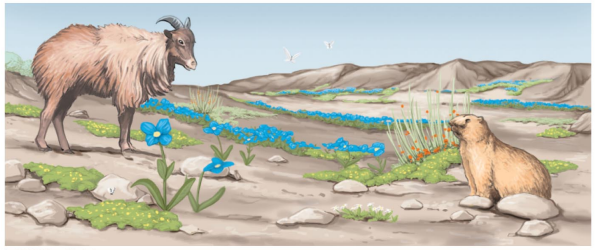
Biology – Chapters 3 - 6
Ecology

Honors Biology – Chapters 34 - 38
Ecology

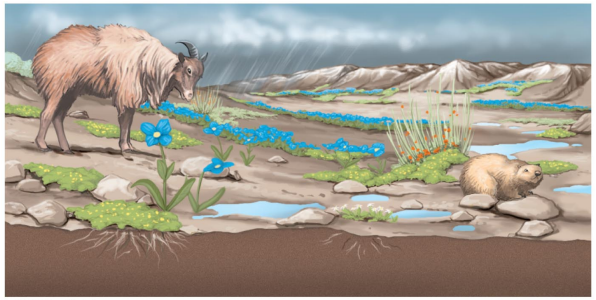
Ridgefield Memorial High School

This plant is an example of an organism.

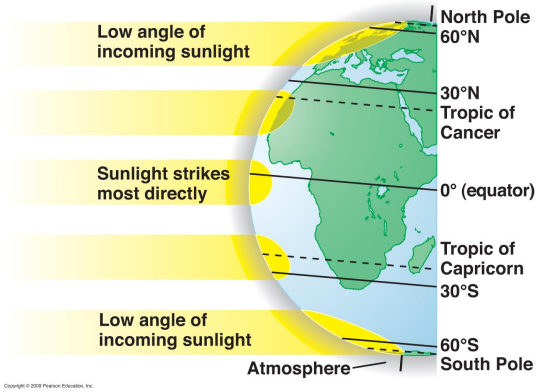
These plants, which are all of the same species, represent one population.



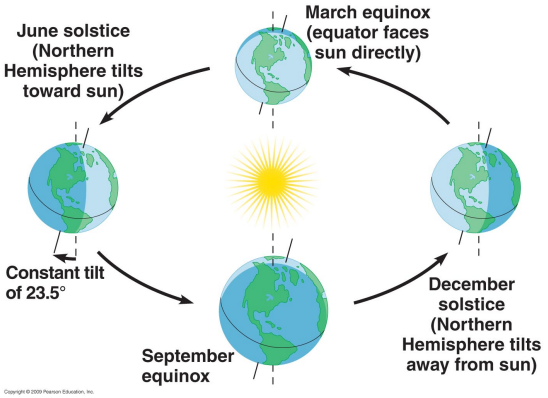
The plants, animals, and other biotic factors represent one community.



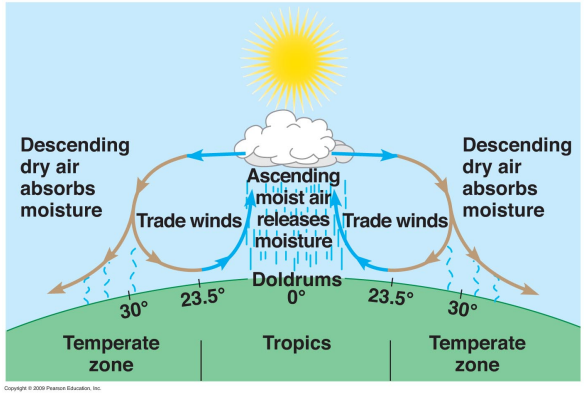
The plants, animals, water, soil, and other biotic and abiotic factors represent one ecosystem.



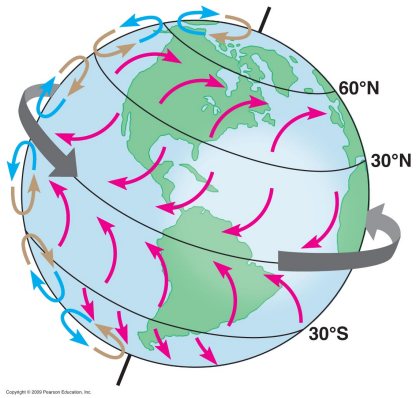
Tropical environments receive the most sunlight. Temperate environments receive less. Arctic environments receive the least amount of sunlight.



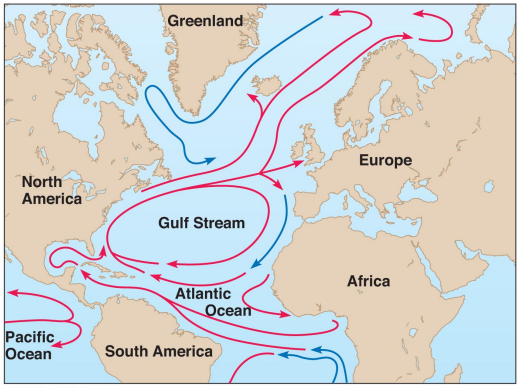
The seasons are caused by the 23.5° tilt of the Earth's axis.



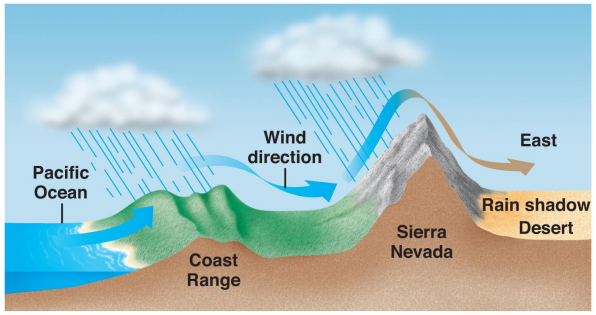
The tropics tend to receive a lot of rain because warm, moist air rises and then condenses.



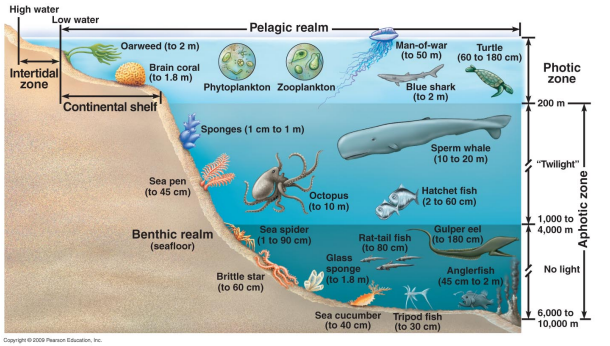
Global wind patterns are caused by the fact that the equator rotates faster than the poles. This is known as the Coriolis effect.



