Unit 1-The Living World

The ecosystem is the interaction between living (_____) and non-living (_____) factors.

Biotic Factors

Abiotic Factors

Producers rely on energy from the _____ and produce nutrients through the process of _____. Examples include _____, _____ and _____.

Herbivores feed on _____, _____ and _____. And rely on energy obtained by eating producers. These animals are NOT _____. Examples include _____ , _____and _____

Carnivores feed on _____. These organisms are considered _____. They use _____, _____, _____, _____ and _____.

Omnivores feed on _____ and _____. Examples include _____, _____ and _____

Detritivores and scavengers feed on _____ animals and include _____, _____, _____, and _____.

Biotic factors rely on _____ factors to survive

Biotic

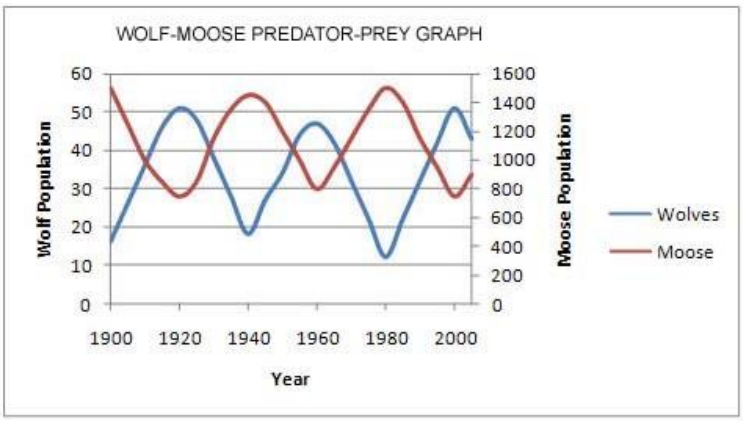
Abiotic

Relationships

Predator- Prey (+ , -) In a stable ecosystem, there will be more _____ than _____, although these numbers may fluctuate over _____

** Parasite/host will have the same distinction (+ , -)

Describe the fluctuation in each population.



List some factors that can alter this graph.

Symbiotic relationships are _____ and _____

Mutualism (+ , +) is where _____ organisms benefit. Examples inlcude:

Commensalism (+ , 0) is where one organism _____ and the other is unaffected

Examples include:

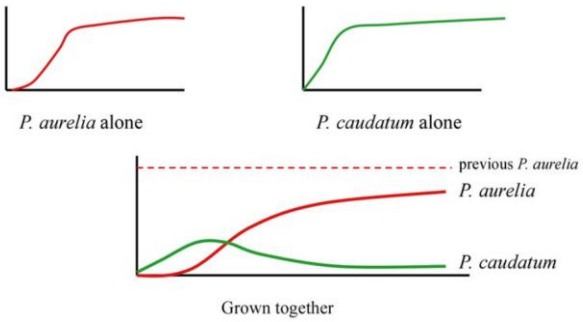
Parasitism (+ , -) is where the parasite benefits and the _____ is harmed. Examples include:

Parasitoids lay eggs inside a _____ organism, then the larvae _____ the host

Competition

Competition (- , -) occurs when two or more organisms are trying to use the _____ resource. Examples include:

Competitive exclusion is when _____ species would normally survive just fine, but when put together, one will clearly outcompete the other.



Will also be seen if too many young are born and the parents can only take care of and feed so many.

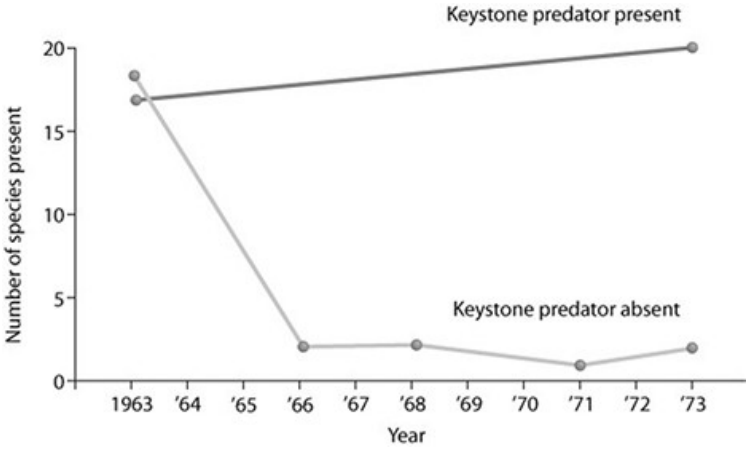
A **keystone species** plays a major role in the _____/_____. Without the keystone species, the whole communit may _____. Examples inlcude _____ and _____

Beavers alter the commuity by…

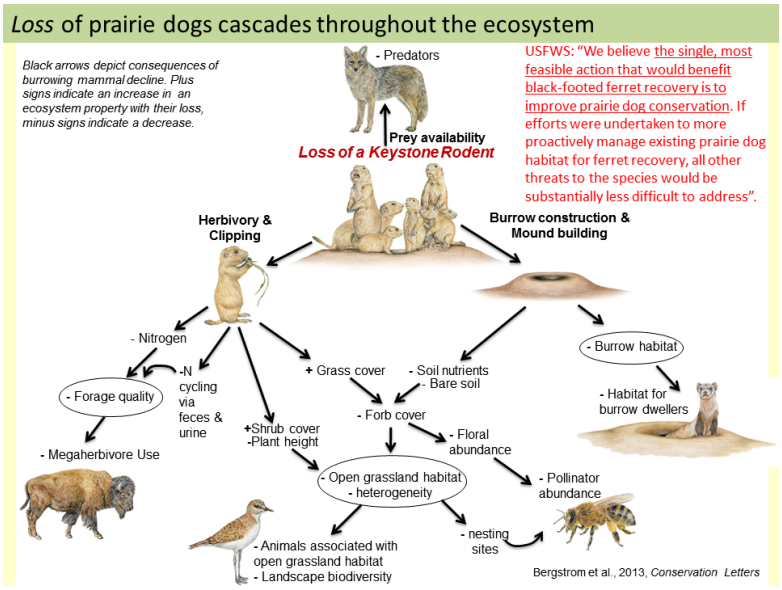
Sea stars alter the community by…..

How long did it take for the number of species to decline once the keystone predator was removed?

Approximately how many species were lost over that time?



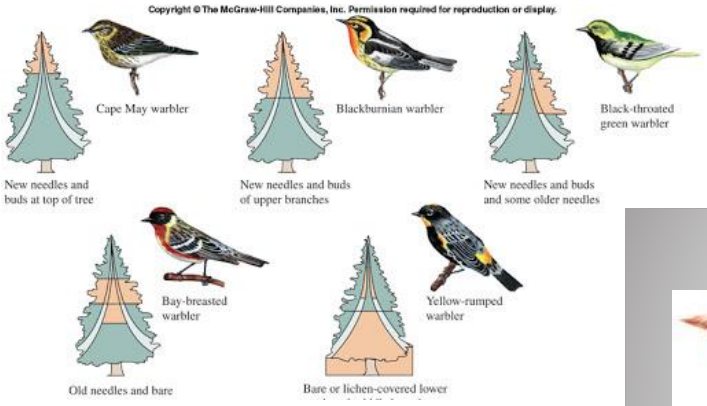
What happened in the keystone species/wolf video?

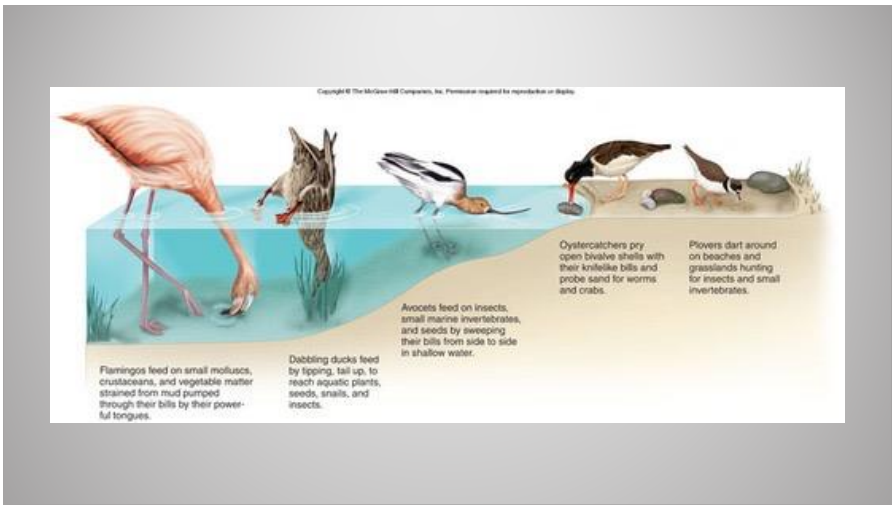


An **indicator species** is an organism whose presence or absence reflects a _____ environmental condition. Indicator species can signal a change in the biological conditions of an ecosystem.

Resource Partitioning allows different species to use the _____ resource without too much _____

Spatial partitioning occurs withing a tree or coastline.

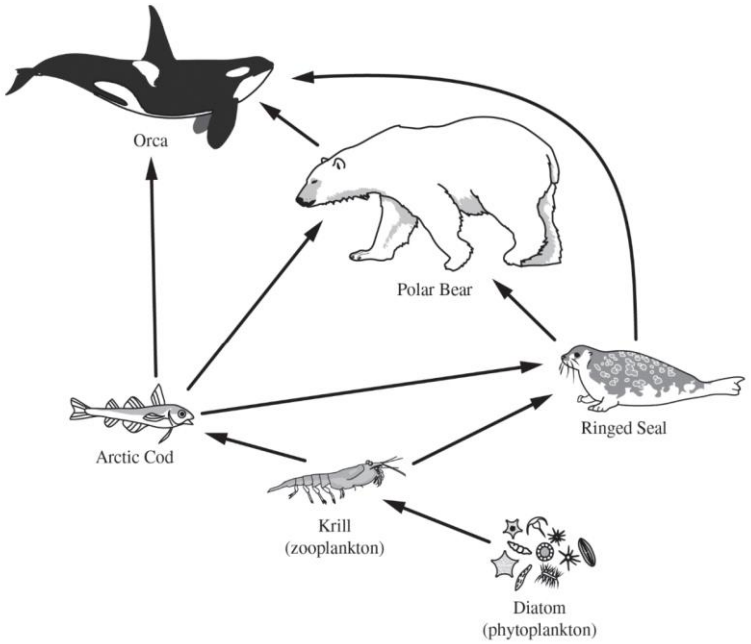




Other examples of partitioning include:

Practice FRQ

Identify two organisms that compete for a shared resource. **Describe** how resource partitioning could reduce competition between the two organism you identified.

