

# Ecology



# *Believe it or Not*

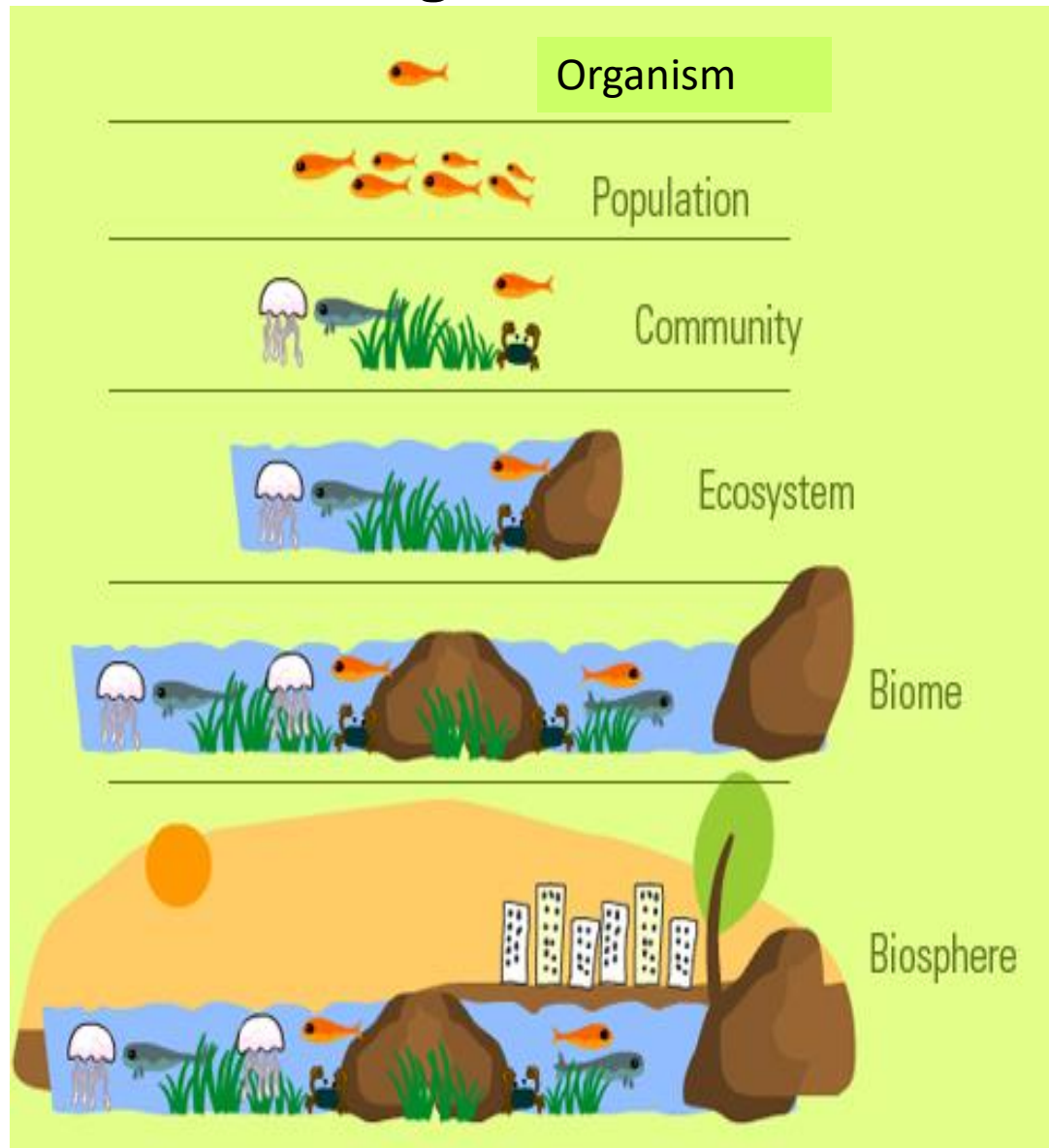
1. The Cuyahoga river caught on fire in 1969. [Video](#)
2. The songs of birds are no longer heard in Guam due to introduced snakes during WWII
3. Watch out for the bears when you are in Eastern Ohio woods. Injuring or killing one is against the law!!
4. The world population is at [7,600,000,000](#) people as of now!!

# 1. Define **Ecology**

- Ecology is the scientific study of interactions among organisms and between organisms and their environment