Warm (red) and cold (blue) ocean currents affect the climate in many places. Typically, warm water currents start near the equator and cold water currents start near the poles.



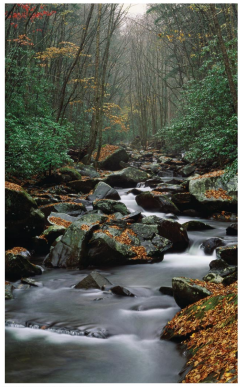
Deserts in Nevada are the result of the warm, moist air rising at the mountains and losing water.



The major abiotic factor in ocean ecosystems is sunlight (or the lack of it). Vertically, the ocean is divided into a photic zone and an aphotic zone.

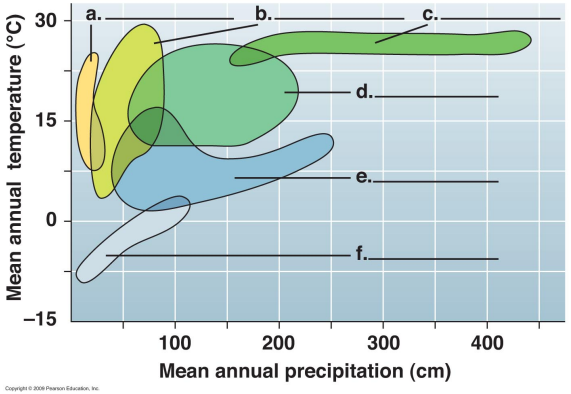
Coral reef ecosystems are one of the most biologically diverse places on Earth. They are analogous to the tropical rain forest on land.

Estuaries are an aquatic ecosystem in which saltwater and freshwater mix.

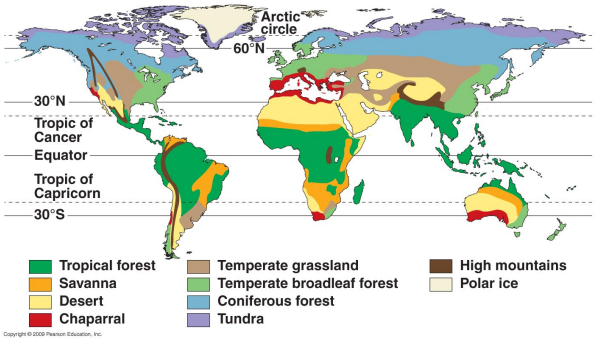


A stream is an example of a freshwater ecosystem.

Wetlands, such as marshes and swamps, are freshwater ecosystems with great diversity.



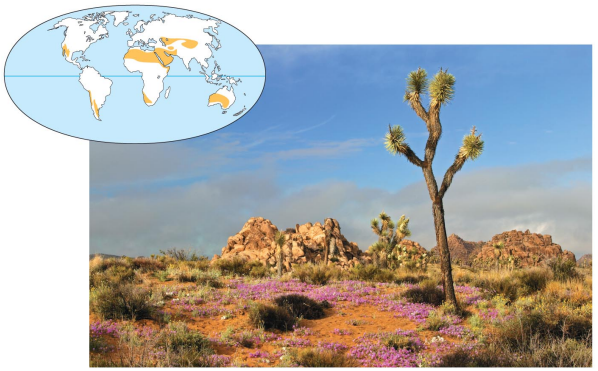
Biomes are primarily defined by their average temperature and yearly precipitation. Can you identify the biomes labeled a-f?



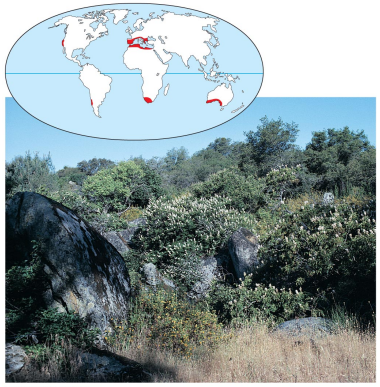
This map shows the major terrestrial (land) biomes or ecosystems.

A tropical rain forest is hot and wet all year and is one of the most diverse places on Earth.

A savannah is a tropical grassland. It is hot and relatively dry.



Deserts are extremely hot and dry ecosystems.
They often are found in the rain shadow of mountains.

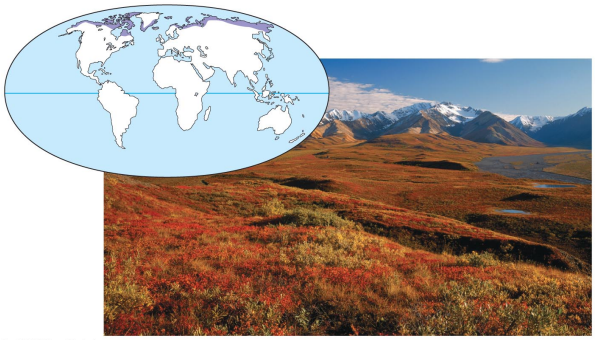


The chaparral is the "place of evergreen scrub oaks."
They are found in certain coastal areas.

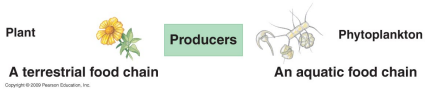
Temperate grasslands make up the central part of the United States.
They are used for farming and grazing.

Temperate deciduous forests make up the east coast of the United States.
Trees lose their leaves in the fall.

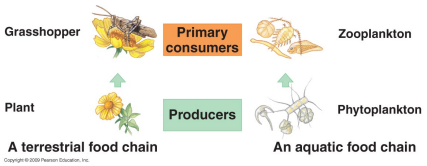
A taiga, or coniferous forest, is found in colder areas.
Trees keep their leaves year-round.



In a tundra, the climate is so cold that the ground is frozen.
The frozen soil is called permafrost.