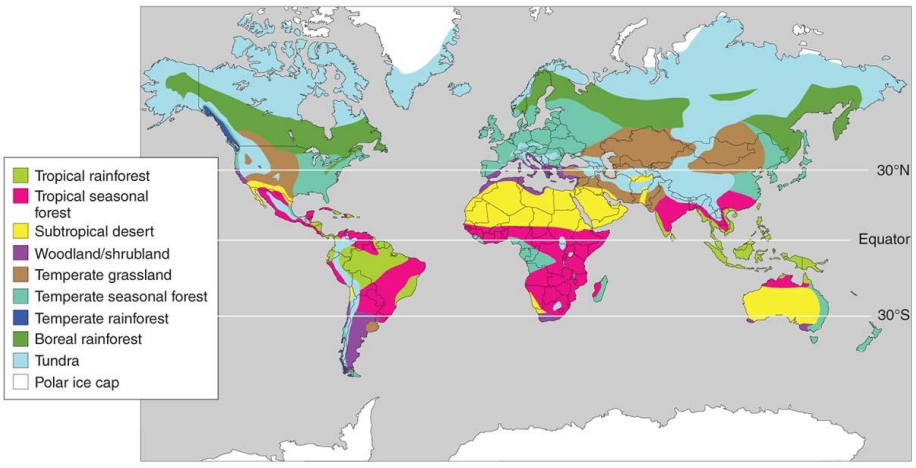


Terrestrial Biomes

Biomes contain characteristic _____ of plants and animals that result from and are adapted to its _____

The world's distribution of biomes is _____ and has changed in the past and may shift _____ as a result of _____ change.

Terrestrial biome is a geographic region categorized by a particular combination of average annual _____, _____ and distinct _____ growth forms on _____.



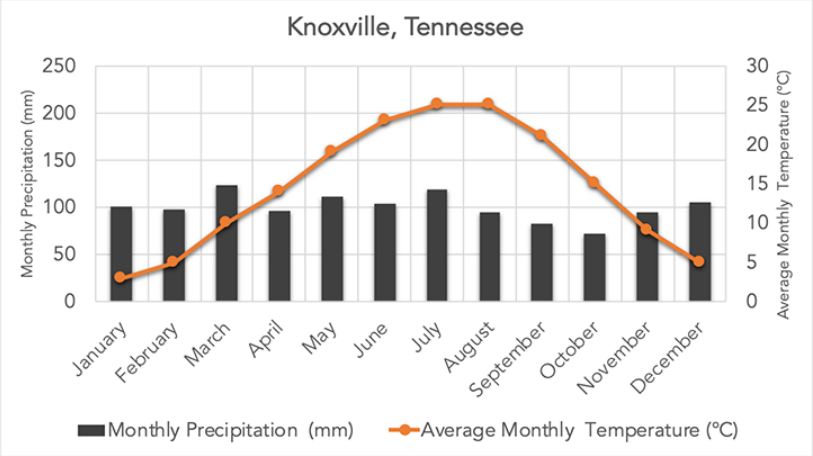
As you travel from the _____ towards the _____, the biomes change. As average temperatures and precipitation amounts increase, so does _____

Climate diagrams display monthly _____ and _____ values which help determine productivity.

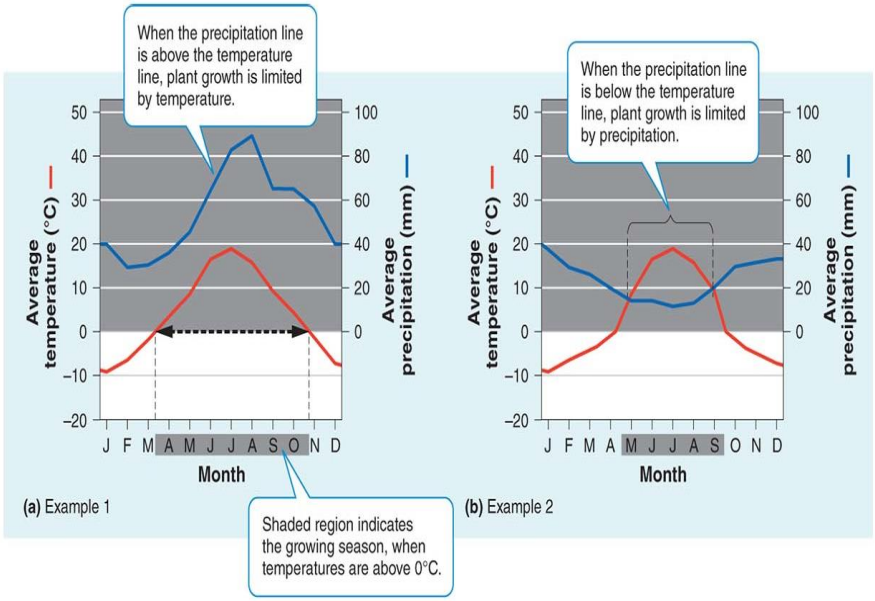
What is the temperature range for Knoxville, TN?

What is the average monthly precipitation?

Would you say it is consistent throughout the year?



You can also use a climate graph to determine if temperature or precipitation limits plant growth.



Tundra

Tundra- A _____ and _____ biome with low growing vegetation.

In winter, the ground in completely _____ with a growing season about _____ months long. The underlying soil is permanently frozen and is called _____.

Temperature range _____ to _____

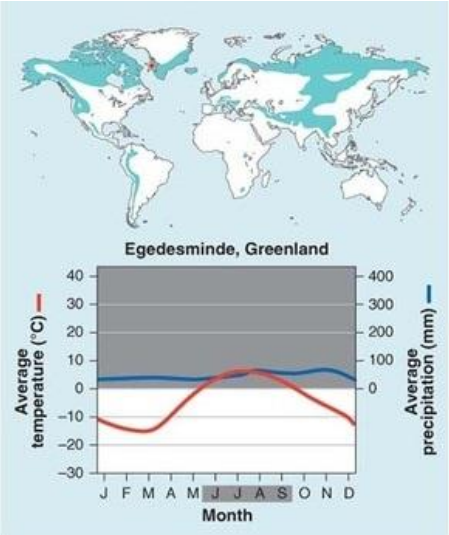
Precipitation about _____ per month

Found at high _____ and high _____

Soil nutrients are very _____

Name three specific places you will find tundra in the world.

Why is the tundra not seen in Australia?



Boreal Forest (Taiga)

The **boreal forest** is composed primarily of _____ trees that can withstand cold winters and a _____ growing season. They are found between _____ and _____ in North America, Russia and Europe, with the largest area of old growth found in _____. Tree species include _____, _____, _____ and some _____ trees.

Temperature range _____ to _____

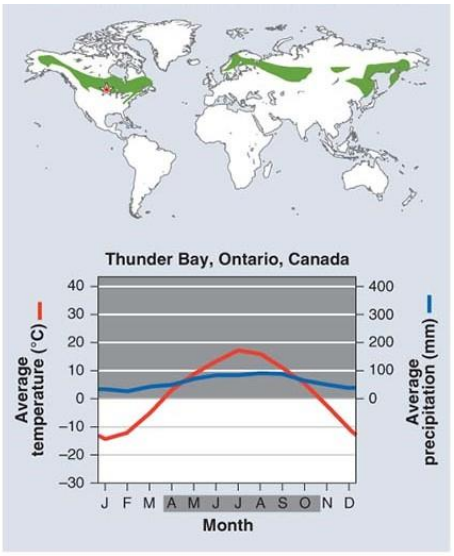
Precipitation about _____-_____ per month

Soil nutrients are _____ because

Needles decompose _____

Bad for _____

Good for _____



Temperate Rainforest

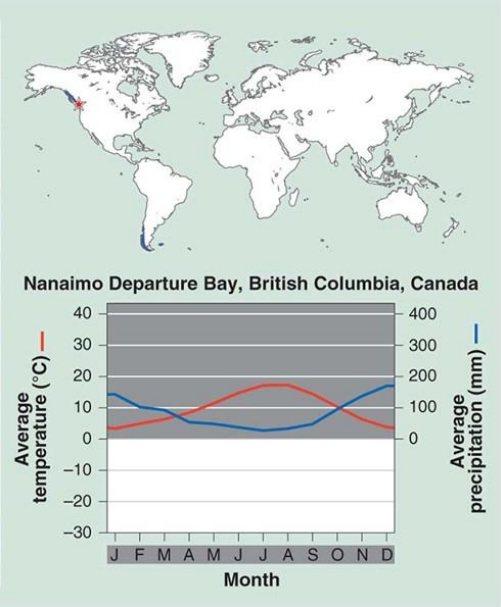
Temperate Rainforests are _____ with moderate temperatures and _____ precipitation. They are found near the coast of N. America from _____ to _____, as well as southern Chile and New Zealand. _____ moderate the temperatures and bring the precipitation. The nearly _____ month growing season supports the growth of _____ trees, some reaching almost 300 feet tall. The winters are _____ and the summers are _____.

Temperature range _____ to _____

Precipitation about _____-_____ per month

Found at mid _____

Soil nutrients are very _____ because the nutrients are taken up quickly by the growing trees.



Temperate Seasonal Forest (Deciduous)

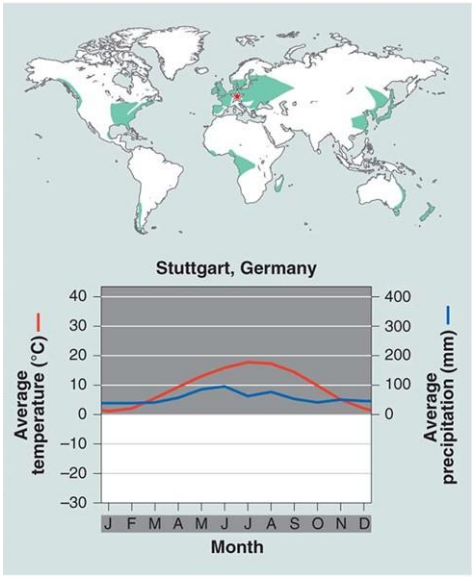
The **temperate seasonal forest** has _____ summers and _____ winters with over _____ precipitation annually. They are found along the east coast of the US, throughout Europe and Asia. The US has the largest area of deciduous forests.

The warmer temperatures favor _____ so the soil nutrients are good.

Temperature range _____ to _____

Precipitation about _____-_____ per month

First biome converted to _____ on a large scale.



Woodland/Shrubland

The **woodland/shrubland** have _____ dry summers with mild _____ winters. Found on the coast of _____, southern _____ and surrounding the _____Sea. There is a _____ month growing season, but low precipitation in the summer makes _____ a problem. The plants in the region are well adapted for _____ and _____. These include shrubs, scrub oaks and sagebrush.

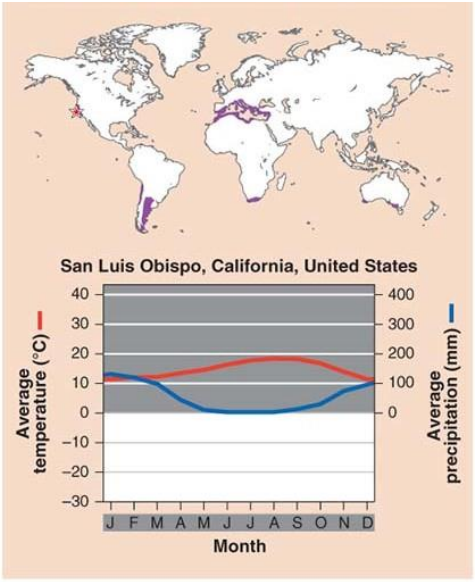
Temperature range _____ to _____

Precipitation about _____-_____ per month

Good for grazing animals and growing grapes, even though the soil nutrients are _____.

Chapparal-Broad leafed _____, _____, small bushes and shrubs.

Why is California continually battling wildfires throughout the summer?



Why is the winter slightly better?

Temperate Grassland/Cold Desert

The **temperate grassland** region is characterized by _____, _____ winters with _____ and _____ summers. They have the _____ annual precipitation of any temperate biome. They are found in the _____ of North America as well as in South America, Asia and Europe.