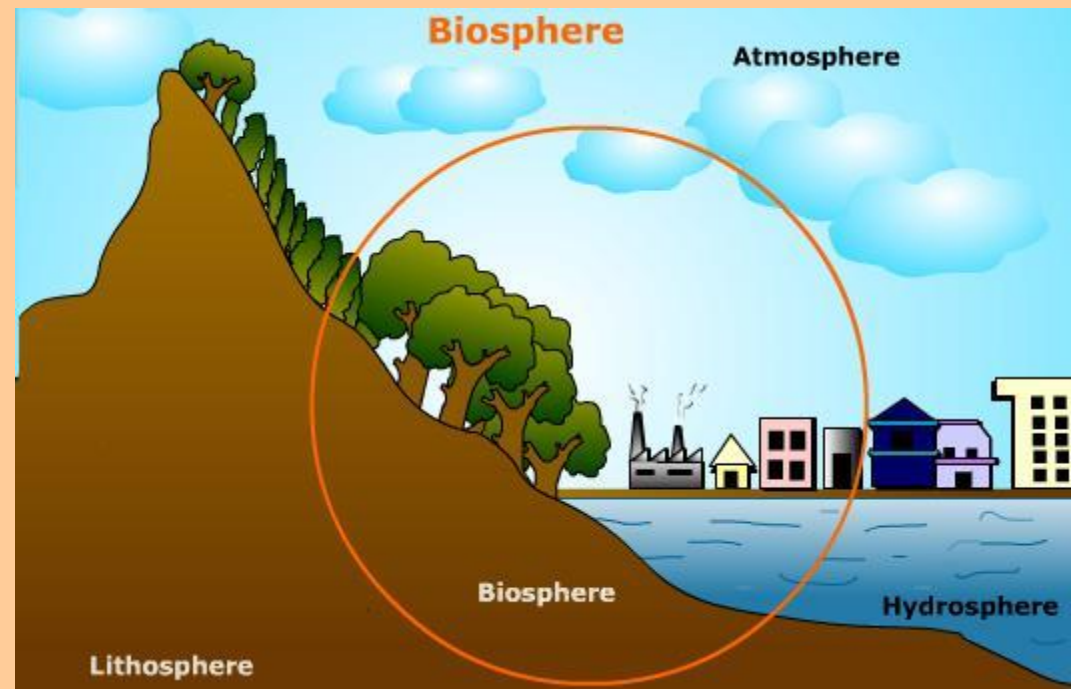


## 2. Give the definition of each of the following levels of organization



## 2. Give the definition of each of the following levels or organization

**A. Biosphere**—  
part of Earth in  
which life  
exists  
including land,  
water, and air  
or atmosphere



**THE BIGGEST  
ONE!**

2. Give the definition of each of the following levels or organization

**B. Species**—group of similar organisms that can breed and produce fertile offspring



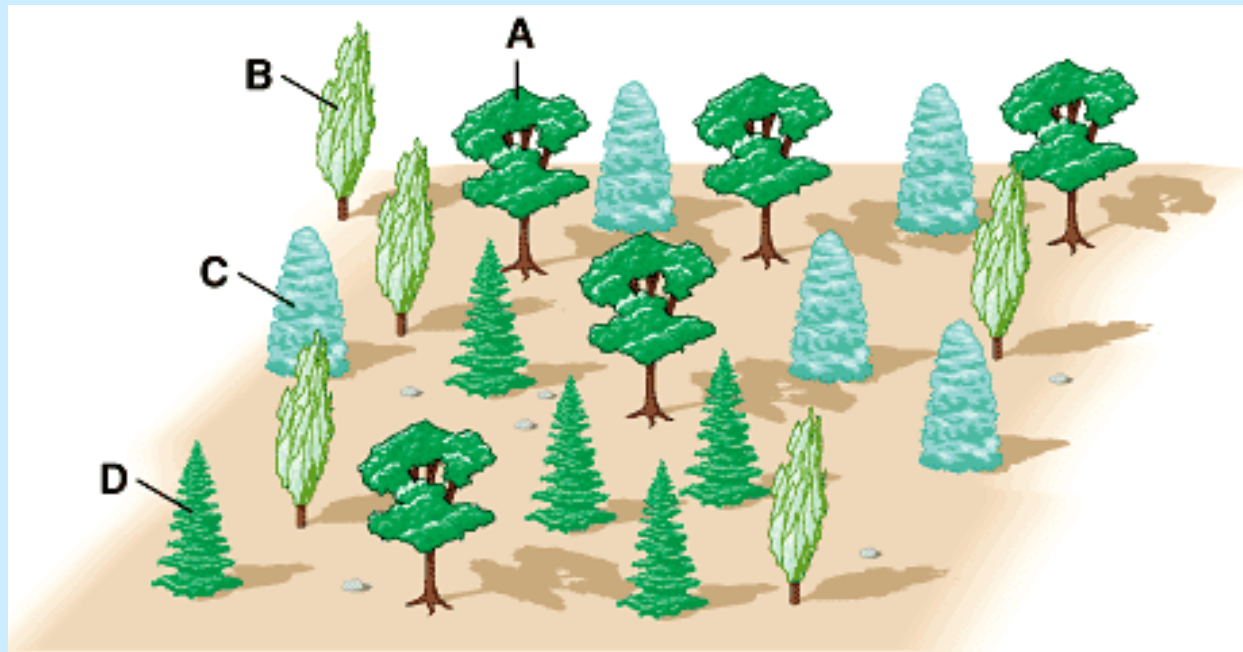
2. Give the definition of each of the following levels or organization

**C. Populations**—group of individuals of the same species that live in the same area



2. Give the definition of each of the following levels or organization

**D. Communities**—assemblage of different populations that live together in a defined area





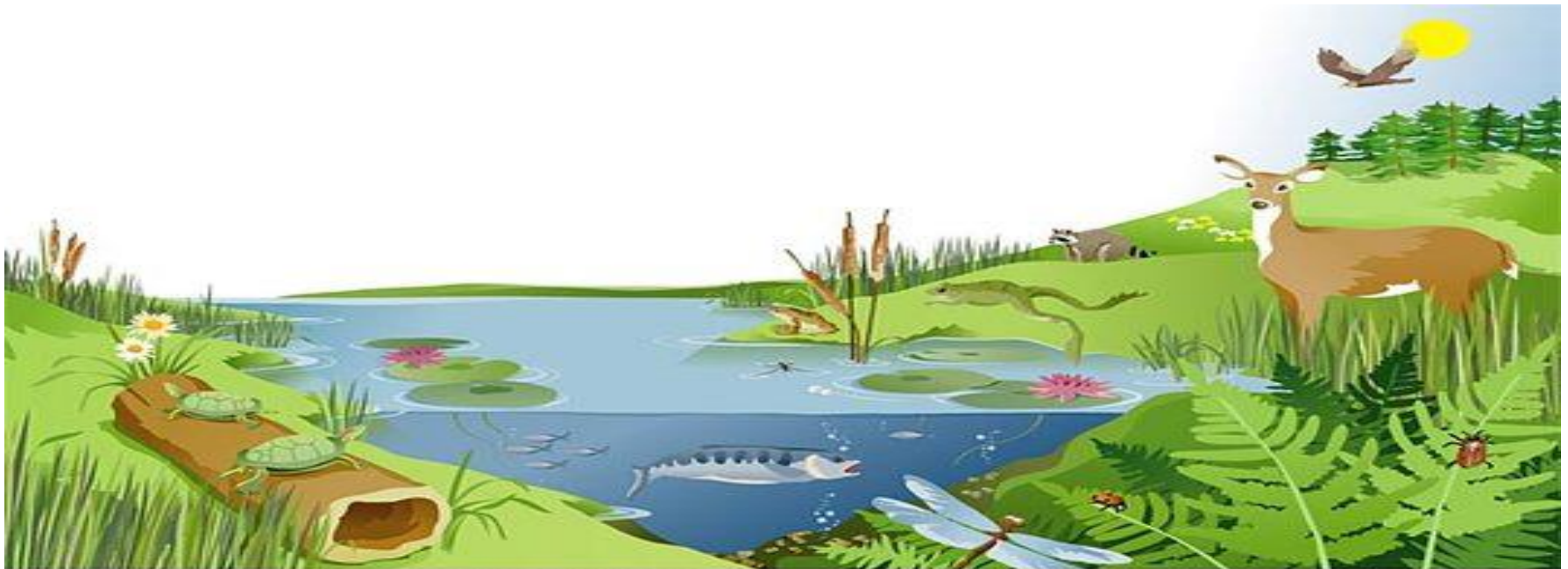
2. Give the definition of each of the following levels or organization

**E. Ecosystems**—collection of all the organisms that live in particular place, together with their nonliving environment



### 3. Differentiate between **biotic and abiotic factors**. Give examples of each.

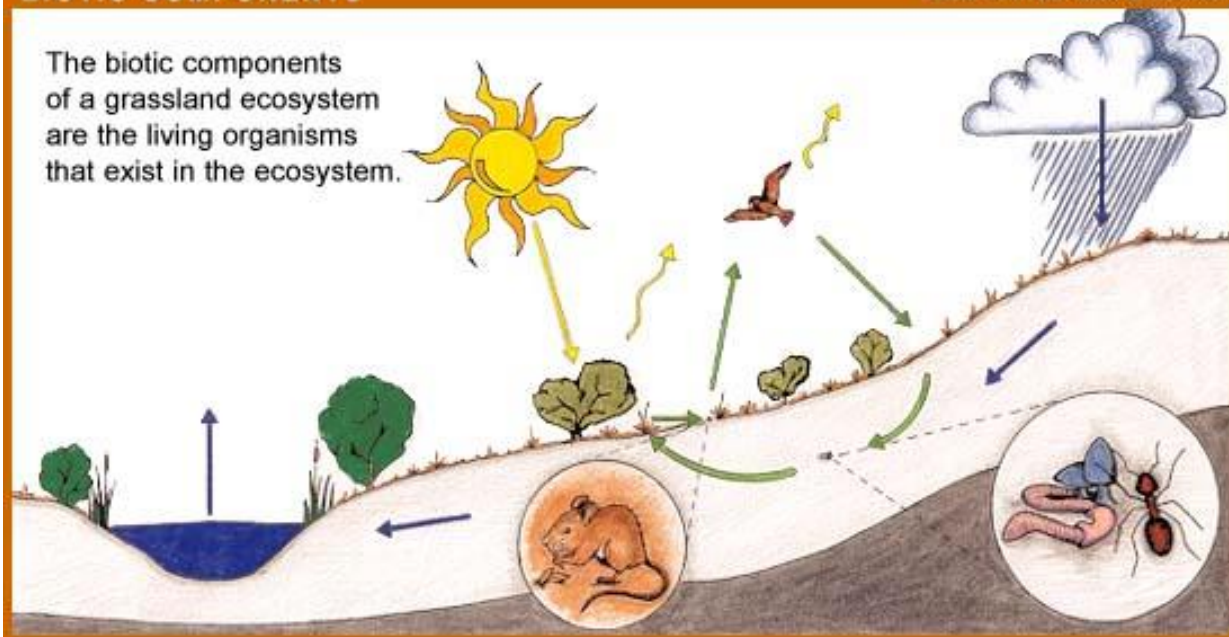
- **Biotic**—living influence on organisms
  - Predators, prey, tree homes
- **Abiotic**—physical influence on organisms
  - Wind, water, temperature