Food chains (and webs) can only support a maximum of 5 trophic levels due to the 10% rule:
PRODUCER → HERBIVORE → 1° CARNIVORE → 2° CARNIVORE → 3° CARNIVORE



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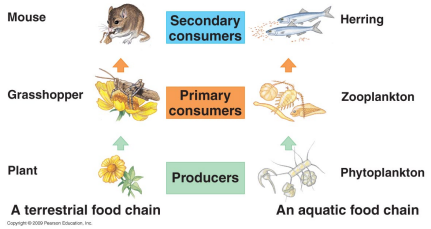

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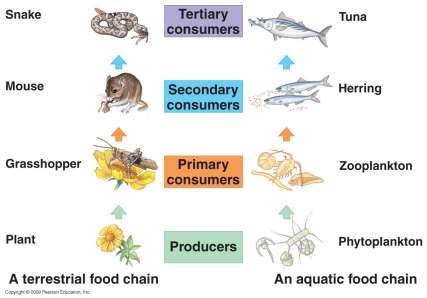

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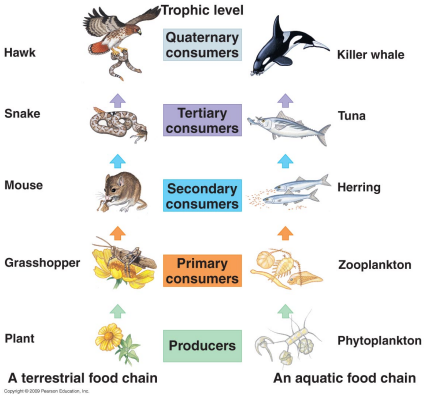

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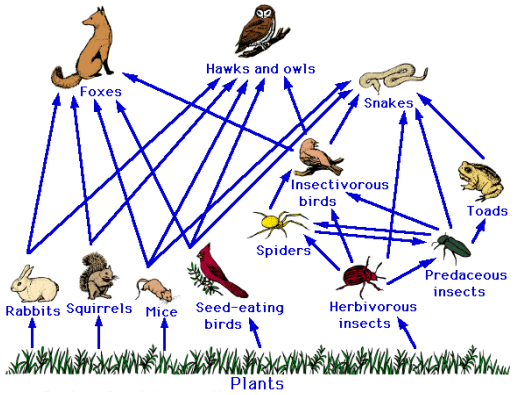
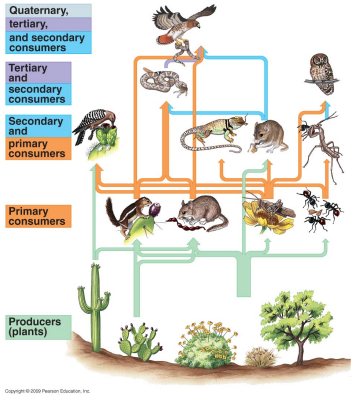


This is an example of a food web in an ecosystem.



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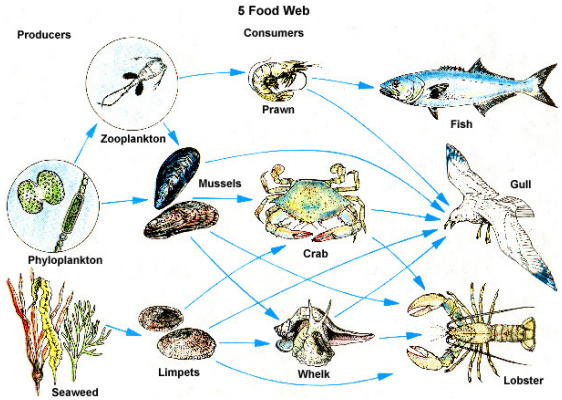

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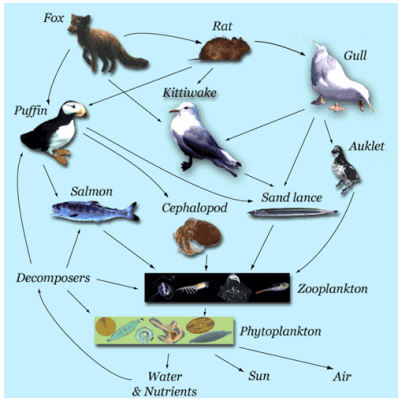
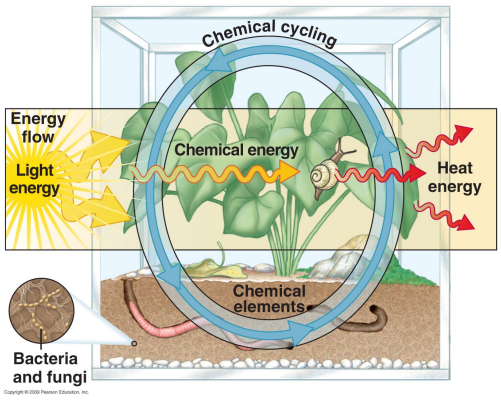
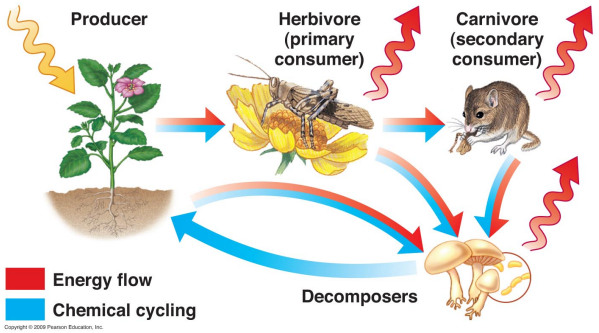


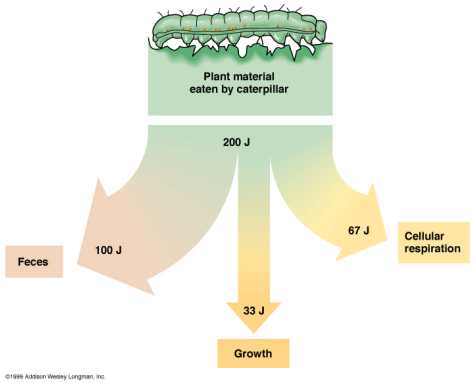
This is another example of a food web in an ecosystem.
What mistakes can you identify in this food web?



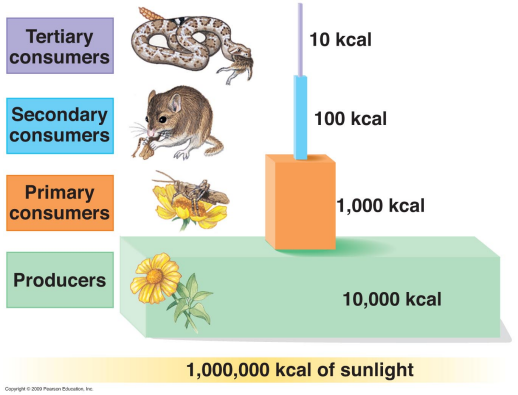
In all ecosystems, matter CYCLES and energy FLOWS.
Matter can be reused, but energy cannot.