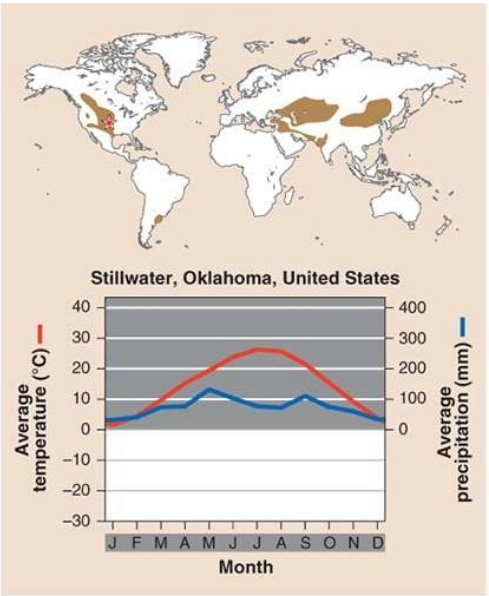
They are made up of _____ and non _____ flowering plants.

Temperature range _____ to _____

Precipitation about _____-_____ per month

_____ soil nutrients

Many converted for _____



Tropical Rainforest

Tropical rainforests are a _____ and _____ biome founund between _____ and _____ with little seasonal _____ variation with _____ precipitation. They contain the most biodiversity per hectacre and contain up to 2/3 of the planets terrestrial species.

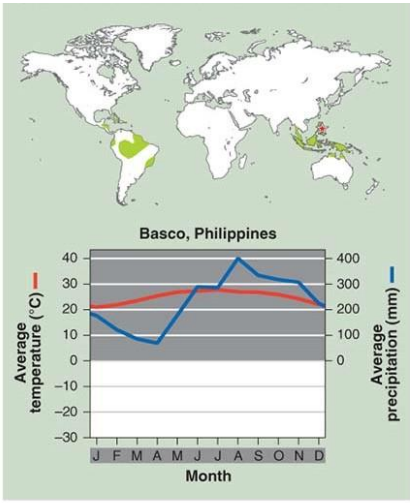
Temperature range _____ to _____

Precipitation about _____-_____ per month

_____ soil nutrients because plants grow so fast,

****They take up the nutrients before they can get incorporated.

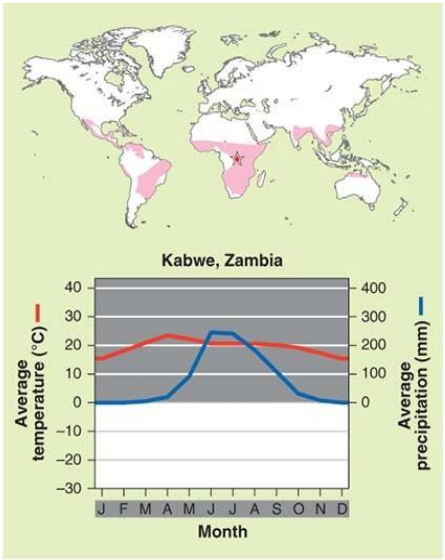
Why are equatorial regions so warm?



The soil is so bad because when vegetation is removed, the

Soil that is left is quickly depleted of _____.

Tropical Seasonal Forest/Savanna



Tropical seasonal forest/savanna have _____ temperatures with a distinct _____ and _____ season. They are found in much of central America, the Atlantic coast of South America and in sub Saharan Africa. The soil is fairly _____. They are dominated by grasses and shrubs, but scattered _____ trees may be found.

Temperature range _____ to _____

Precipitation about _____-_____ per month

These forests are great for wildlife because the trees give animals a place to _____and _____ from predators.

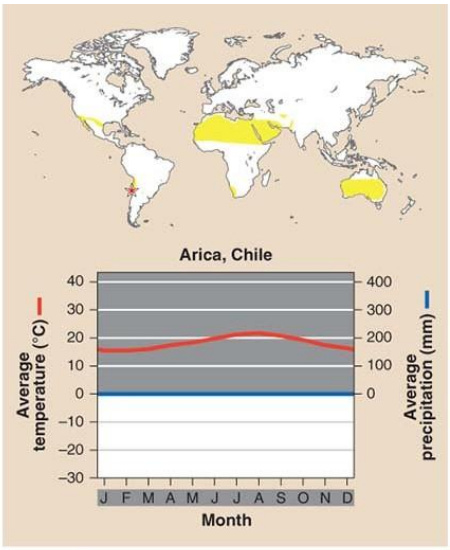
Subtropical Desert

Subtropical deserts are found near _____ and _____. They have _____ temperatures with extremely _____ conditions with sparse vegetation. The Mojave Desert, Sahara (Arabian) desert as well as the Great Victoria Desert in _____. Cacti, _____ and succulent plants are found because of their ability to prevent water _____.

Temperature range _____ to _____

Precipitation about _____-_____ per month

Very _____ soil nutrients because it is primarily _____.



Practice FRQ

Identify one characteristic of a biome and **explain** how that characteristic determines the community found in that biome.

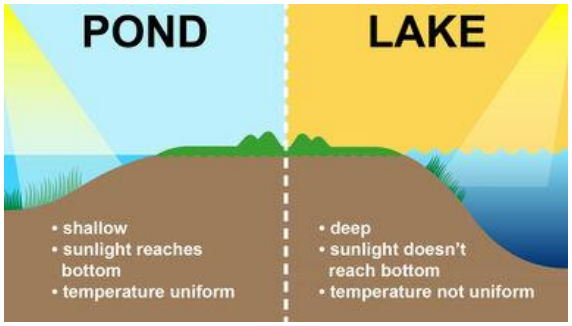
Aquatic Biomes

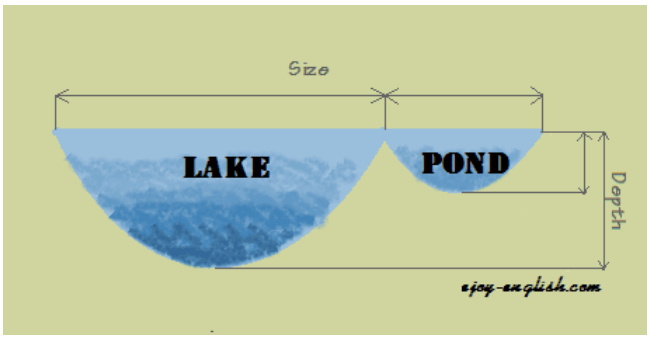
Fresh water biomes have low _____ (salt content) and include:

Streams and rivers are flowing _____ water that may originate from underground _____ or as runoff from rain or _____. Streams are generally _____ where rivers are _____ and carry more water.

Moving water stirs up sediment and can make the water cloudy - _____

Lakes and ponds contain standing _____ and some may be so deep that they cannot support _____. Lakes are generally _____ than ponds, but the distinction is tough to tell by simply looking at them.





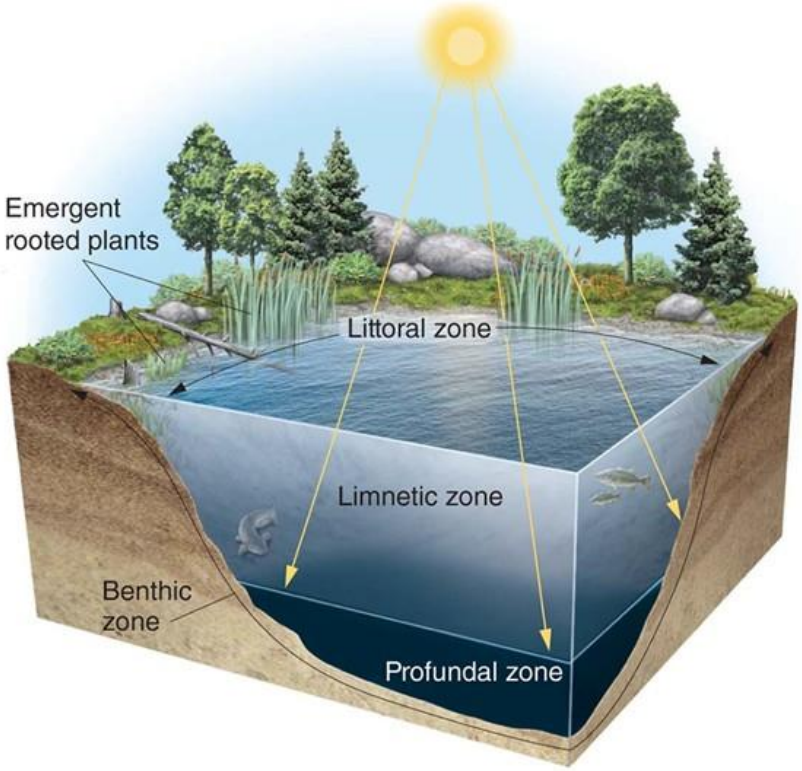
Littoral Zone-The _____ zone of soil and water where _____ and emergent _____ with roots grow.

Limnetic Zone-The deeper zone where plants do not _____

Phytoplankton-_____ algae

Profundal Zone-The region of water where _____ does not reach.

Benthic Zone-The muddy _____ of a lake, pond or ocean.



Primary production in lakes:

Oligotrophic-A lake with _____ levels of productivity

Mesotrophic-A lake with a _____ amount of productivity

Eutrophic-A lake with _____ levels of productivity.

Freshwater wetlands are _____ or _____ by water for at least part of the year but are shallow enough to support _____ vegetation. These are some of the most productive biomes on Earth.

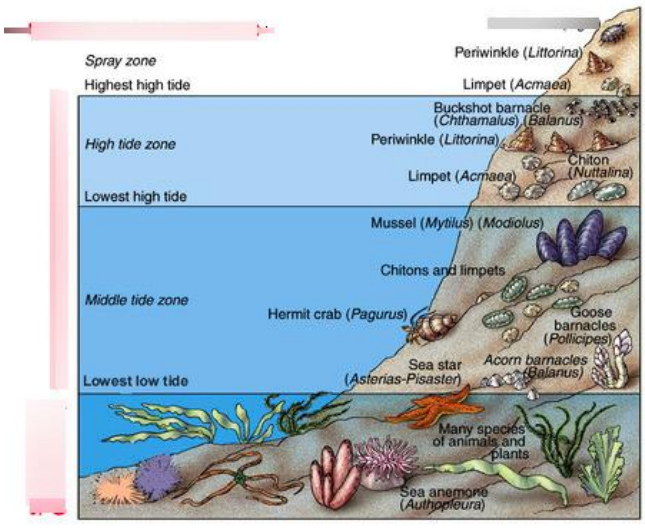
Issues with freshwater-It may become _____ from pollution and acid rain. This is measured in pH. The more acidic, the lower the pH. Water can become HARD with the addition of elements such as _____ and _____. If organic waste is present, decomposition can lead to lower dissolved _____. The _____ requires minimum safety standards for water supplies.

Marine biomes have _____ salinity and include:

A **salt marsh** contains _____ woody emergent vegetation and are found along the coasts of _____ climates. These are some of the most productive biomes on Earth.

Mangrove swamps are found along the coasts of the _____ and sub _____ and contain salt tolerant trees with _____ submerged in water. These can be found protecting the coastlines in _____.

The **intertidal zone** is a narrow band of coastline between the _____ and _____ tide lines. Waves crash and make it a challenge for organisms to hold on.



Coral reefs are the most _____ marine biome and are found in _____ and _____ waters beyond the shoreline. These are the most diverse marine biome even though the water they are found in have relatively low _____ and _____.