## BIOTIC COMPONENTS

ILLUSTRATION: NICOLE BRAND

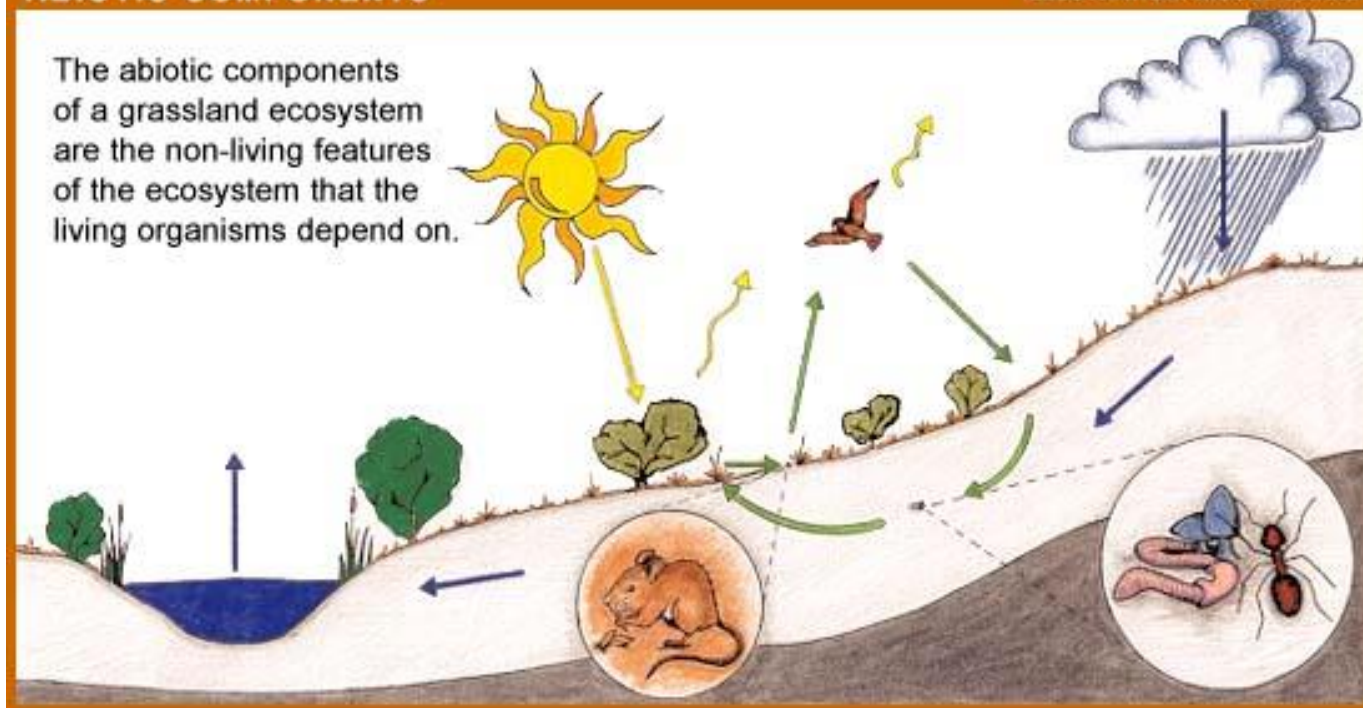
The biotic components of a grassland ecosystem are the living organisms that exist in the ecosystem.



