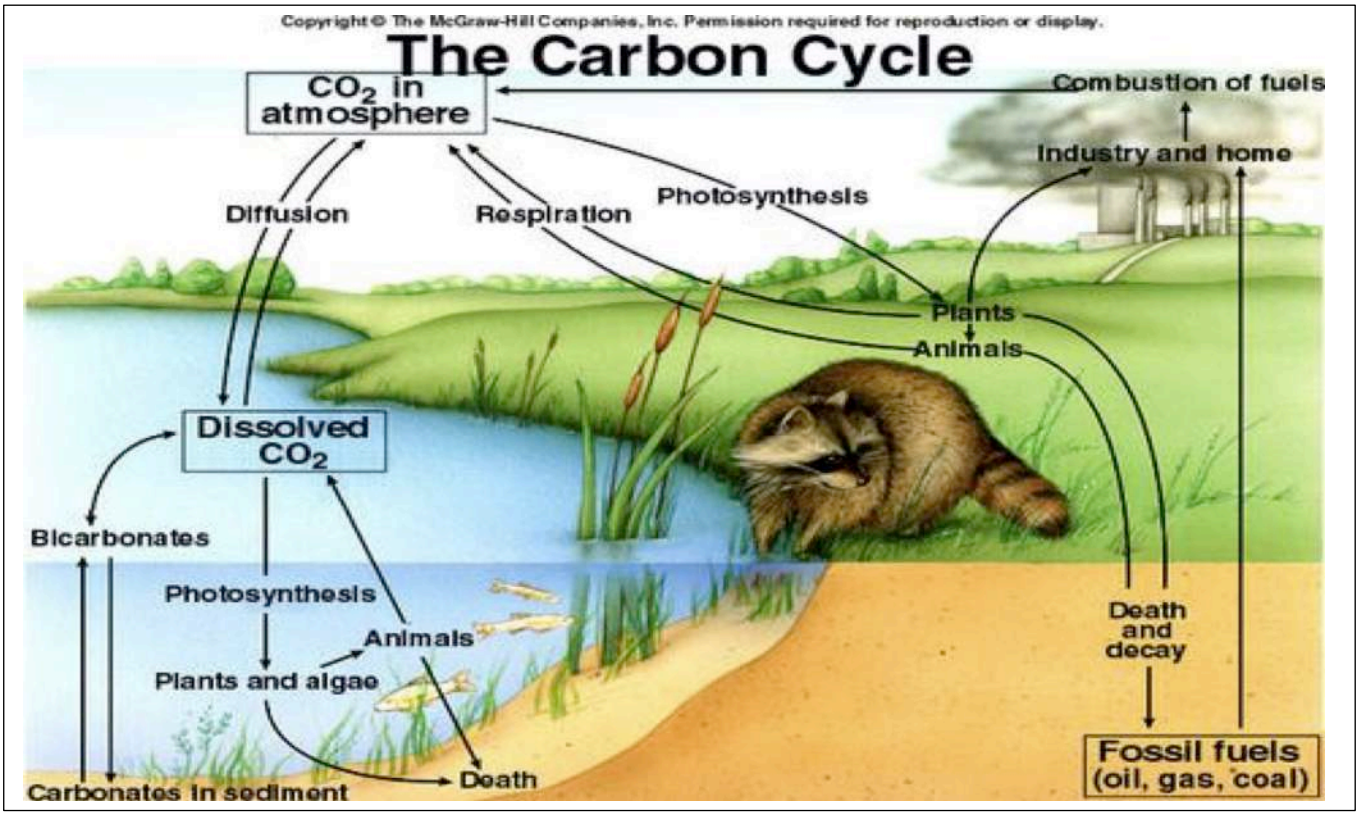
Assessment Anchor: to describe how matter recycles through an ecosystem (i.e. water cycle, carbon cycle, oxygen cycle, nitrogen cycle) (B.4.2.3)