Coral contains a symbiotic relationship with algae (Zooxanthellae) to help the coral (animal) survive in low nutrient water. Because of climate change and pollution, coral reefs are dying leaving behind the skeleton in a process called _____.

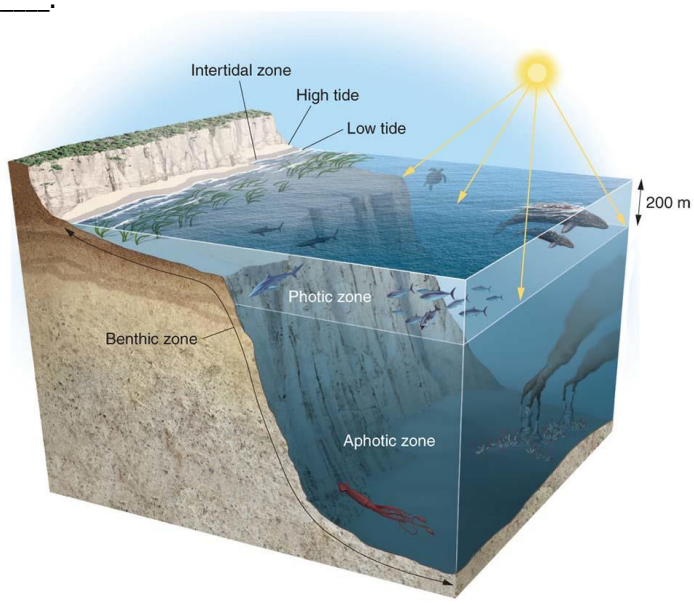
The **open ocean** is the deep water located away from the shoreline where _____ can no longer reach the bottom.

Photic Zone-Upper level of the ocean that receives enough light for _____

Aphotic Zone-The deeper layer that lacks enough _____ for photosynthesis

Chemosynthesis-A process used by some bacteria in the ocean to generate energy with _____ and _____.

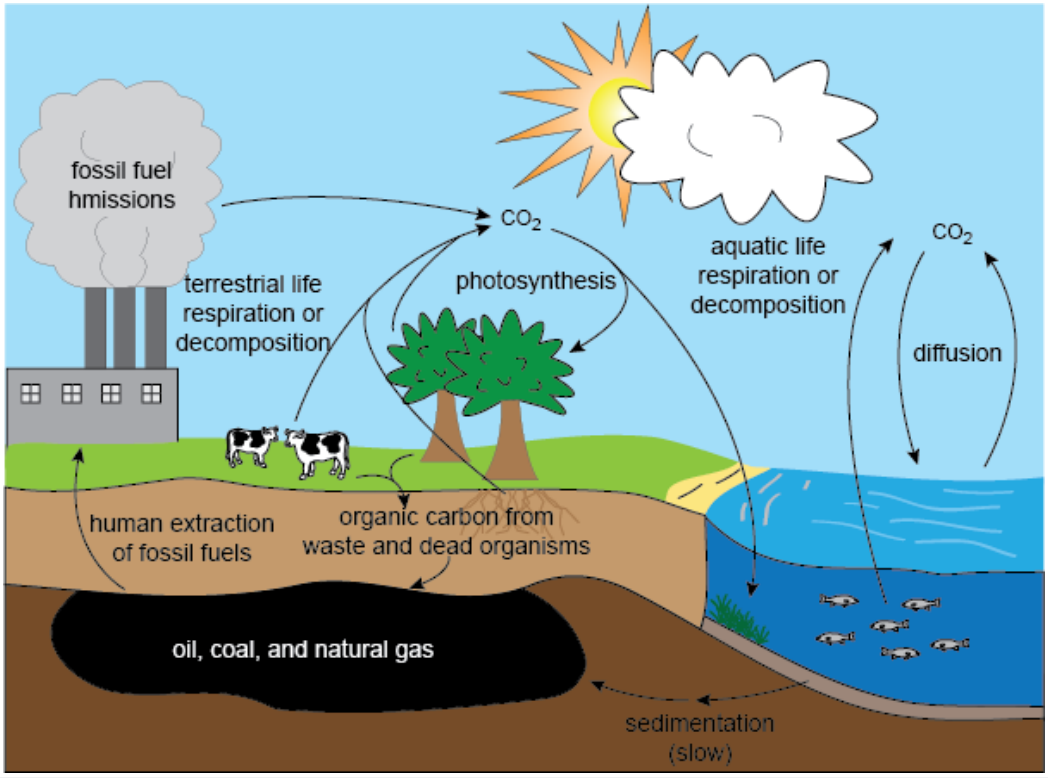
The importance of the photic zone is the algae there provide large amounts of _____ and remove large amounts of _____

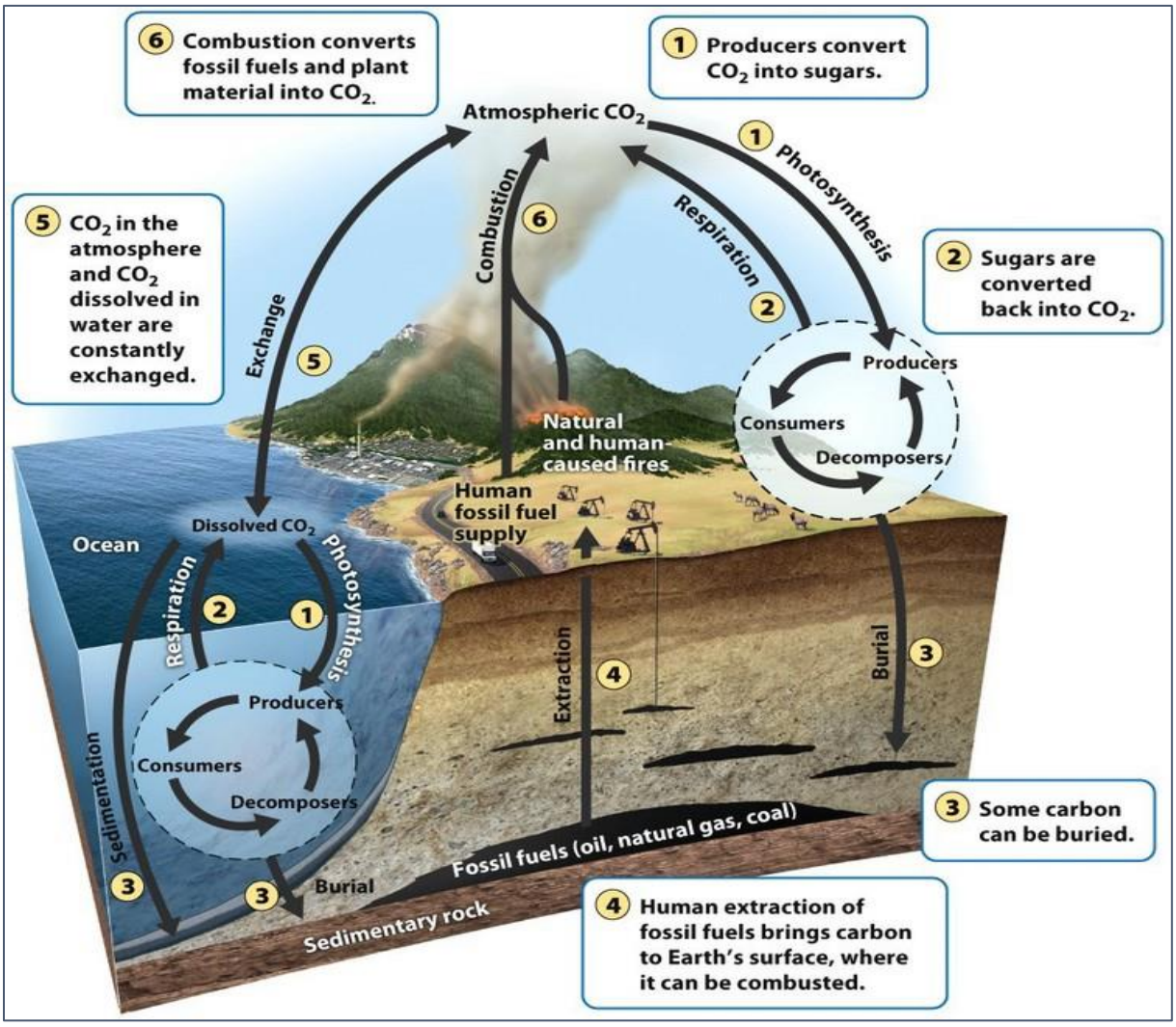


Practice FRQ

Identify an organism found in an aquatic biome and **describe** how that organism is uniquely adapted to live in that biome

The Carbon Cycle





Carbon is the most important element in living things and makes up about _____ of their total body weight. It can be found in long chains like _____ or the backbone of _____. Seven processes drive the carbon cycle:

Quick Slow

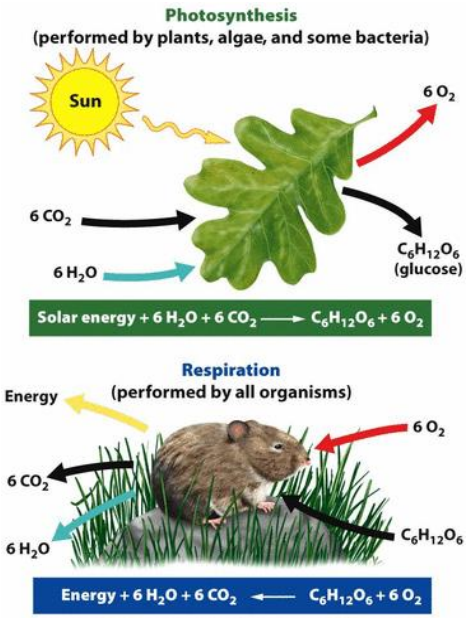
Carbon containing molecules will exchange between sources and sinks. Because they take a different amount of time, an imbalance arises. The _____ remains the largest reservoir of carbon containing compounds.

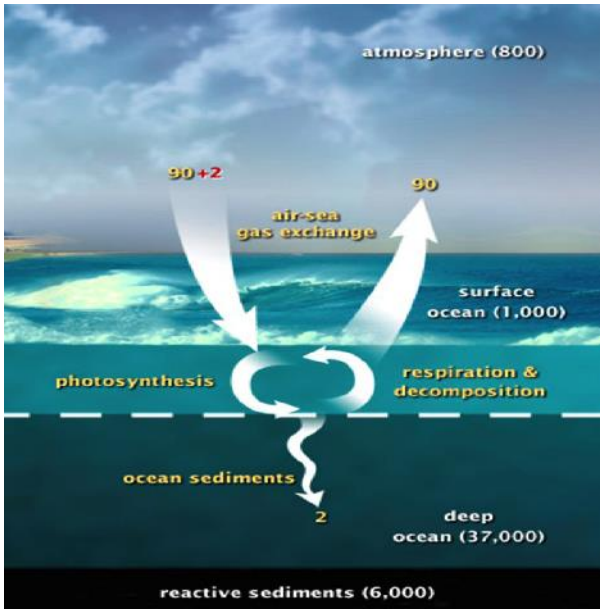
Carbon Sinks Carbon Sources

Two processes that exchange carbon quickly are _____ and _____. In these cases, the carbon is in the form of a gas or sugar

Photosynthesis	**Respiration**
Plants, _____ and phytoplankton	Done by _____ and _____ to release stored energy
Removes _____ from the atmosphere and converts it to _____	Uses _____ to break down _____ and release _____
Glucose is stored energy within the bonds	Releases _____ into the atmosphere
CO_2 sink	CO_2 source

***These two are usually in balance, so there is not net change of CO_2





There is a _____ exchange between the ocean and the atmosphere, by _____ in and out of the water. Because the levels in the atmosphere are getting higher, so are the levels in the ocean, causing ocean _____. (Gas form of carbon—CO_2)

Algae & phytoplankton: take _____ out of the ocean & atm. through _____

Coral reef & marine organisms with shells also take _____ out of the ocean to make calcium _____ exoskeleton

Sedimentation: when marine organisms die, their bodies sink to ocean floor where they're broken down into _____ that contain carbon

Burial: over, long, periods of time, pressure of water compresses calcium containing sediments on ocean floor into sedimentary stone (_____, _____) - long-term carbon and calcium reservoir

Fossil Fuels (FF): coal, oil, and natural gas are formed from fossilized remains of organic matter. Ex: dead ferns (coal) or marine algae & plankton (oil)

Extraction & Combustion: _____ up or mining fossil fuels & _____ them as energy source; releases CO_2 into atm.