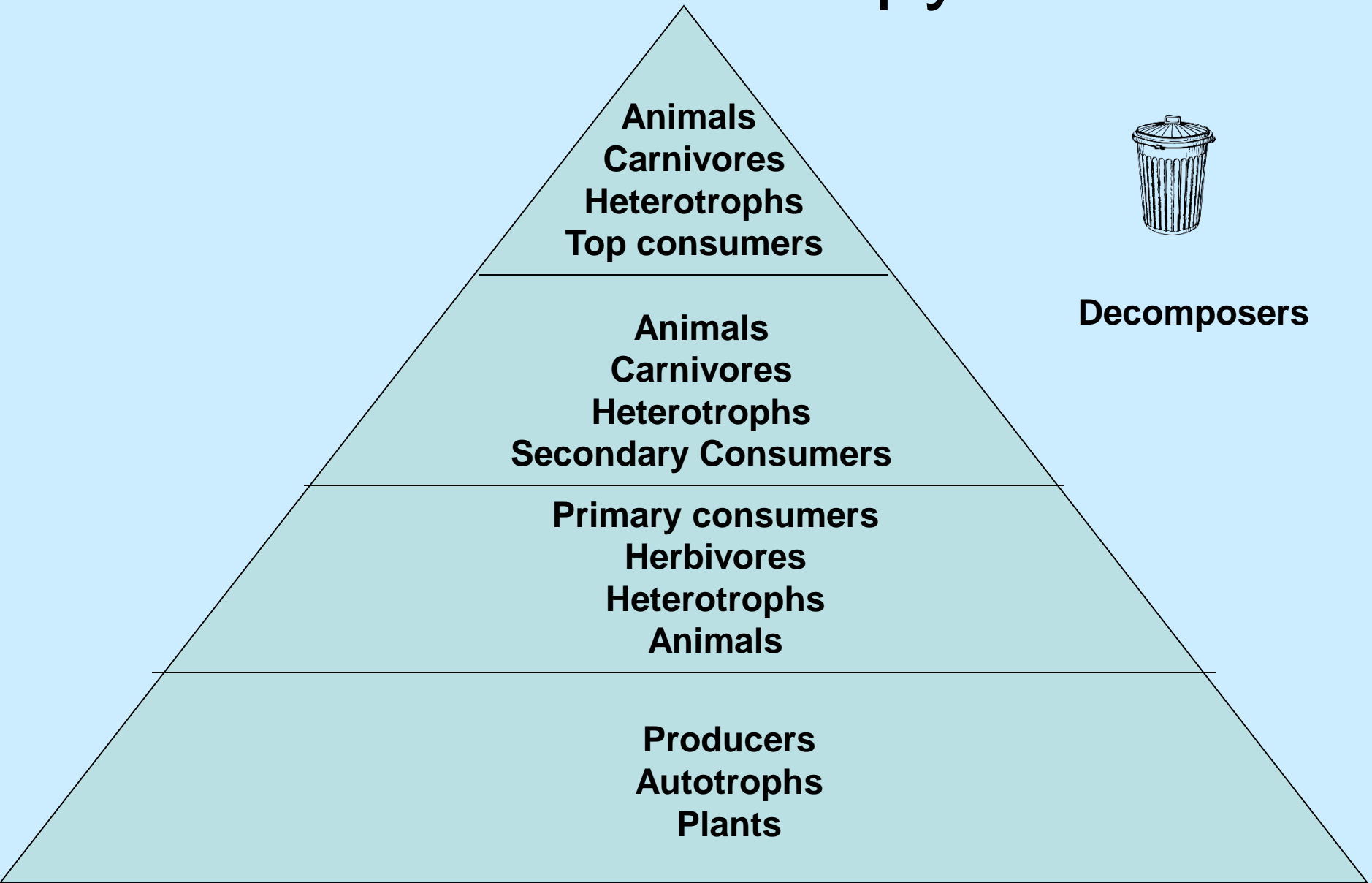
## ABIOTIC COMPONENTS

ILLUSTRATION: NICOLE BRAND

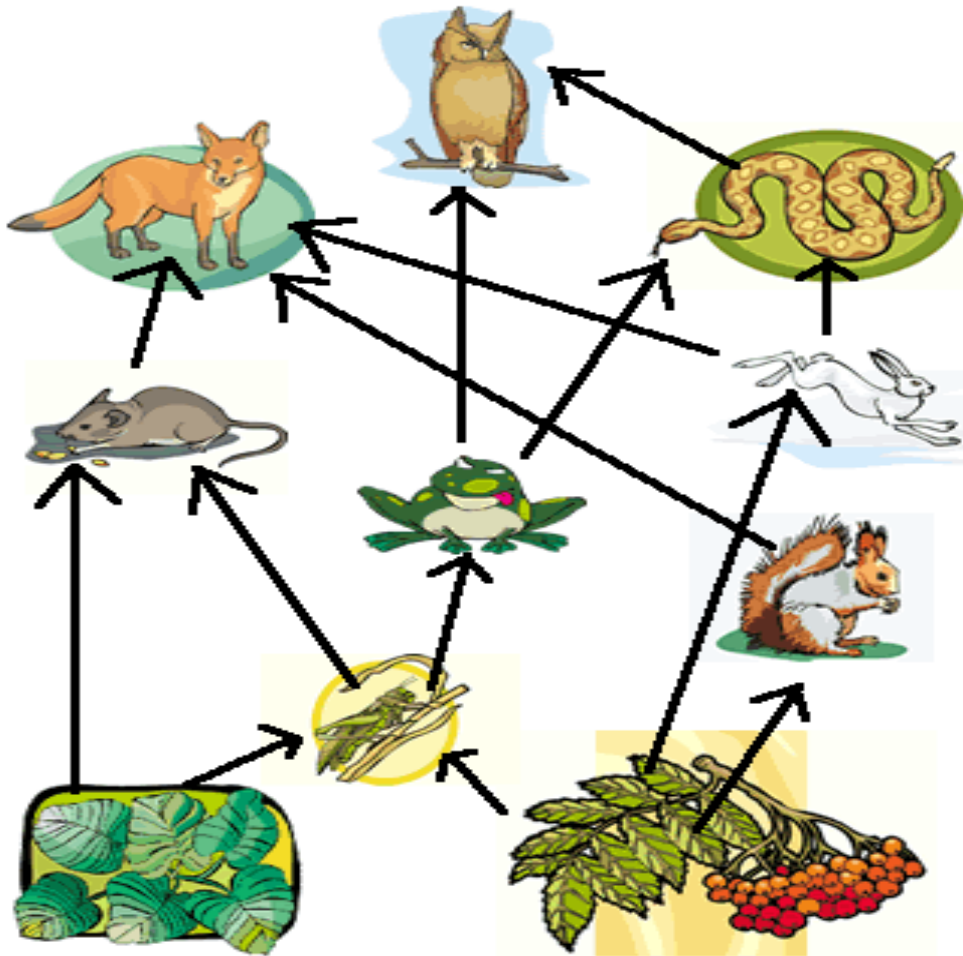
The abiotic components of a grassland ecosystem are the non-living features of the ecosystem that the living organisms depend on.



# 4. Fill in the food pyramid



# 5. Label the food web shown below

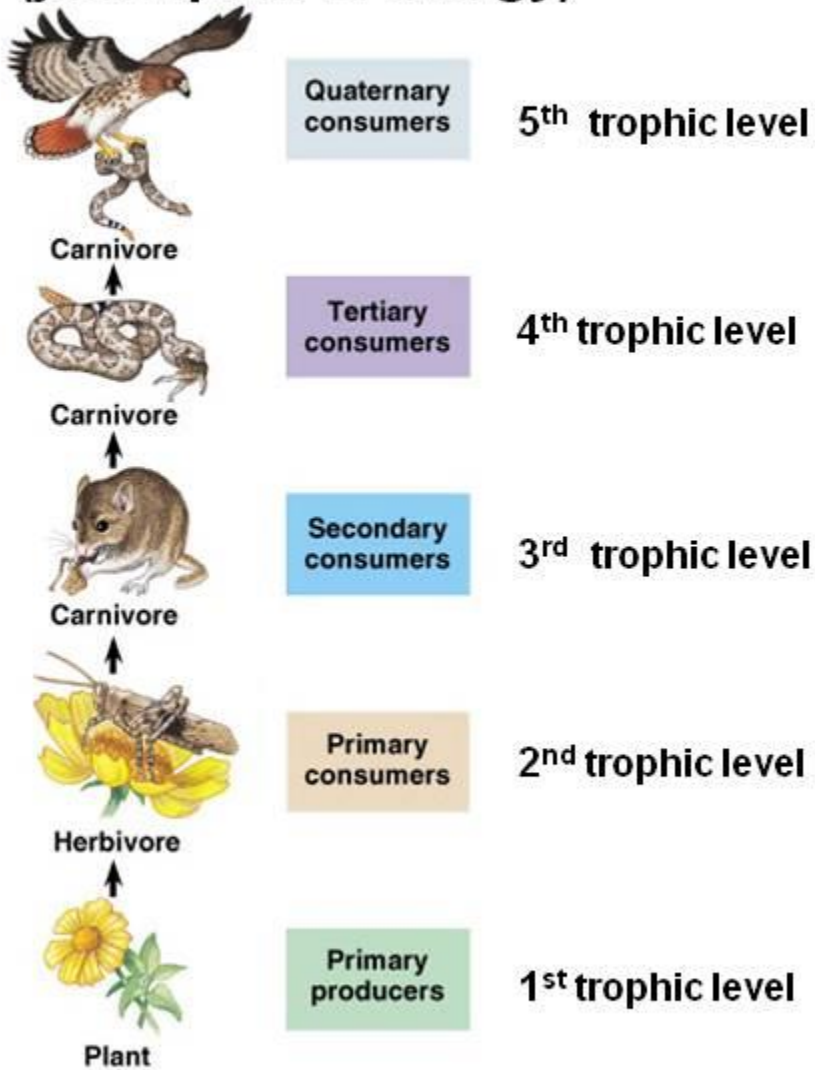


## 6. **Food Chain** vs **Food Web**

- **Food Webs** shows multiple feeding interactions while a **Food Chain is** very linear.
- **Food webs** are made up of multiple food chains

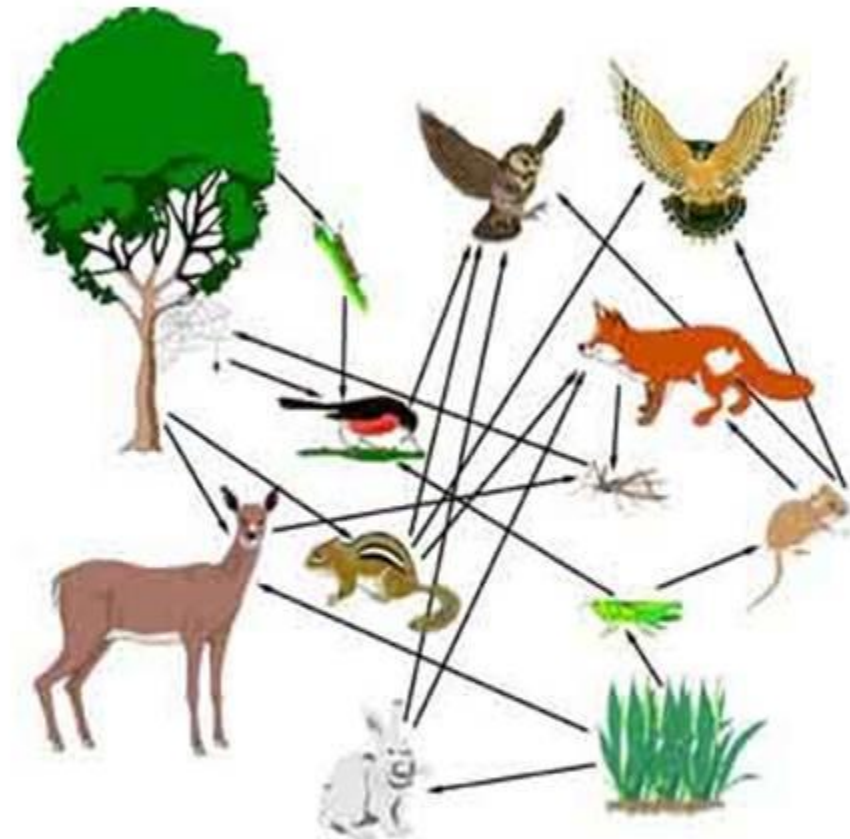
# Food Chain

(just 1 path of energy)



# Food Web

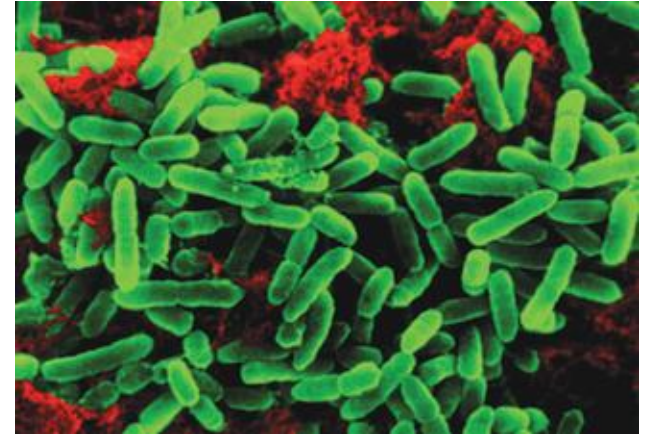
(all possible energy paths)



The *arrow* points to the eater and shows the transfer of energy.