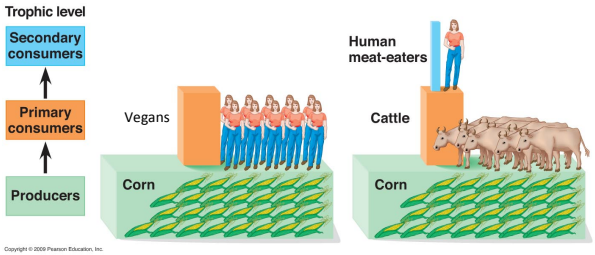
This diagram summarizes how energy flows and matter cycles.



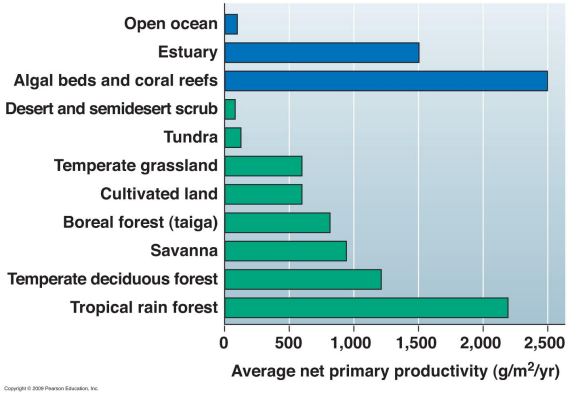
The 10% rule states that most of the energy from food goes to cellular respiration, heat, or waste. Only 10% (or less) is applied towards growth, which can go to the next trophic level.



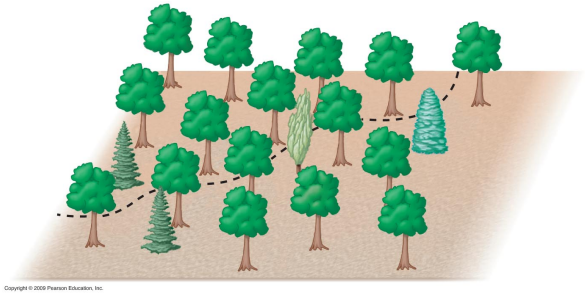
This is a diagram simplifying the concept of the 10% rule.



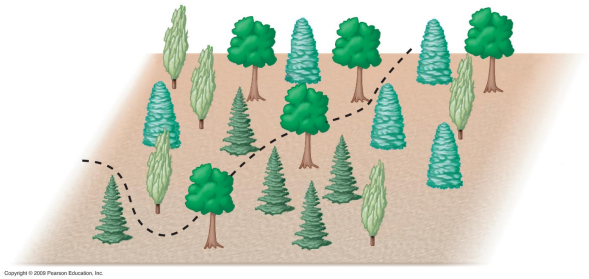
Due to the 10% rule, it would be MUCH better for the environment if all humans were vegans.



Net primary productivity is an indication of how successful photosynthesis is at each biome. The biomes with the most amount of plants or algae have the greatest net primary productivity.



This forest ("woodlot A") has very little species diversity.

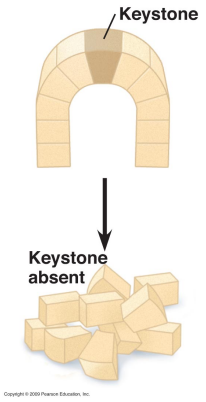


This forest ("woodlot B") has so much more species diversity.

TABLE 37.10 RELATIVE ABUNDANCE OF TREE SPECIES IN WOODLOTS A AND B

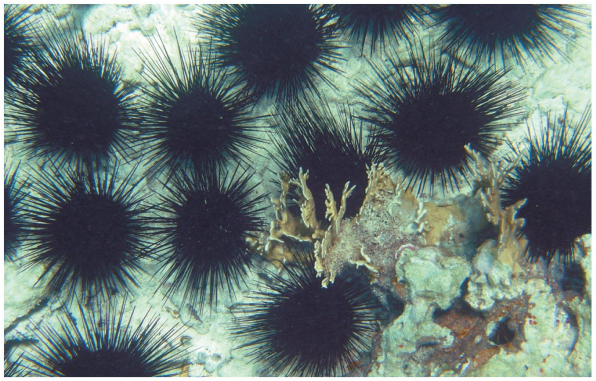
Species	Relative Abundance in Woodlot A (%)	Relative Abundance in Woodlot B (%)
	80	25
	10	25
	5	25
	5	25

This chart summarizes the species diversity of the forests in the previous two slides.



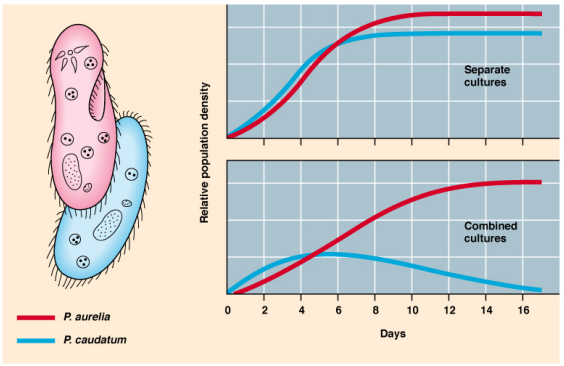
A keystone species has a MAJOR impact on an ecosystem, even if it is physically small or has a small population size.

This sea star is a keystone species because it keeps the number of mussels in check.

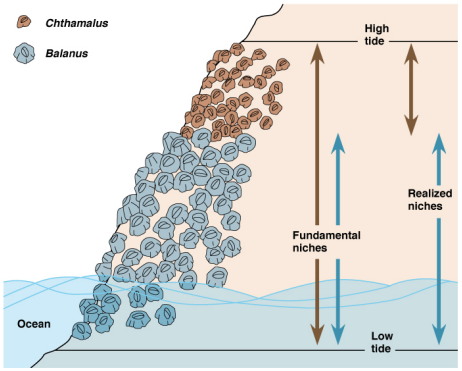


These sea urchins are a keystone species. It eats seaweed...

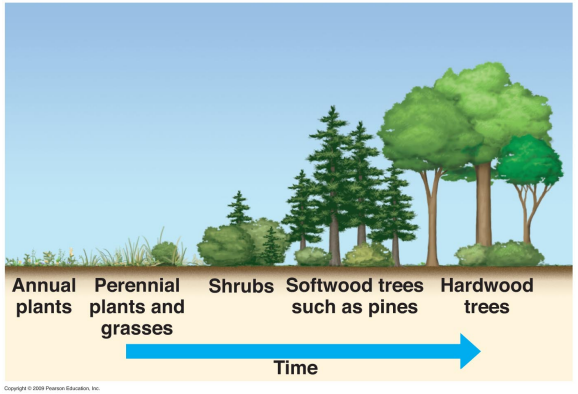
...which prevents the coral reef from being overtaken by seaweed and blocking sunlight below.