Why are we in trouble????

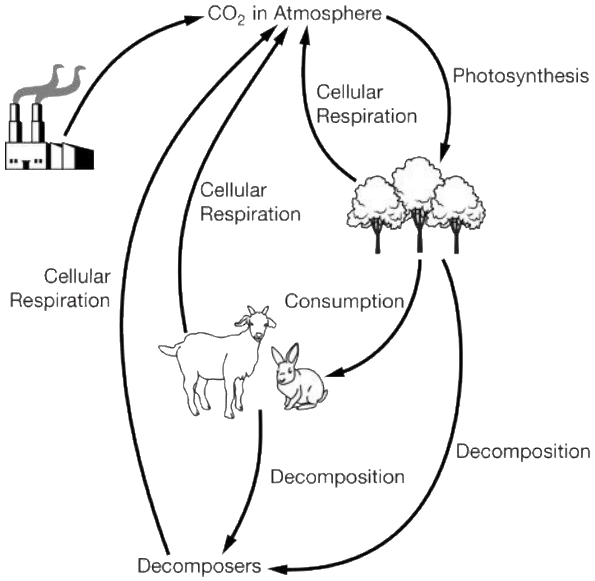
Which processes add CO_2 to the environment?

Which process removes CO_2 from the environment

Which process most directly result in the storage of carbon?

What is the major storage reservoir of carbon in the form of CO_2?

Which one is NOT in the diagram?

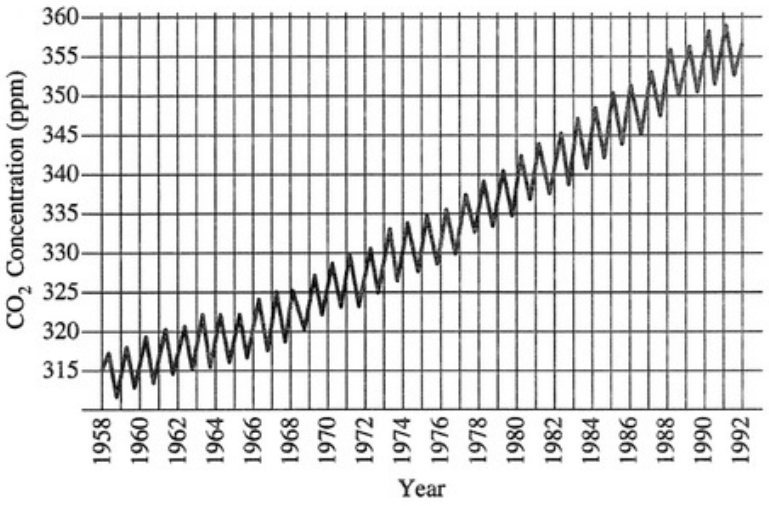


What is a possible cause for the increase in CO_2 over the past 30 years?

How much has the concentration of CO_2 increased from 1970-1990?

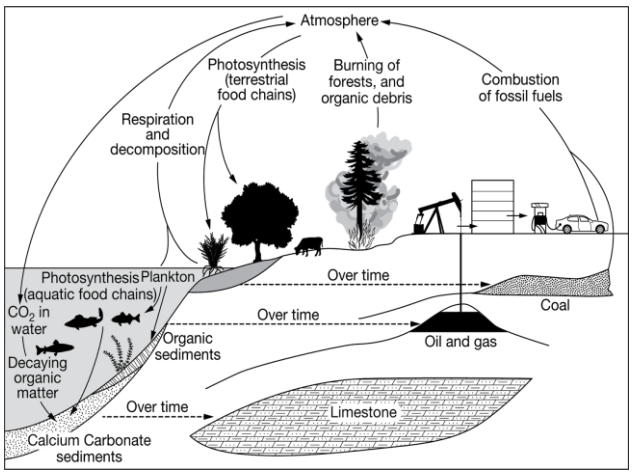
What is the percent change in CO_2 form 1970-1990?

Why are there fluctuations in the curve?



Practice FRQ

Identify one process in the diagram that happens quickly and one process that happens slowly.
Explain how the rate at which fossil fuels are transferred into the atmosphere, as shown in the diagram, has altered the carbon cycle during the past 250 years.

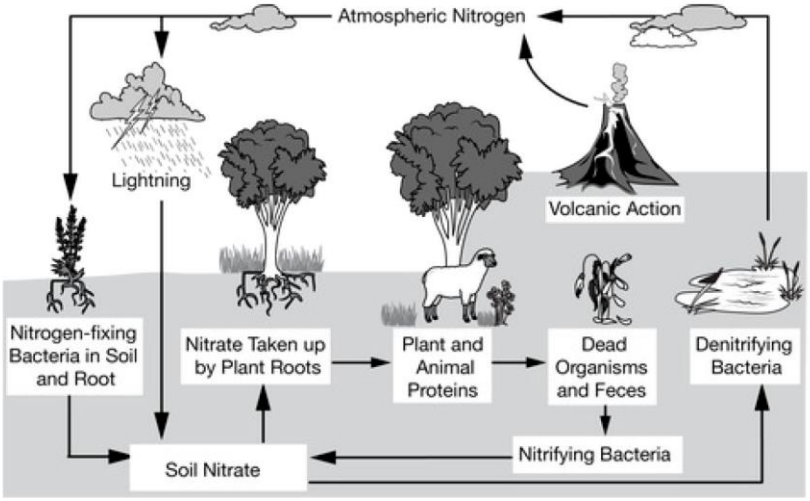


The Nitrogen Cycle

The movement of _____ containing molecules between sources and sinks. Sources release nitrogen into the _____ while sinks remove it. Nitrogen reservoirs hold nitrogen for shorter periods than they hold carbon. Reservoirs include: _____, _____ and the _____

The atmosphere is the _____ reservoir. Nitrogen exists there as _____ and is critical to living things because nitrogen is found in _____, _____ and to make _____

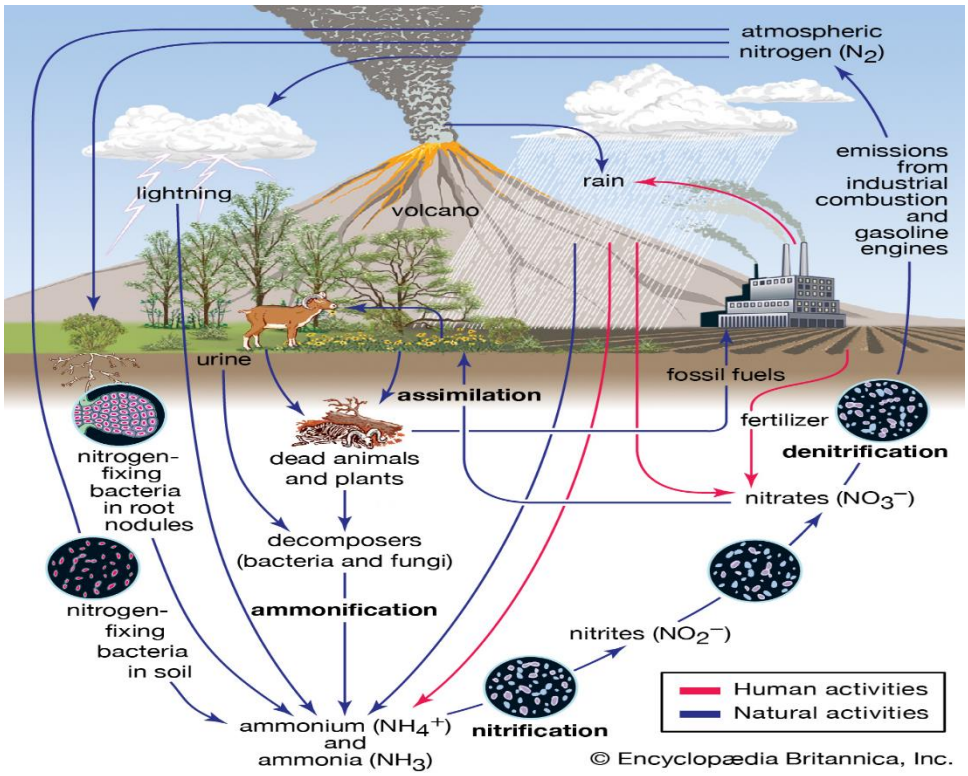
SOURCES (Circle) SINKS (Square)



Nitrogen fixation is the process of _____ being converted to biologically available _____ and or _____

Bacterial Fixation-Certain bacteria have a _____ relationship with plant root nodules and convert _____ into _____

Synthetic Fixation-Humans combust (burn) fossil fuels and convert _____ into _____. These may be used as fertilizers.



Assimilation-Plant roots and animals take up nitrogen and incorporate it into their _____

Ammonification-Soil _____, _____ and _____ covert waste and dead biomass back into _____.

Nitrification-Conversion of _____ into _____ and then into _____ by soil bacteria

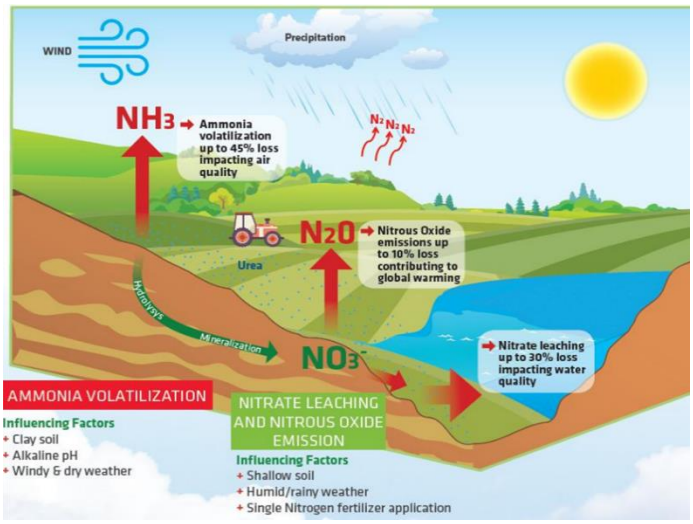
Dentirification-Conversion of soil nitrogen _____ into _____ gas which returns to the atmosphere.