# 7. Decomposers recycle the nutrients from dead organisms

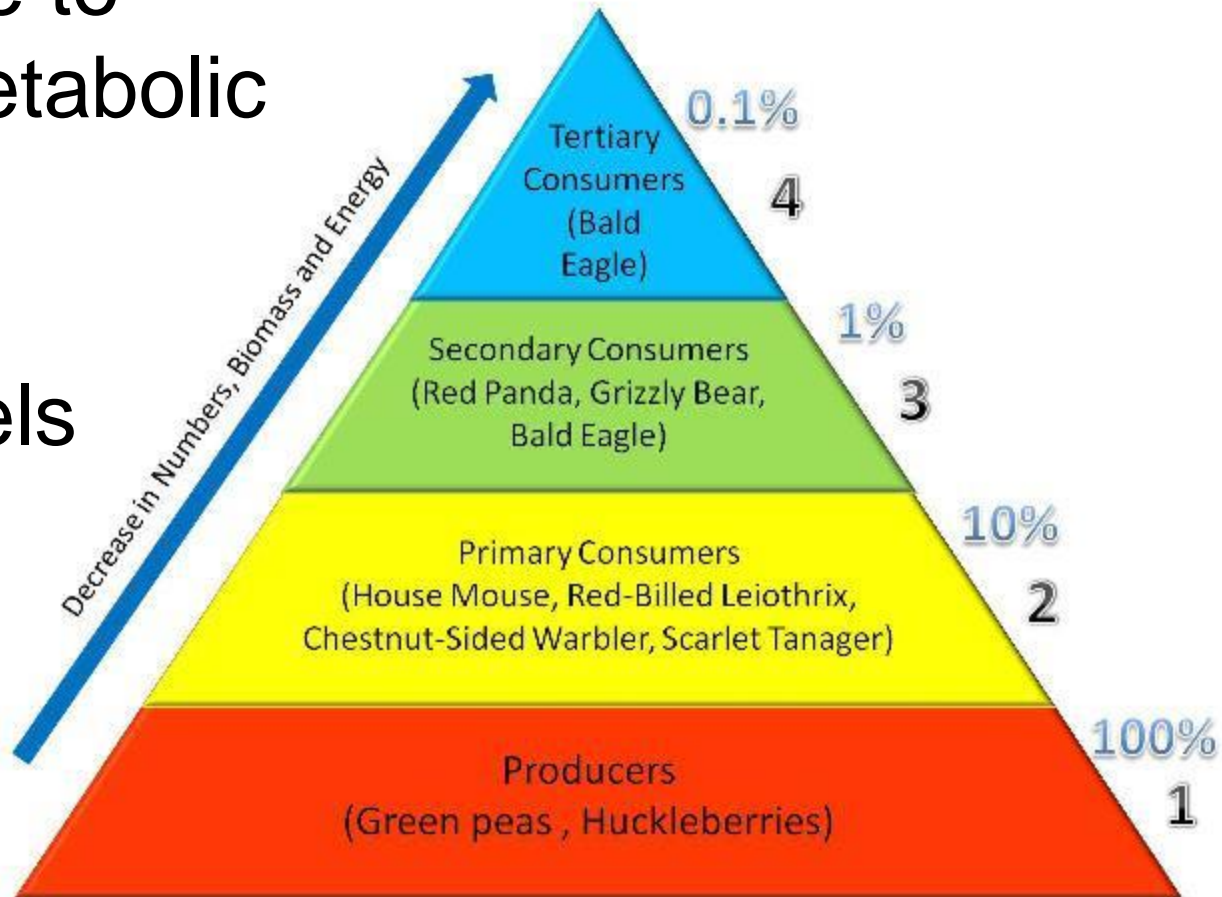
- **Bacteria of decay**
- **Fungus**





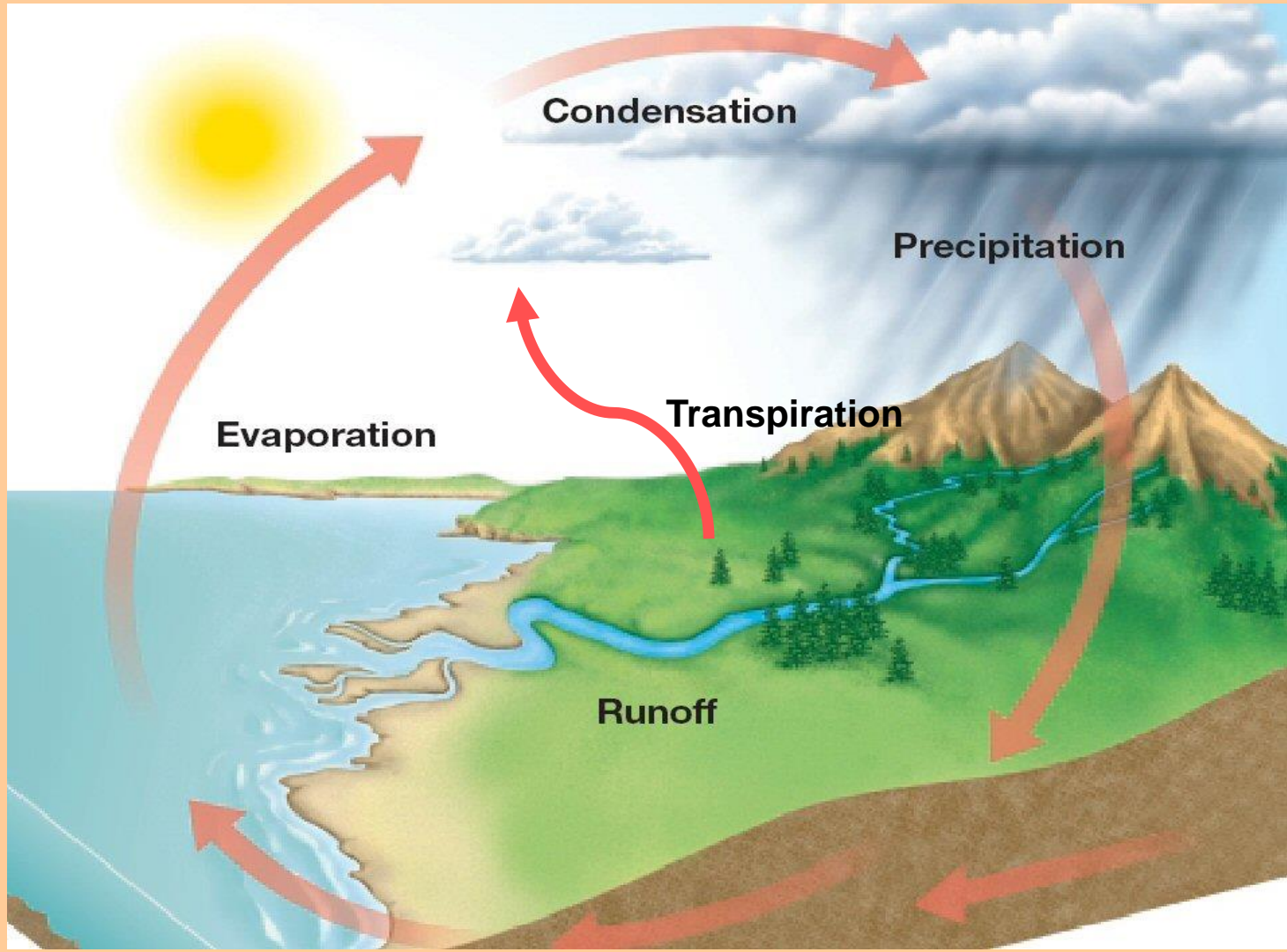
## 8. How much energy is transferred from trophic level to trophic level?