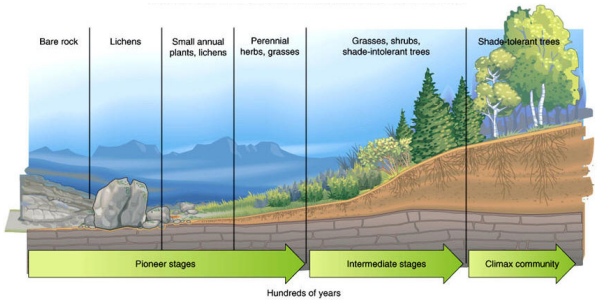
When two organisms compete for the same niche, only one organism can win.



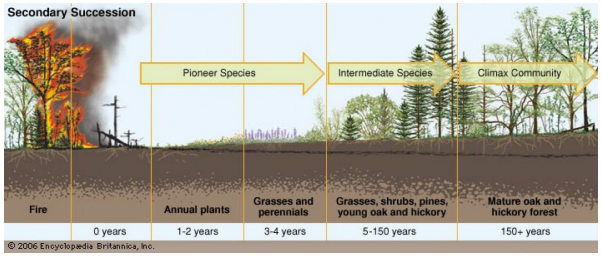
If an organism's fundamental niche is not available, it reverts to its realized niche (backup plan).



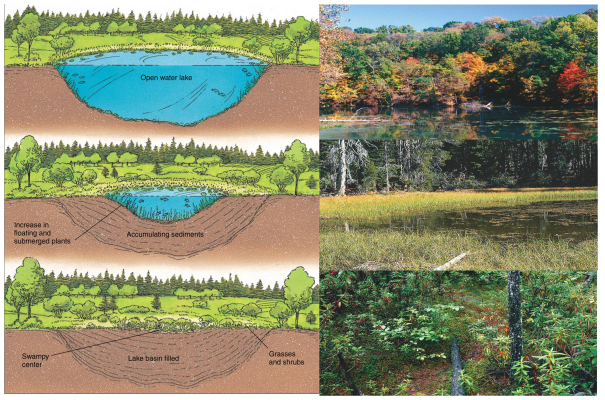
Succession occurs when bare land slowly becomes a forest over hundreds of years.



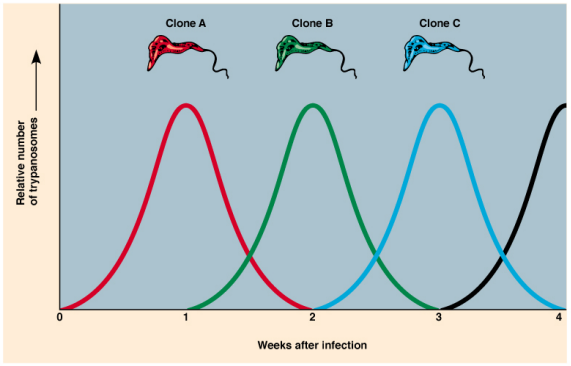
Primary succession occurs if the landscape begins with bare rock.



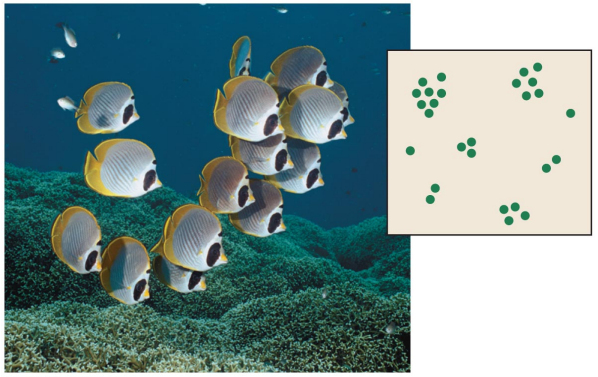
Secondary succession occurs in the landscape begins with soil. For example, secondary succession can occur after a forest fire.



Lake succession occurs if a lake dries up, fills with sediments, and slowly develops into a forest.

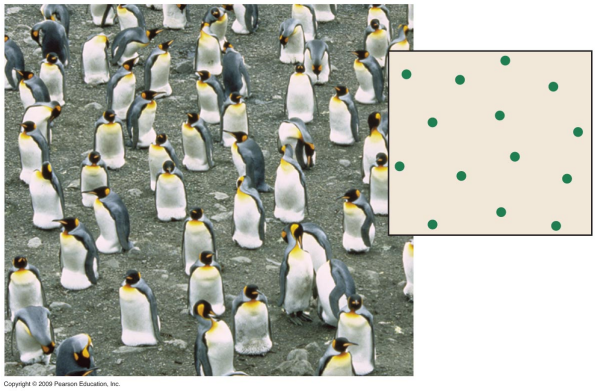


When an organism is infected or dies, there is a succession of parasites that feed on it.

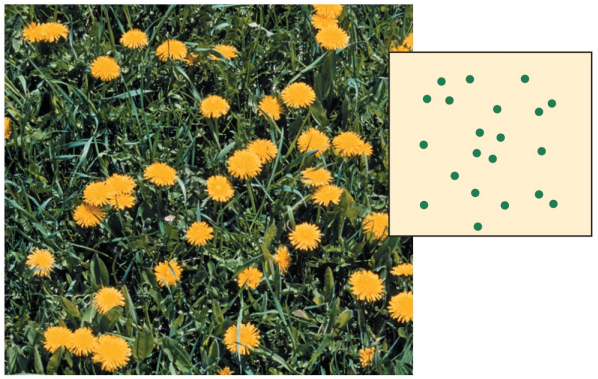


These fish are showing a clumped dispersion pattern to reduce the risk of predation.

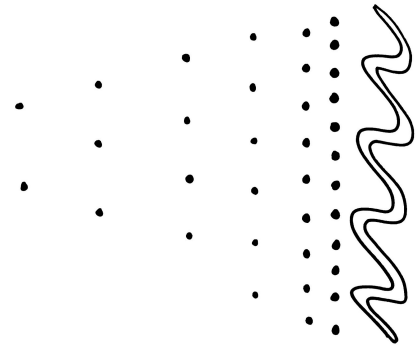
Buffalo, swans, fish, and flowers all show a clumped dispersion pattern.



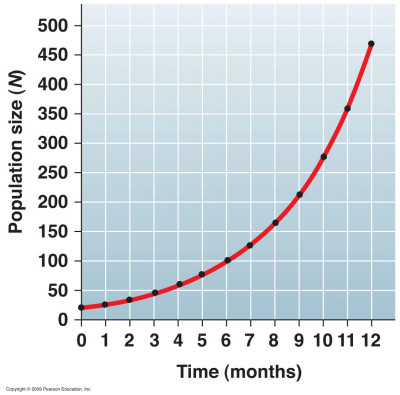
These penguins are showing a uniform dispersion pattern as a result of territorial behavior.