Nitrogen Cycle

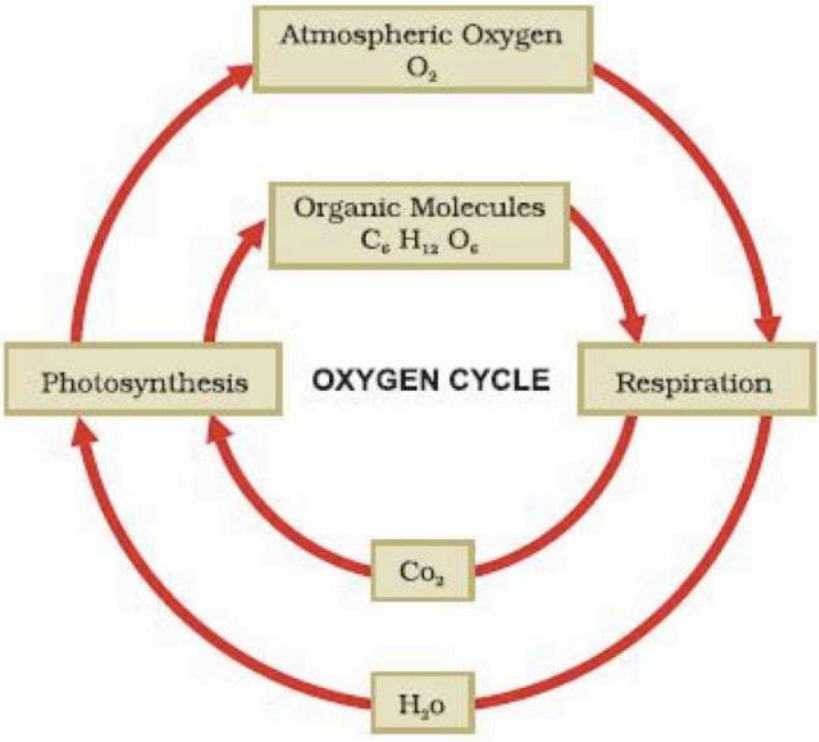


Water Cycle





Oxygen Cycle

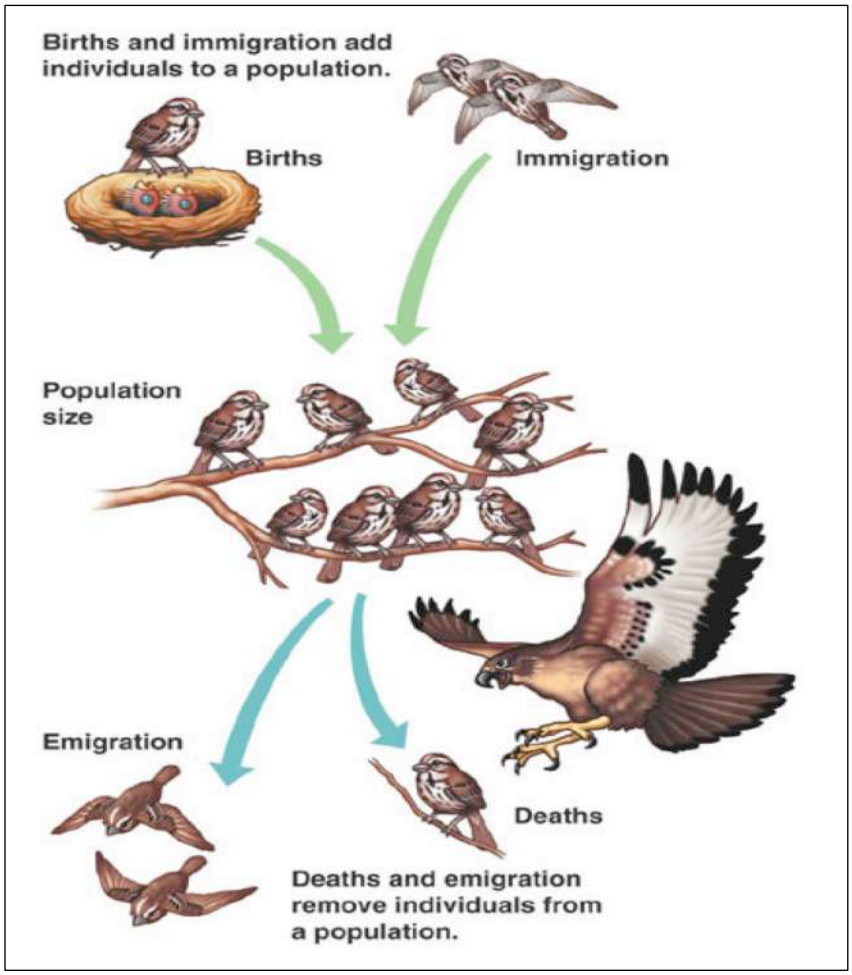


Assessment Anchor: to describe how ecosystems change in response to natural and human disturbances (e.g. climate change, introduction of nonnative species, pollution, fires) (B. 4.2.4)