- 90% loss due to heat loss, metabolic processes
- 10% transfer between levels



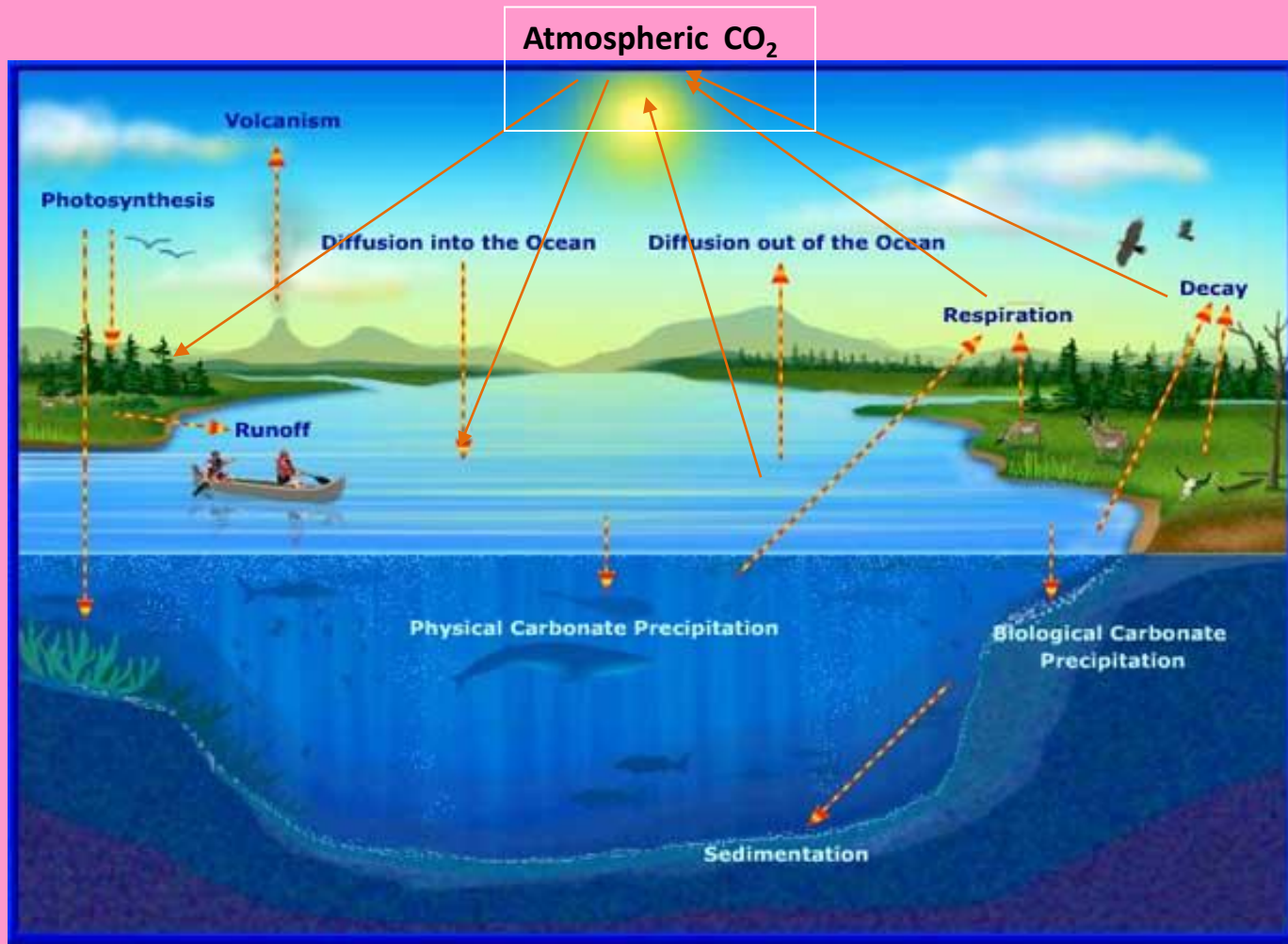
9. Summarize the biogeochemical cycles  
B. **Water cycle**—flow of water in various phases in an ecosystem

**Transpiration is the loss of water through plant leaves**



# 9. Summarize the biogeochemical cycles

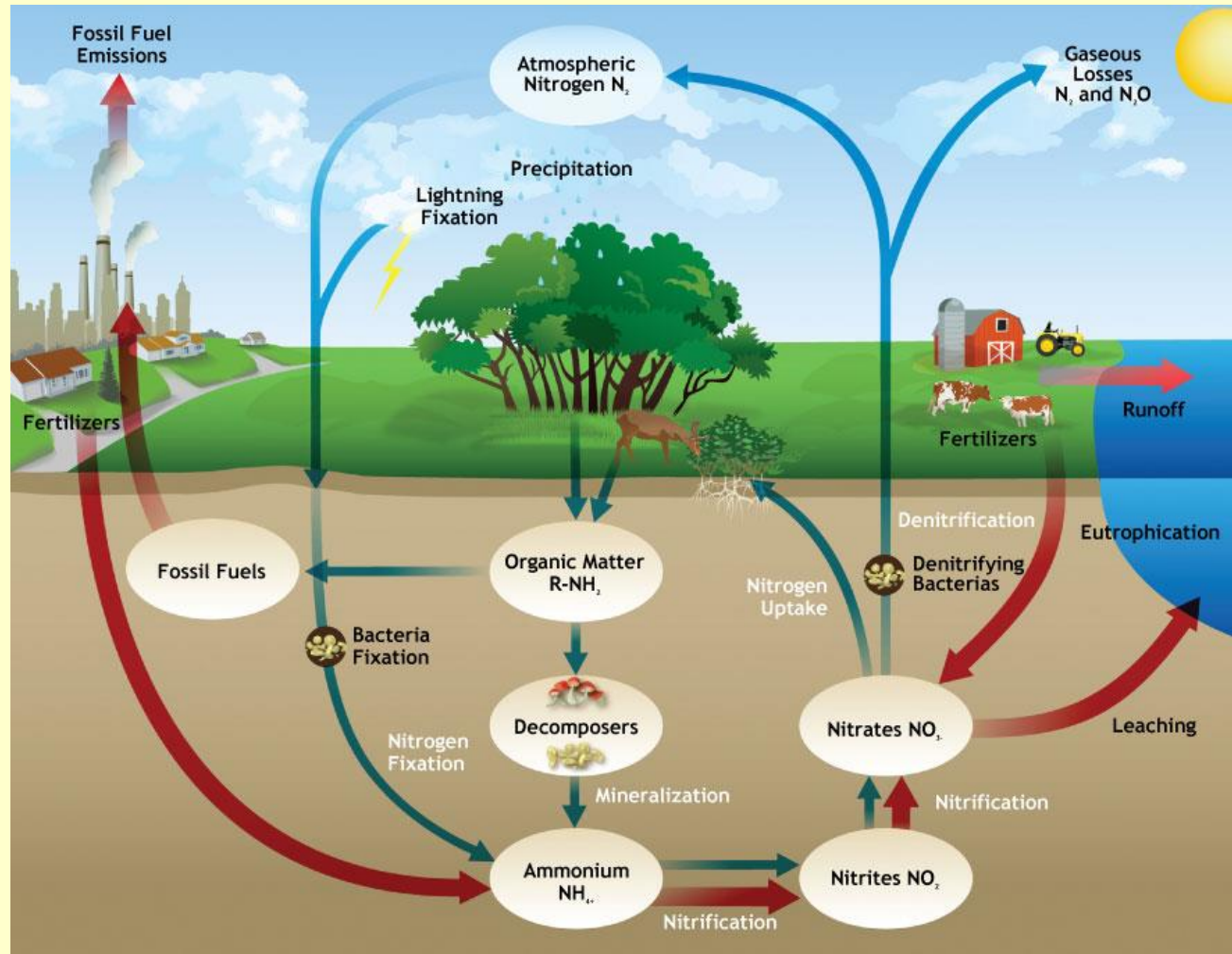
## A. Carbon cycle--Flow of carbon (both organic and inorganic) in an ecosystem