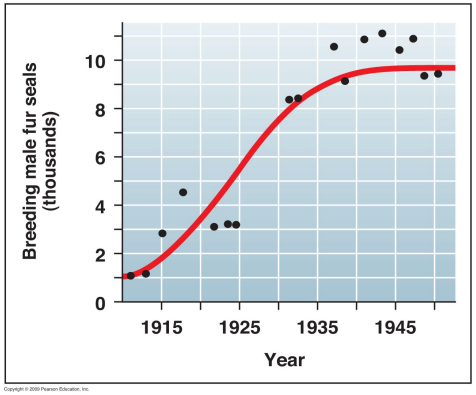
These dandelions are showing a random dispersion pattern based on how the wind blew their seeds.



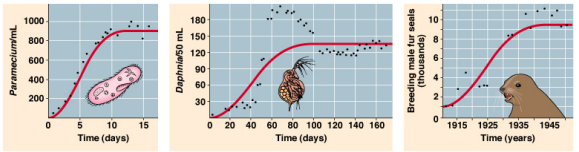
A gradient dispersion pattern occurs when most organisms live near a natural resource (such as a river) and become spread out as they move away from the resource.



This graph shows stages 1 and 2 of a population growth curve. This is called exponential growth. The birth rate is higher than the death rate.



This graph shows all 3 stages of a population growth curve. Stage 3 is called logistic growth. The birth rate equals the death rate.

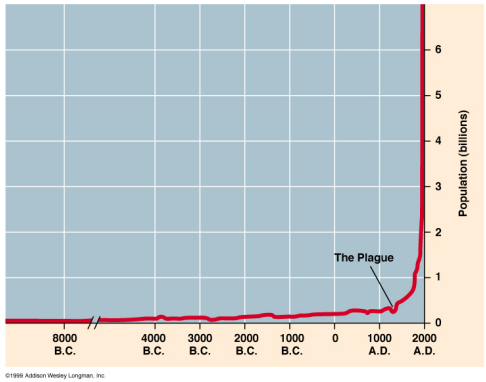


(a) A *Paramecium* population in laboratory culture

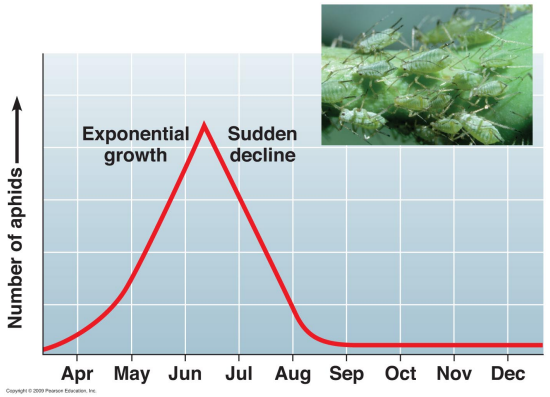
(b) A *Daphnia* population in laboratory culture

(c) A fur seal (*Callorhinus ursinus*) population on St. Paul Island, Alaska

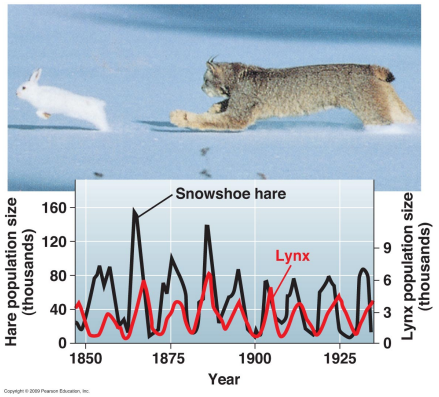
Carrying capacity is the maximum population size the environment can support. Carrying capacity occurs during periods of logistic growth (the birth and death rates are equal).



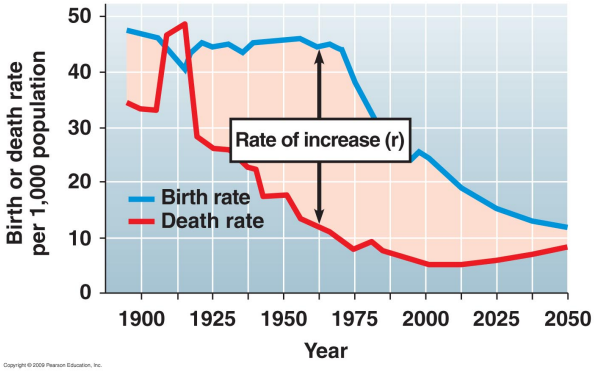
This graph shows that humans exhibit exponential growth and have not reached carrying capacity yet.



Occasionally, exponential (or logistic) growth can be interrupted by biotic or abiotic factors.



The lynx and the hare exhibit a typical predator-prey population cycle.



A population grows the most when the birth rates is high and the death rate is low.

TABLE 37.2 INTERSPECIFIC INTERACTIONS

Interspecific Interaction	Effect on Species 1	Effect on Species 2	Example
Competition	–	–	Squirrels/black bears
Mutualism	+	+	Hippo/microbes in hippo stomach
Predation	+	–	Crocodile/fish
Herbivory	+	–	Hippo/grasses
Parasites and pathogens	+	–	Heartworm/dog; *Salmonella*/humans
Commensalism	+	0	barnacles/gray whale

Organisms interact with other species in many different ways.

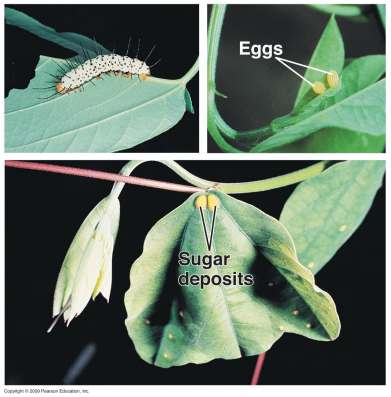
CO-EVOLUTION (+/-):
Herbivores evolved large, flat teeth in order to grind up tough leaves and vegetation.

CO-EVOLUTION (+/-):
Roses evolved thorns on their stems in order to protect themselves against herbivores.