Natural/Human Disturbance	Effect on Ecosystems	Example
Climate change	• populations which are adapted to particular climates may be unable to live in certain areas • melting polar ice caps may cause sea levels to rise, flooding the coastal areas that hold many of Earth's unique ecosystems	Many human activities, from energy and food production to transportation, increase the level of greenhouse gases in the atmosphere. **Greenhouse gases** are atmospheric gases such as water vapor, carbon dioxide, and methane that trap heat energy near the surface of the Earth causing a phenomenon known as the **greenhouse effect**.
Introduction of **nonnative species** (also **called invasive species**)	Generally nonnative species: • have fewer predators or no predators in their new ecosystem • use more of the ecosystem's resources or use available resources more effectively • may reduce other **endemic** populations directly, through predation	The round goby is a small white fish that was first reported in PA waters in 1996. This nonnative species was brought to the Great Lakes in ships traveling from the Black Sea. The round goby has an advantage over other species because it is able to feed even in complete darkness. Its introduction into the Great Lakes has resulted in the decline in the population of other species of fish, especially the mottled sculpin.
Pollution	**Pollution** is the addition of substances, objects, or other factors that cause harmful changes to an ecosystem. Agricultural runoff is a type of pollution that can result in **eutrophication.** Eutrophication refers to the changes that occur to an aquatic ecosystem as a result of added nutrients. In addition to chemicals, excess noise and light can also be forms of pollution.	Agricultural runoff can act as fertilizer for aquatic plants. In response to added nutrients, algae populations may increase rapidly causing an **algal bloom**. This increase in algae can limit light penetration and reduce photosynthesis in other aquatic plants. Once the population of algae has used up all the excess nutrients, some of the population die. This increases the food supply for decomposers which increases their population. The increase in decomposers results in a depletion of oxygen in the water which can lead to the death of fish and other aquatic animals.
Habitat destruction	A **habitat** is an ecosystem area that provides the resources a species needs to survive and reproduce. Different species have different habitat requirements. Habitat destruction is currently ranked as the primary cause of species extinction worldwide.	Human error or lightning strikes can both cause fires that can have devastating consequences to the organisms living in grasslands or forests. Also, intentional deforestation (in the form of fires, clear-cutting, and unsustainable logging practices) is threatening a wide range of plant and animal species as their habitats are destroyed.

Assesment Anchor: to describe the effects of limiting factors on population dynamics and potential species extinction (B.4.2.5)

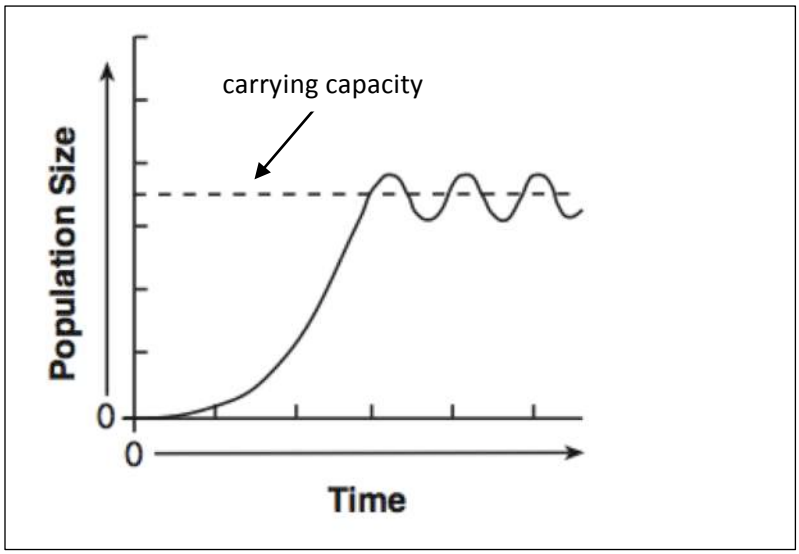
According to the graphic below, **birth and death rates** affect the population size, in addition to immigration and emigration rates.



Limiting factors are any biotic or abiotic resource that limits the size of a population.

So, what types of factors would affect the birth and death rates of the bird population in the graphic (thereby limiting the size of the population)?

- availability of food
- population of predators
- water
- shelter
- disease
- weather events



Carrying capacity is the maximum population that an ecosystem can support.

A size of a population generally fluctuates around the carrying capacity of the ecosystem.