# 9. Summarize the biogeochemical cycles

C. **Nitrogen cycle cycle**—flow of nitrogen (both organic and inorganic) in an ecosystem

***Controlled by bacteria***



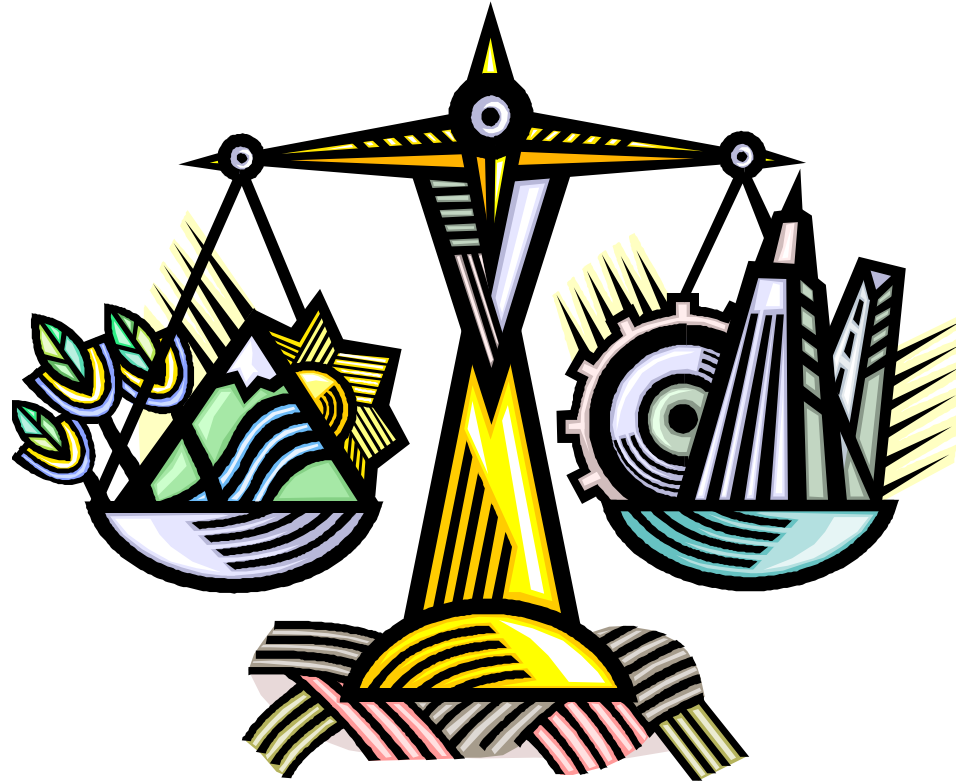
- **What is the atmosphere adding to the soil**
  - **Nitrogen ( $N_2$ )**
- **What organism converts atmospheric nitrogen ( $N_2$ ) in the soil into Ammonium?**
  - **Nitrogen fixing bacteria**
- **What process converts the nitrogen into Ammonium?**
  - **Nitrogen fixation**
- **What will cause the  $N_2$  to be returned to the atmosphere?**
  - **Denitrification**
- **What organisms cause the conversion of Nitrates to  $N_2$ ?**
  - **Denitrifying bacteria**
- **What breaks down organic matter into Ammonium?**
  - **Decomposers**

# 10. Explain what a limiting nutrient is and give an example

- **Limiting nutrient**—any factor that causes the growth of a population to decrease
  - No carbon, nitrogen, oxygen
  - Lawns are yellow without nitrogen. Less photosynthesis



# Chapter 4 Ecology



# 11. What is the greenhouse effect and how does it maintain earth's temperature range?

- **Greenhouse effect** —natural occurrence in which heat is retained in Earth's atmosphere by  $\text{CO}_2$ ,  $\text{CH}_4$ , and  $\text{H}_2\text{O}$ , and other gases
  - Prevents too much heat from being radiated away from Earth



# The Greenhouse Effect

Some of the Infrared radiation passes through the atmosphere but most is absorbed and re-emitted in all directions by greenhouse gas molecules and clouds. The effect of this is to warm the Earth's surface and the lower atmosphere.

Solar radiation powers the climate system.



Some solar radiation is reflected by the Earth and the atmosphere.



ATMOSPHERE

EARTH

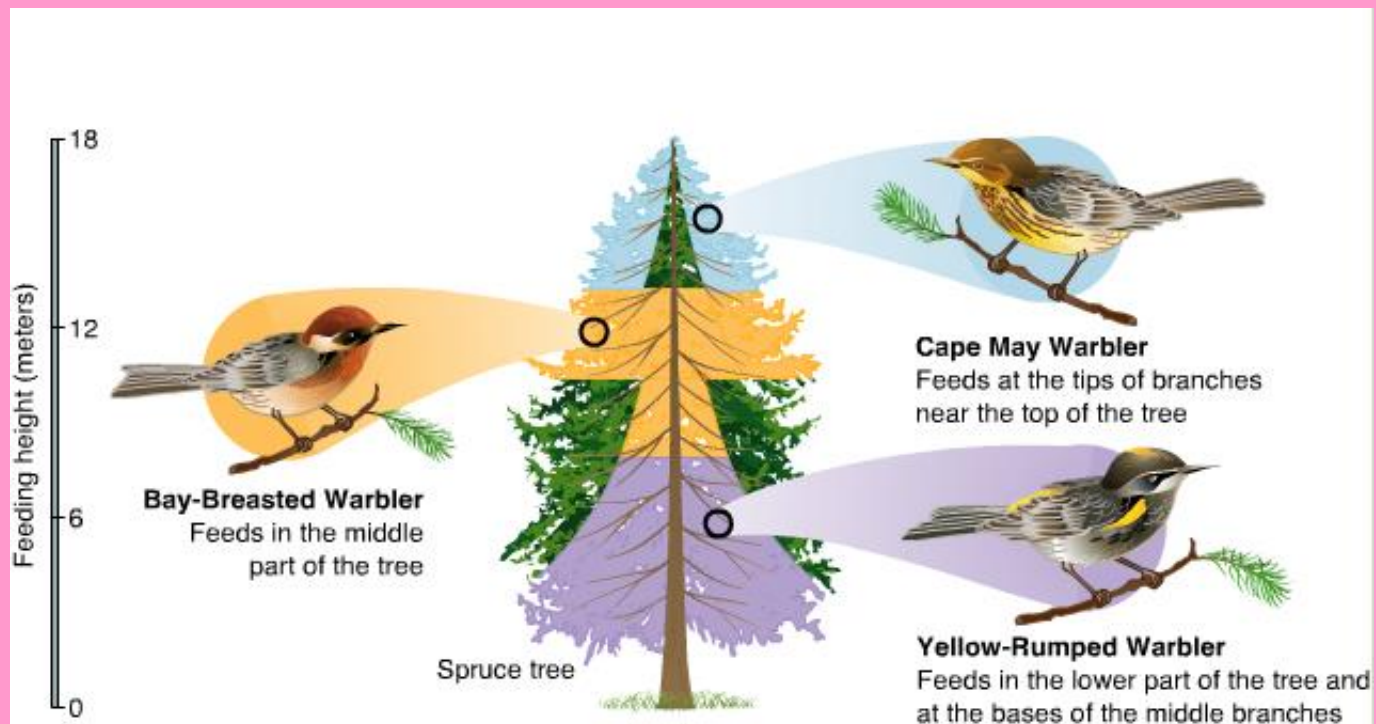
About half the solar radiation is absorbed by the Earth's surface and warms it.

Infrared radiation is emitted from the Earth's surface.