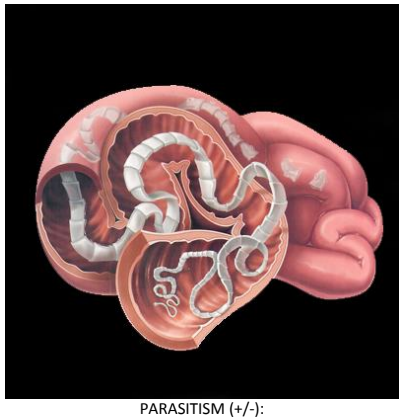
CO-EVOLUTION (+/+):
Flowering plants and insects co-evolved a mutualistic relationship.

CO-EVOLUTION (+/+):
Rafflesia evolved a mutualistic relationship with flies, which are attracted to its stench.

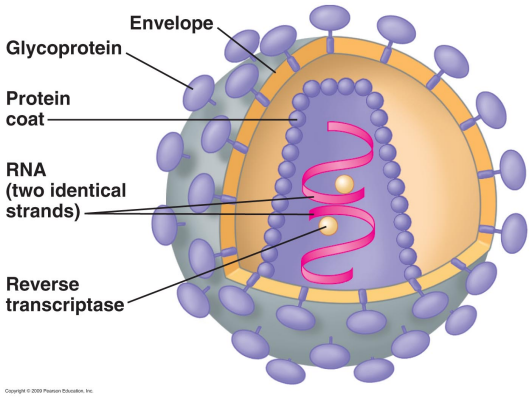
CO-EVOLUTION (+/-):
Poison ivy evolved poisonous chemicals to protect itself against herbivores.



CO-EVOLUTION (+/-):
These caterpillar eggs look just like the sugar deposits on the passionflower vine.



PARASITISM (+/-):
The tapeworm grows by eating the food in the intestines.



PARASITISM (+/-):
HIV infects a human T-cell and uses it to reproduce.

PARASITISM (+/-):
The aphids steal the plant's sap and offer nothing in return.

COMMENSALISM (+/0):
Barnacles attach to the grey whale but the whale is unaffected.

COMMENSALISM (+/0):
The shrimp cleans the sea anemone, but the sea anemone isn't really affected.

MUTUALISM (+/+):
E. coli produces vitamin K in your intestines. Your intestines provide E. coli with food.

MUTUALISM (+/+):
A lichen consists of fungi (decomposer) and algae (photosynthesis).

MUTUALISM (+/+):
The corals provide shelter and the algae (not shown) provide glucose.

COMPETITION (+/- or -/-):
Two peacocks fight each other for a mate.

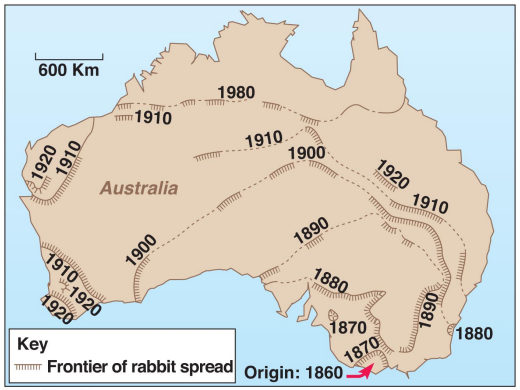
COMPETITION (+/- or -/-):
Two dogs fight over food or territory.

PREDATION (+/-):
A bird flies down and eats a worm.

PREDATION (+/-):
A shark eats a fish.

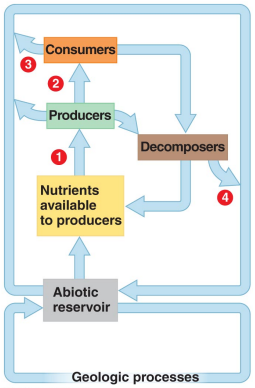
PREDATION (+/-):
A gray tree frog camouflages against a tree to protect against predation.

PREDATION (+/-):
The poison-arrow frog shows bright colors as a warning against predators.

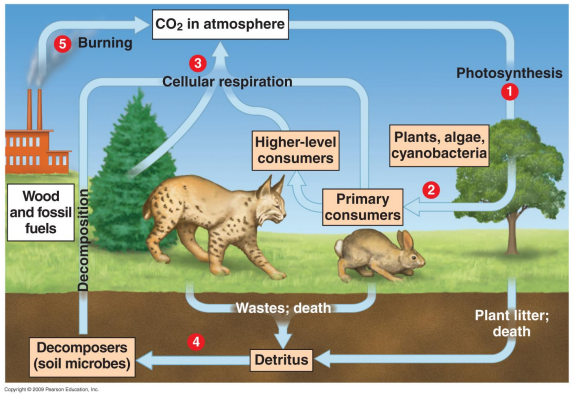


In 1859, 24 rabbits were brought to Australia. 50 years later, there were over 100,000,000 of them. The rabbits are an example of an invasive species.

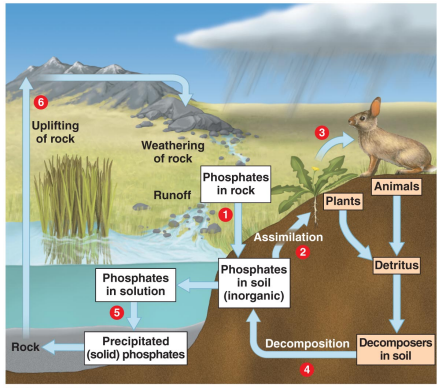
The rabbits multiplied because they had no natural predators in Australia. This is typical of an invasive species.



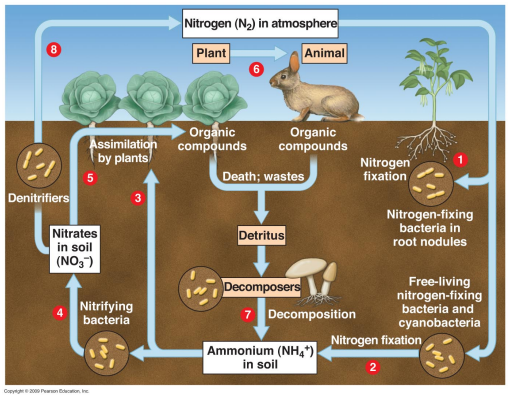
Nutrient cycles involve both the living organisms (biotic factors) and the non-living environment (abiotic factors).



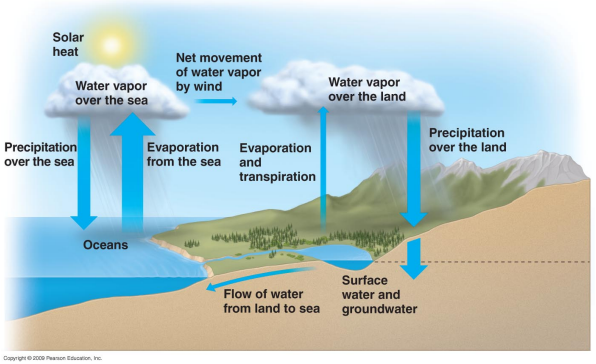
The carbon cycle primarily involves photosynthesis and cellular respiration.