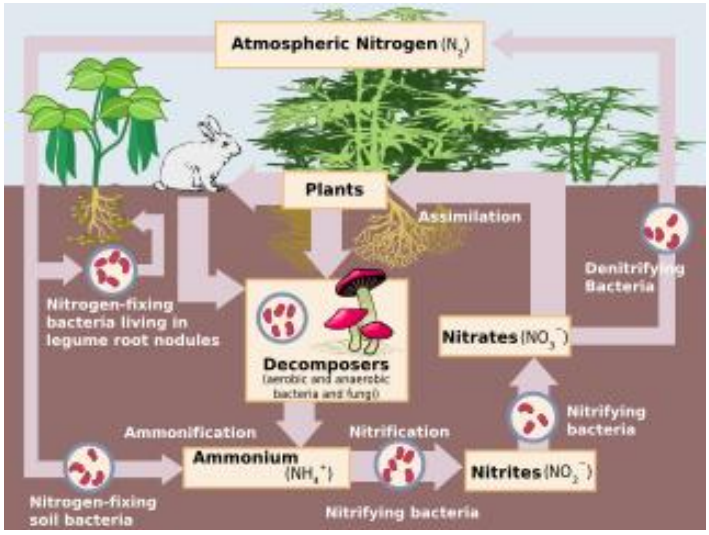
Human Impact

_____ is a greenhouse gas which warms the atmosphere.

Ammonia volatilization-Excess fertilizer can lead to _____ gas entering the atmosphere. _____ gas in the atm leads to _____ precipitation and respiratory irritation in humans. It also means less _____ stays in the soil for crops.

Leaching and Eutrophication-synthetic fertilizer use leads to _____ leaching or being carried out of soil by _____.



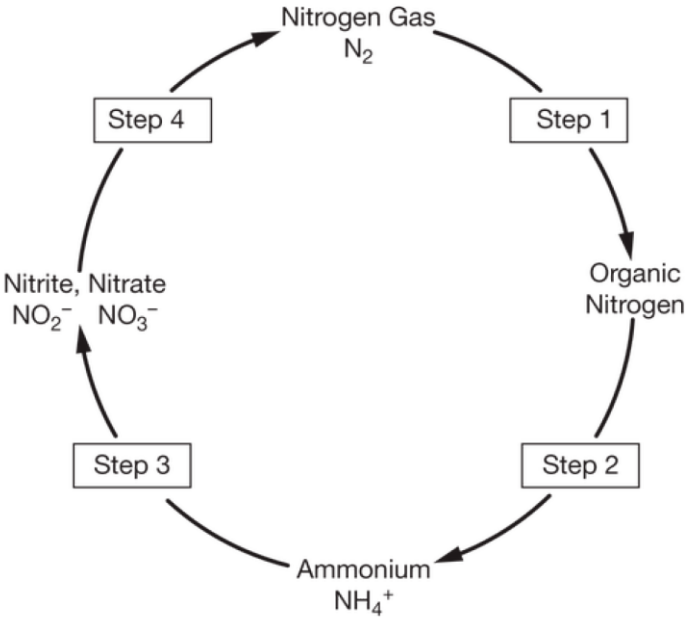


Step 1

Step 2

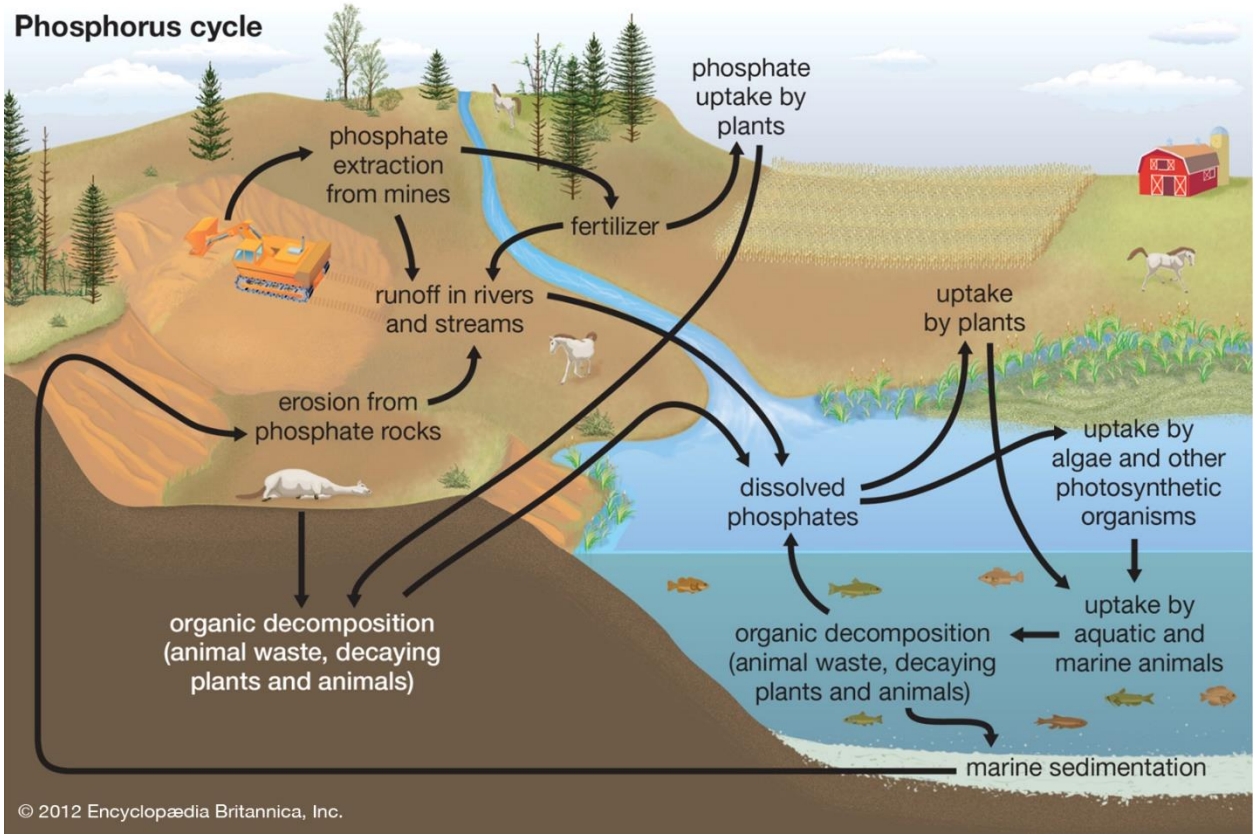
Step 3

Step 4



Practice FRQ
Describe one chemical transformation that occurs in the natural nitrogen cycle and **explain** the importance of that transformation to an ecosystem.

The Phosphorus Cycle



Rocks and sediments are the major _____ for phosphorus (and sulfur)

The phosphorus cycle is very _____ compared to the carbon and nitrogen cycles

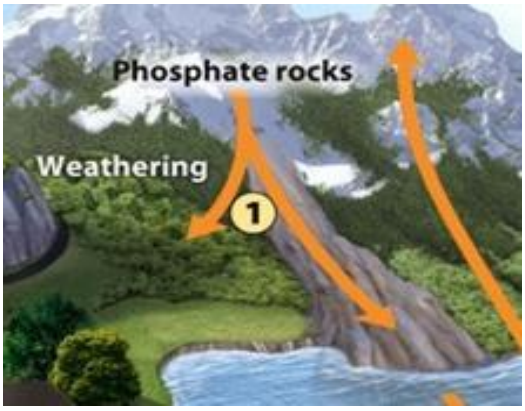
There is no _____ phase of phosphorus in the atmosphere

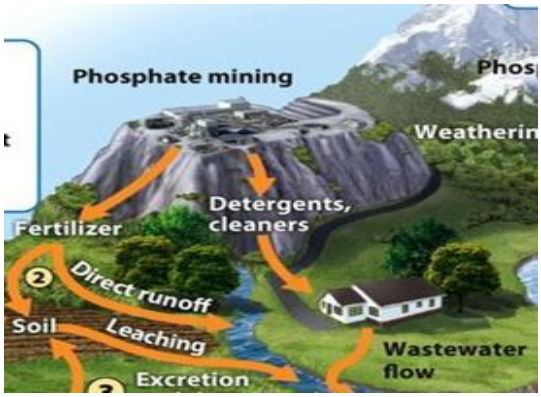
Because is cycles so slowly, it is usually the limiting _____ for plant growth in ecosystems. In a steady state because soil phosphorus is _____ into plants, then returned when the plant dies.

Phosphorus is important because it if found in _____, _____ and in the _____ and _____ enamal of some animals. It is the limiting element because it forms _____ compounds, and only a small amount is found in _____ environments. Along with _____, it is necessary for plant growth.

The natural source is _____, which release the phosphorus when _____. This is why this process is so slow. It will enter as a phosphate (_____)

Synthetic sources come from mining, _____ and detergent. This is how large amounts can runoff into _____.



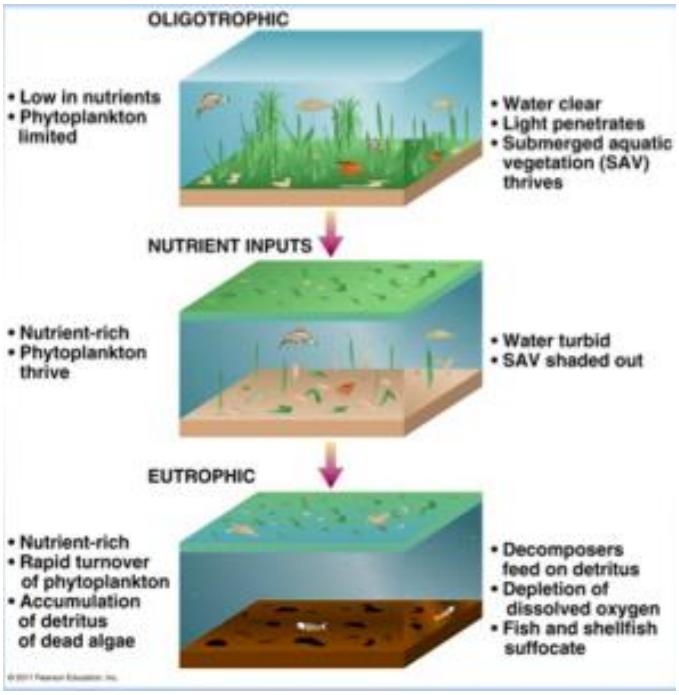


_____ is the process in which phosphorus is absorbed into plants. Animals will get the phosphorus when they _____ the plants. The animal waste is slowly broken down by _____ and returned to the soil.

Since the phosphorus is insoluble, is forms solids and sinks to the bottom called _____. When the continents collide, the seafloor is _____ and the phosphorus is now able to be _____.

Eutrophication is excess nutrients (_____ and _____) fueling fungal growth and _____ light.

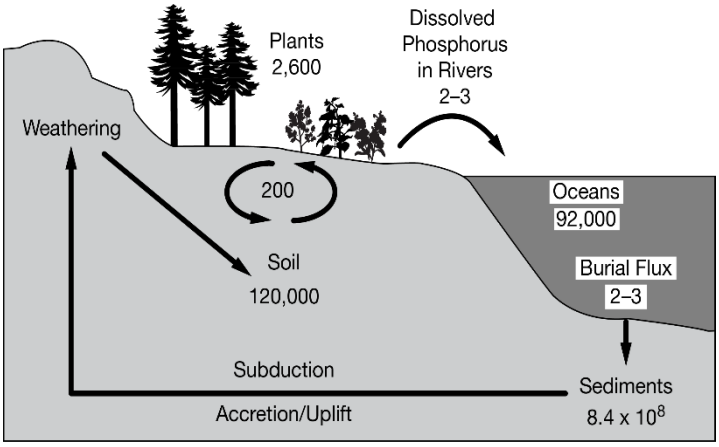
When the algae dies off, bacteria break down and use up _____. This will ultimately kill _____.