The phosphorus cycle is important because it phosphorus is found in DNA, RNA, and cell membranes.

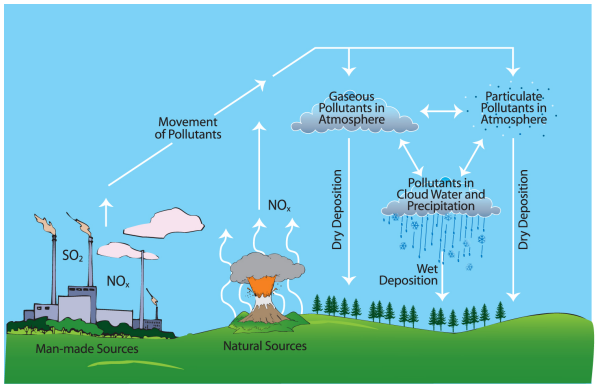


The nitrogen cycle is important because nitrogen is found in DNA, RNA, and proteins.

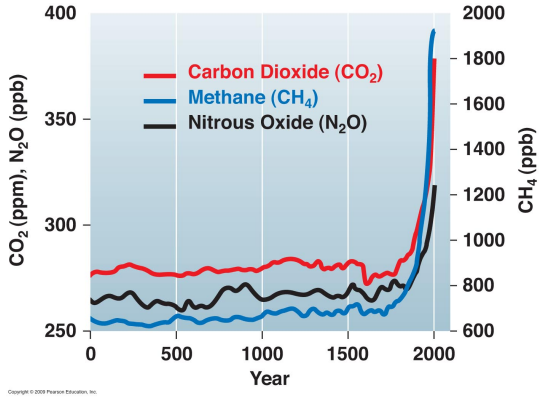


The water cycle involves evaporation, condensation, and precipitation.

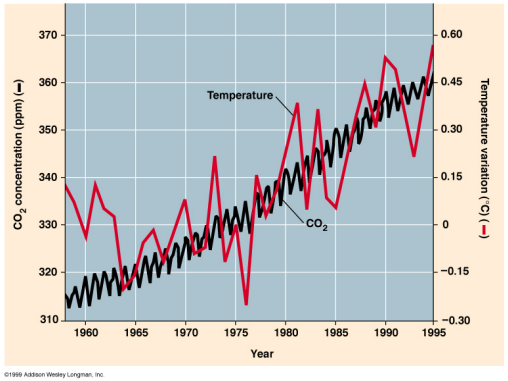
Smog (seen here in Los Angeles) is a mixture of smoke and fog.
It is primarily caused by the burning of fossil fuels



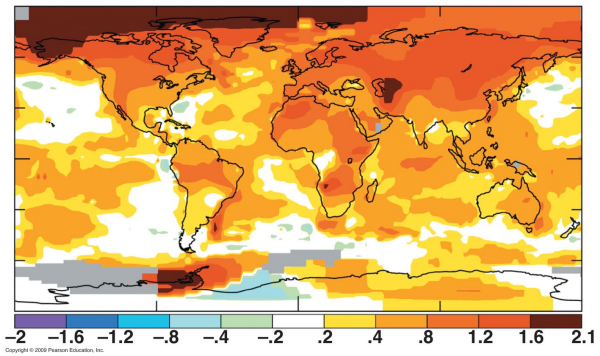
Acid rain is caused by sulfur gases combining with H_2O in the atmosphere to form sulfuric acid (H_2SO_4). Sulfuric acid impairs the ability of plant roots to absorb nutrients.



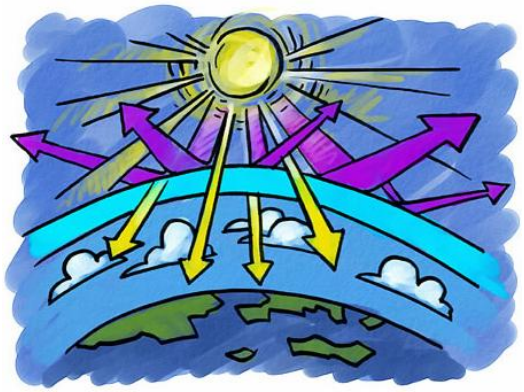
The atmospheric levels of greenhouse gases (caused by pollution) have skyrocketed.



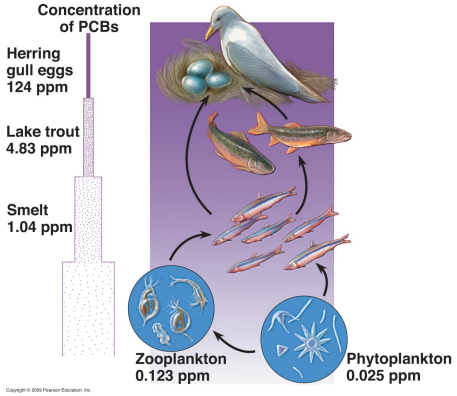
There is a direct correlation between levels of CO_2 and global temperature change.
GLOBAL WARMING IS NOT A MYTH!



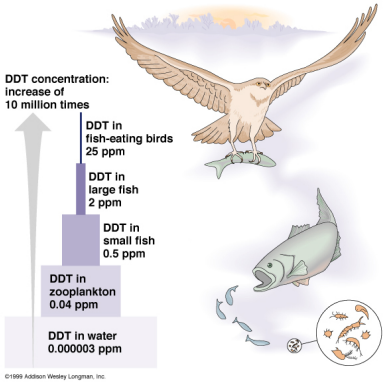
This map shows how the global temperature has changed over the past 50 years.



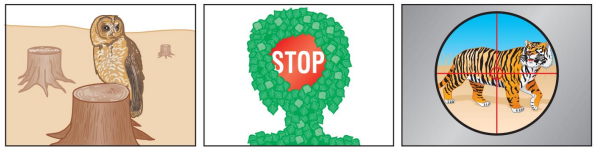
The ozone layer protects us from the harmful ultraviolet rays of the sun. CFC's (chlorofluorocarbons), found in aerosol cans and coolants, destroy the ozone molecules.



DDT is a fat-soluble toxin, so it accumulates in the fat tissues of organisms...



...and gets biomagnified as it makes its way up the trophic levels (food chain).



Habitat destruction, invasive species, and overexploitation are 3 threats to biodiversity.