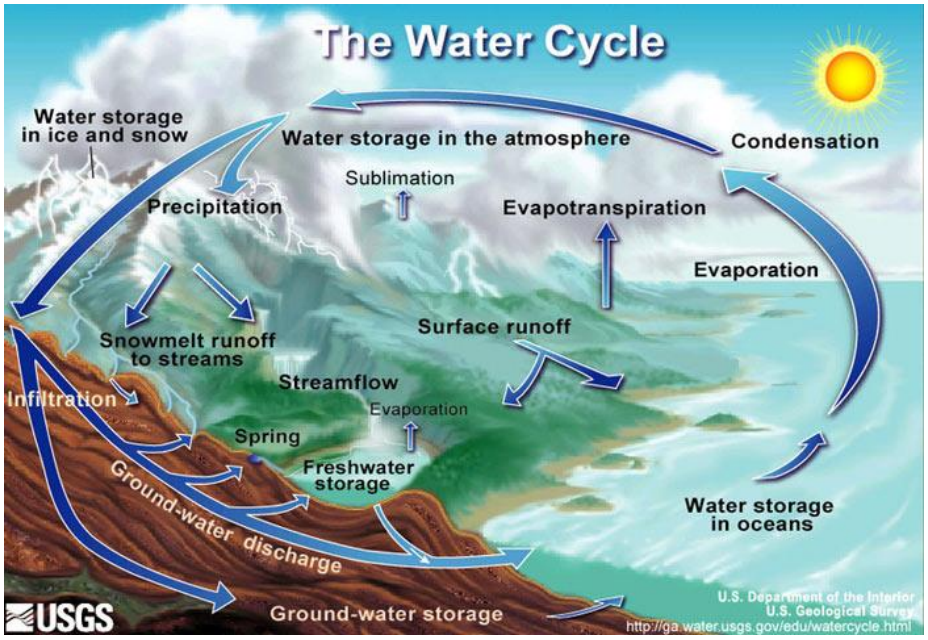
Dead zones occur in the _____ where the Mississippi River enters, bringing large amounts of nitrates and sulfides.

Practice FRQ

Choose 2 reservoirs depicted in the diagram and **describe** how phosphorus moves from one to the other.



The Water Cycle

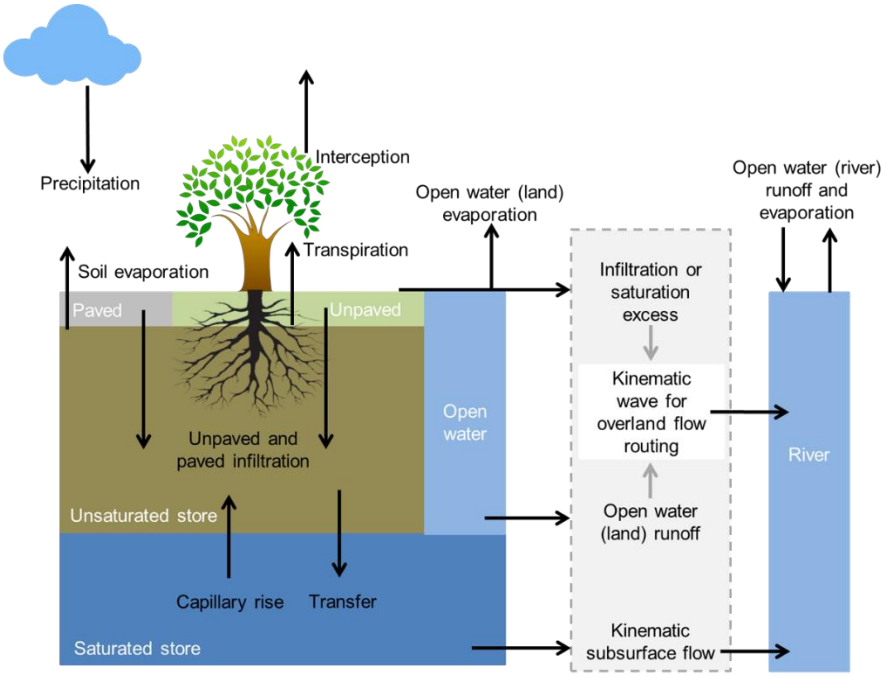


The water cycle is driven by energy from the _____. The heat causes the liquid water to _____ and later _____ and finally _____ somewhere else.

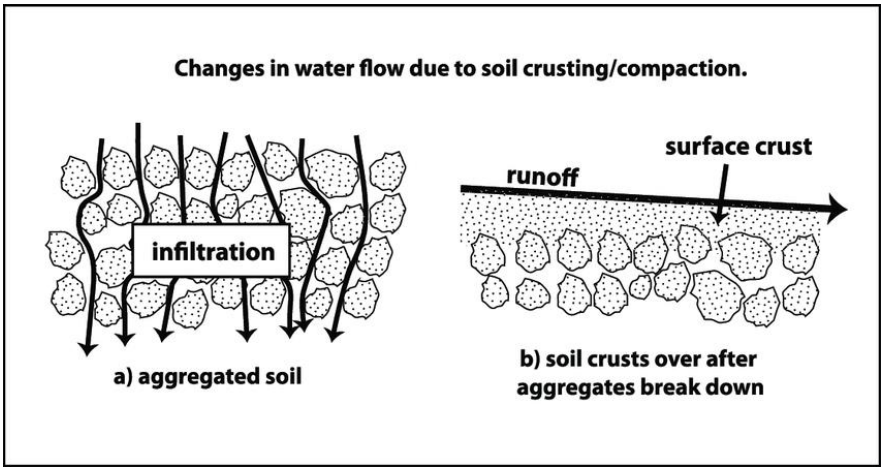
The _____ is the largest reservoir, but ice caps and _____ are other sources. Of the freshwater on earth, _____ of the fresh water is found in the ice caps.

Of all of the water on Earth, _____ is freshwater.
Liquid to gas occurs in two processes, _____ and _____.

Transpiration is the process _____ use to draw water from the ground and _____ water into the _____.



Once the precipitation reaches the ground, it can either _____ or _____. If the ground is not packed or paved, the water can _____ in. The water will eventually end up as _____.



Leaching occurs when water _____ the soil and _____ some of the minerals. This is how minerals can _____.

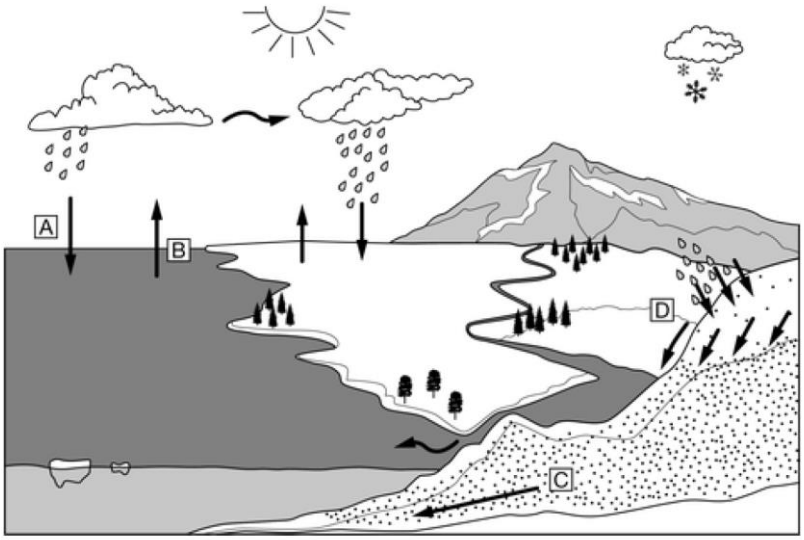
Label

A

B

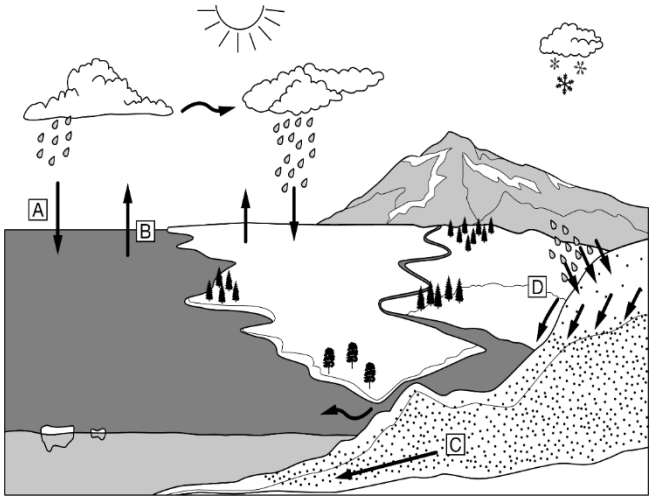
C

D



Practice FRQ

Choose a process from the diagram. **Identify** the process and **describe** how water is moving from one reservoir to another.



Primary Production

Units: kcal/m^2/yr.

ENERGY AREA TIME

High primary production=_____ plant growth= Lots of _____ and _____. If the ecosystem has high PP, it is usually has high _____. Rule of thumb, the higher the temperature and precipitation, the higher the _____in an area. _____ have a lot of primary production.

Primary Productivity: rate that solar energy is converted into organic compounds via photosynthesis over a unit of time. This is measured per square meter, so size matters. This is the rate of **ALL** produces in an area over a given time

- NPP = GPP – RL
- **Net Primary Production** is the amount of energy left over for consumers after plants used some for respiration.
- **Gross Primary Production** is the total amount of sun energy that plants capture and convert to energy (glucose) through photosynthesis.
- **Respiration Loss** is the energy plants use for their own cellular processes and growth.

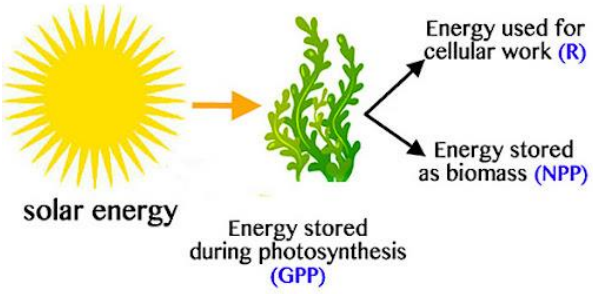
So… _____ primary production is the amount of energy lost through _____ by producers subtracted from the _____ primary productivity. The energy source is the _____.

- If the net primary production in an ecosystem is 10,000 kcal/m^2 per year and the respiration from aquatic plants is 12,000 kcal/m^2 per year, what is the gross annual primary production?

- If the gross primary production in an ecosystem is 4200 kcal/m^2 per year and the respiration from aquatic plants is 1,000 kcal/m^2 per year, what is the net annual primary production?

- If two different sites have the same gross primary production but different amounts of net primary production. Site A has a net primary production of 1500 kcal/m^2 per year while site B has a net primary production of 1000 kcal/m^2 per. What can account for this difference?

Although the ocean is extremely large, it actually has one of the lowest rates of net primary production. How is that possible???

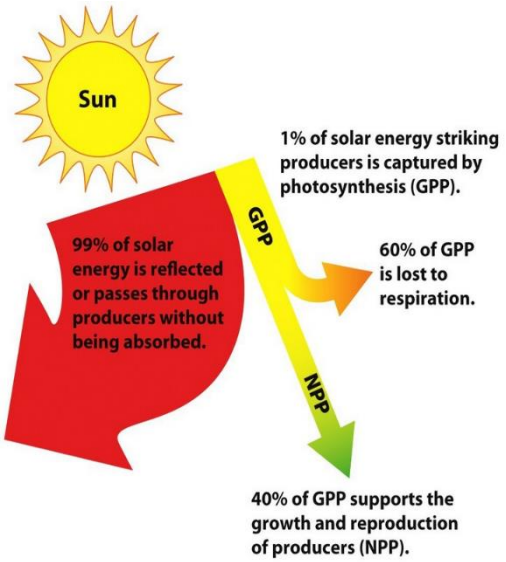


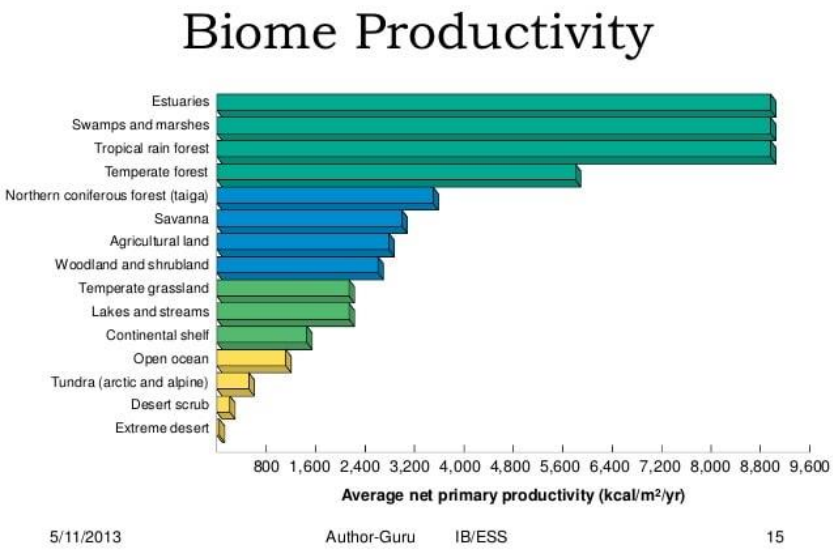
$$NPP = GPP - R$$

net primary productivity = gross primary productivity − respiration

Generally, only _____% of all incoming sunlight is captured and converted into GPP via photosynthesis.

Of that 1%, only about _____% is converted biomass/plant growth (NPP). So actually only _____% of the sun is being used.

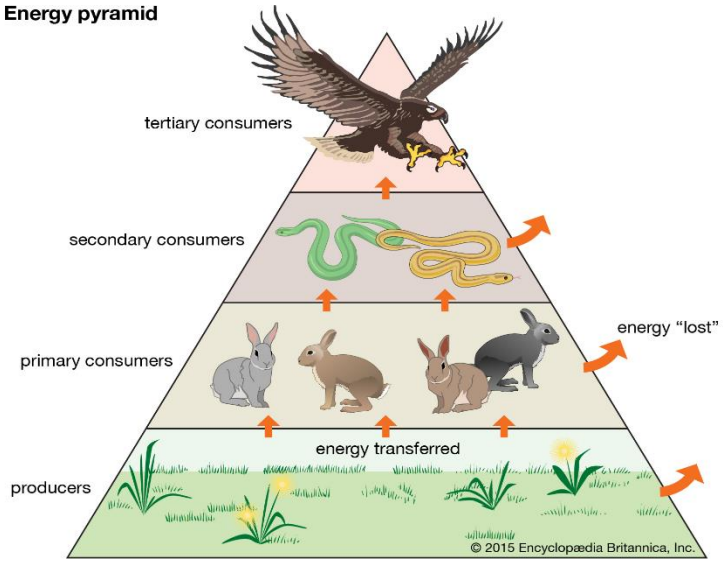




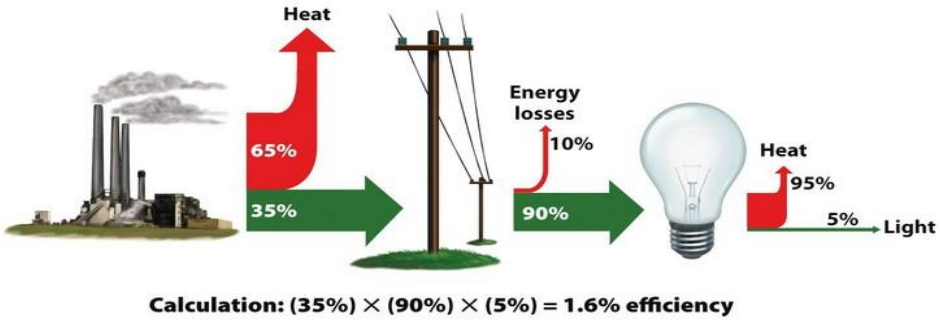
Trophic Levels and 10% Rule

The first law of thermodynamics-Energy is not _____ nor _____.

The second law of thermodynamics-Each time energy is transferred, some is lost as _____



In a food web, the amount of usable energy _____ as you move through the trophic levels. _____% is passed on and _____ is lost as heat.



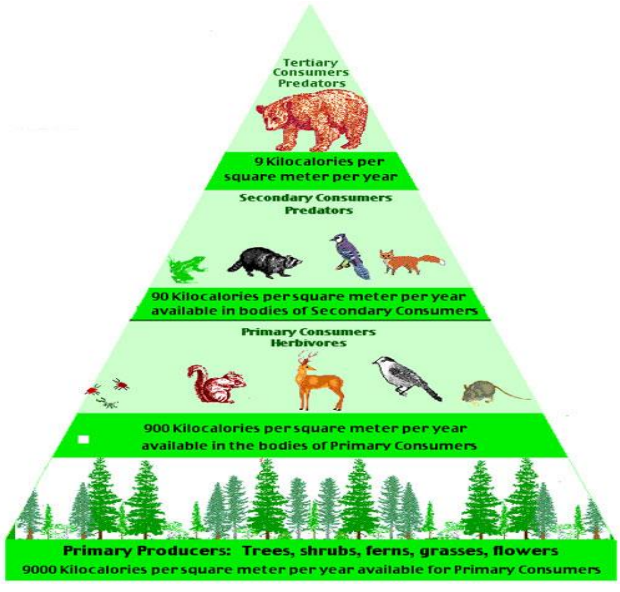
Calculation: (35%) × (90%) × (5%) = 1.6% efficiency

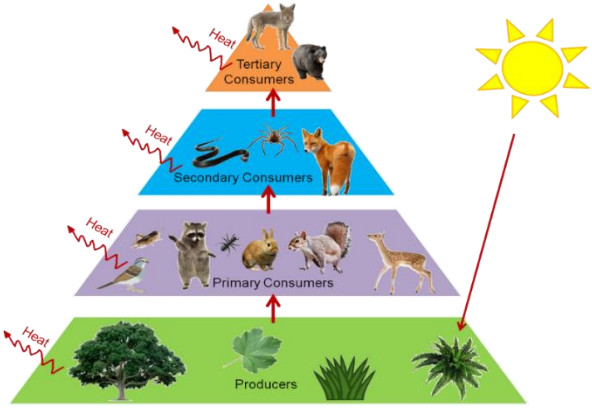
<u>Producers</u> (plants) "produce"- really convert sun's light energy into chemical energy (glucose)

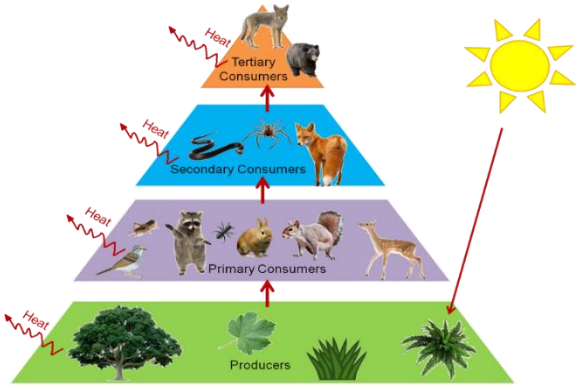
<u>Primary Consumers</u>: animals that eat plants (herbivores)

<u>Secondary Consumers</u>: animals that eat primary consumers or herbivores (aka - carnivores & omnivores)

<u>Tertiary Consumers</u>: animals that eat secondary consumers or carnivores & omnivores (aka - top/apex predators)







Practice FRQ

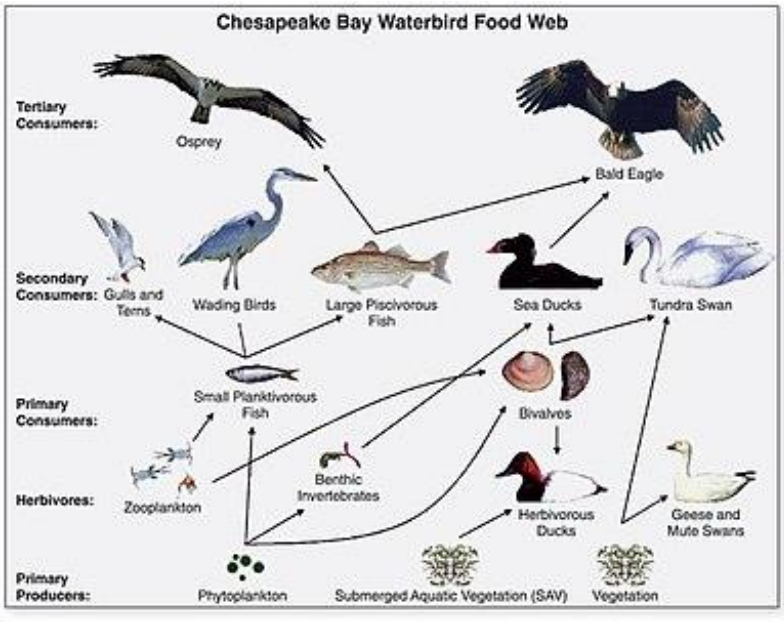
Explain why a relatively large forest can only support a small number of wolves.

Calculate the amount of energy available to the tertiary consumer in the following ecosystem:
100,000 J produced by plants in the ecosystem (after respiration)

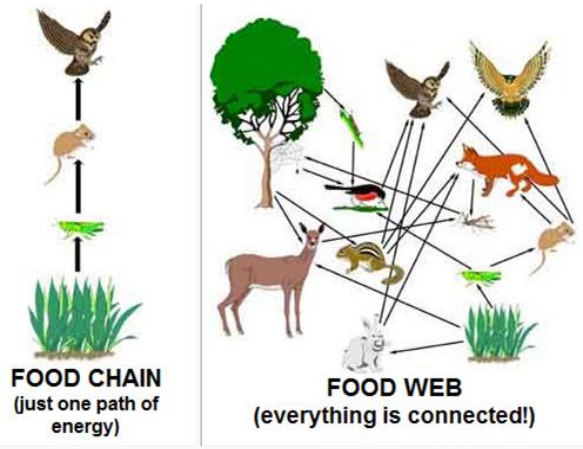
TRICK-What is the energy available to the secondary consumers?

Food Webs and Food Chains

- Shows how matter and energy flow through an ecosystem from organism to organism.
- When one organism preys on or eats another, the matter and energy are passed to the consumer (herbivore/carnivore)
- The arrows point to the consumer- The direction of energy flow.



- A food chain shows one linear path of matter and energy.
- A food web is at least two interconnected food chains.



Practice FRQ

- **Describe** one direct effect that a decline in the frog population would have on the food web.

- **Identify** an organism that is both a secondary and a tertiary consumer.