# 12. What is an organism's niche?

- **Niche**- full range of physical and biological conditions in which an organism lives and the way in which the organism uses those conditions



13. Within communities, organisms will interact with each other. Identify the following interactions:

- **Competition:**

- Organisms of the same or different species attempt to use the same resource in the same place at the same time



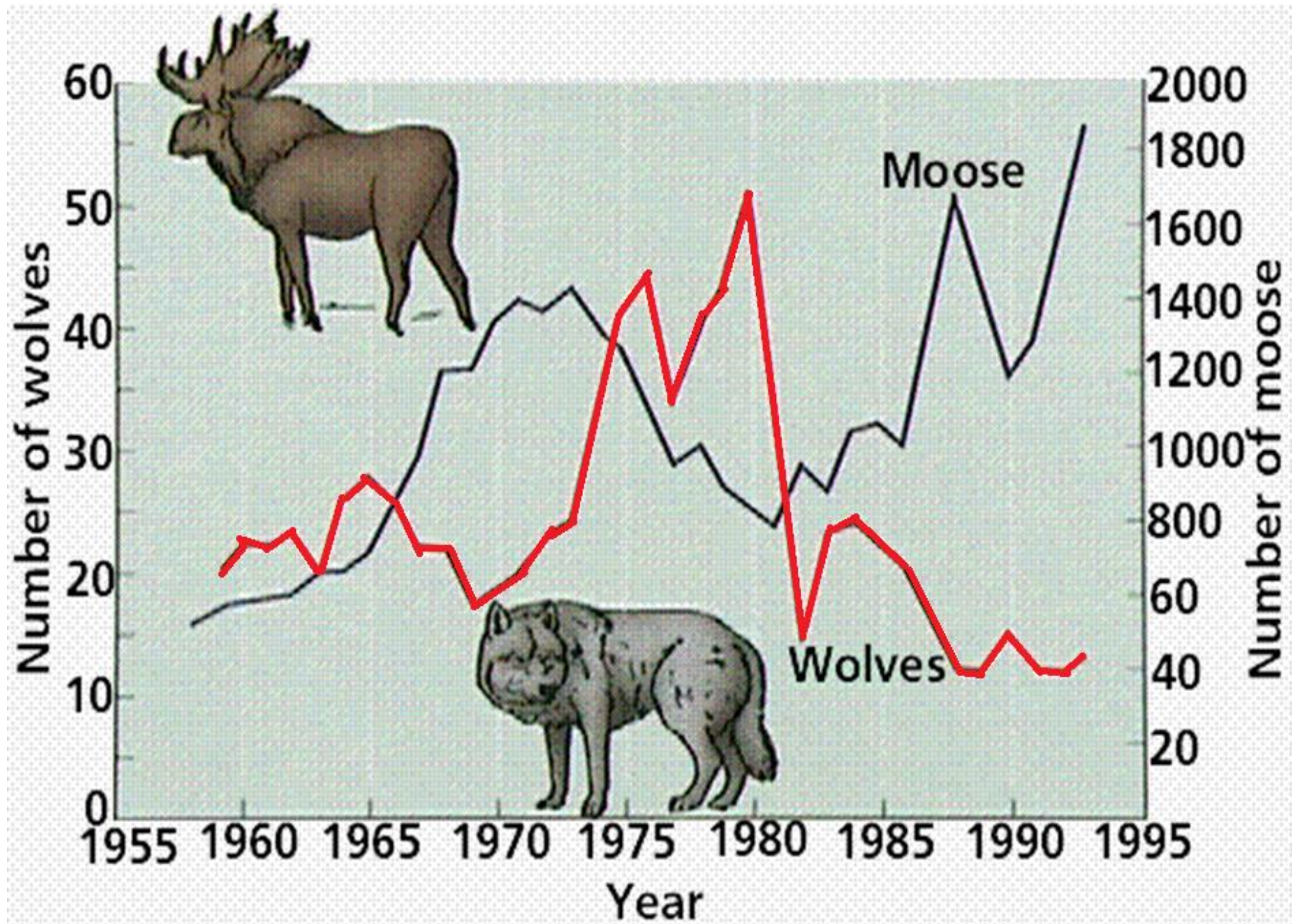
13. Within communities, organisms will interact with each other. Identify the following interactions:



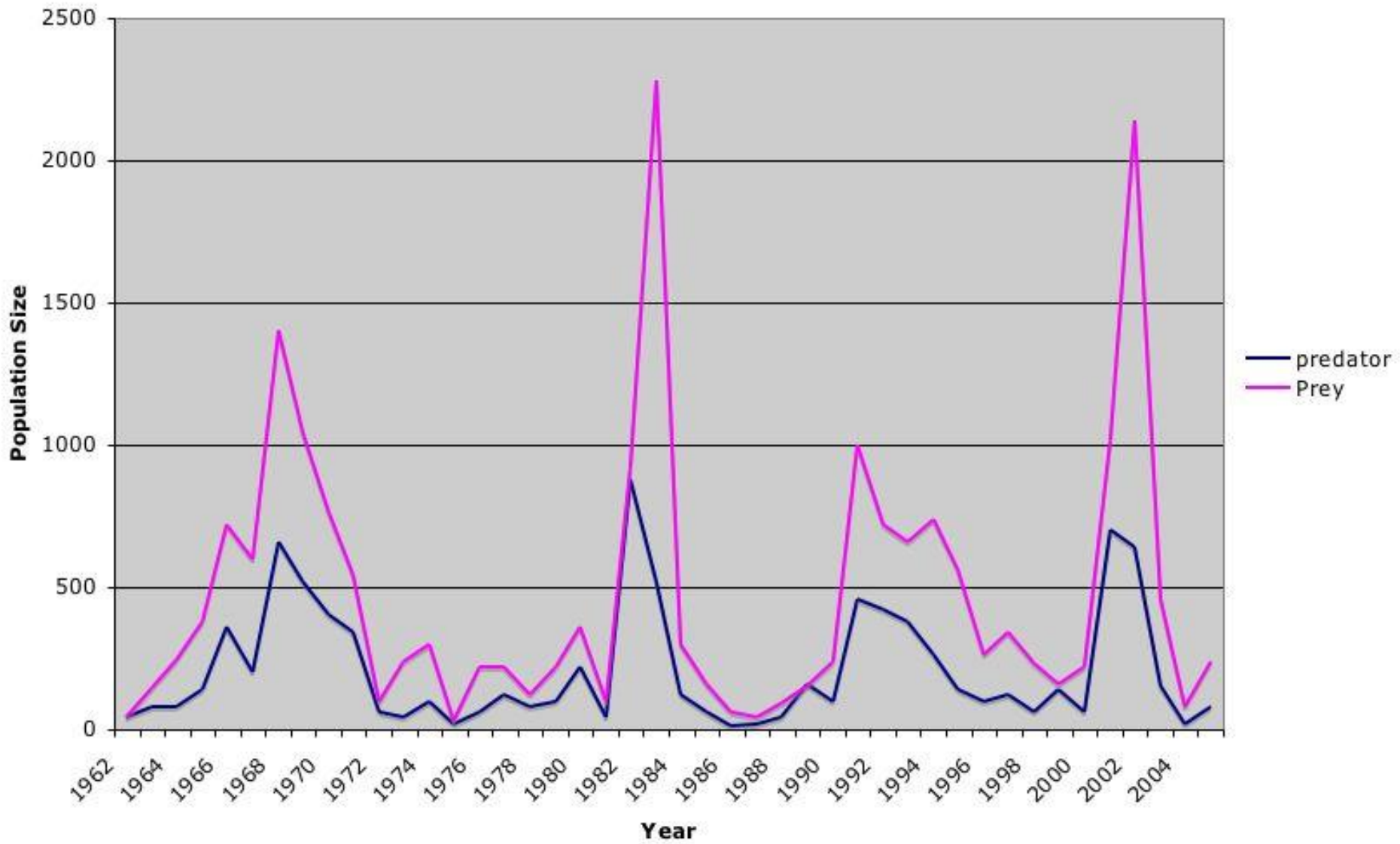
- **Predation:**

- Interaction in which one organism captures and feeds on another organism





# Predator/Prey



# 13. Keystone species

- Species that has a central influence of the ecosystem.
- If removed, ecosystem would drastically altered
  - **California otter eats sea urchins**. Without otter, sea urchins will clean out **kelp forests**
  - **Sea stars** eat mussels which prevents their colonizing the area & **allows other species in**



13. Within communities, organisms will interact with each other. Identify the following interactions:

- **Symbiosis:**

- Relationship in which two organisms live closely together





14. Draw happy faces, sad faces or indifferent faces for each of the following symbiotic relationships:

- Mutualism 😊 & 😊
- Commensalism 😊 & 😐
- Parasitism 😊 & 😞



**Clown fish and  
Sea anemone**



**Egret and Cape Buffalo**

**Tomato horn worm  
with parasitic wasp  
pupa using them as  
food!**



# 15. Succession

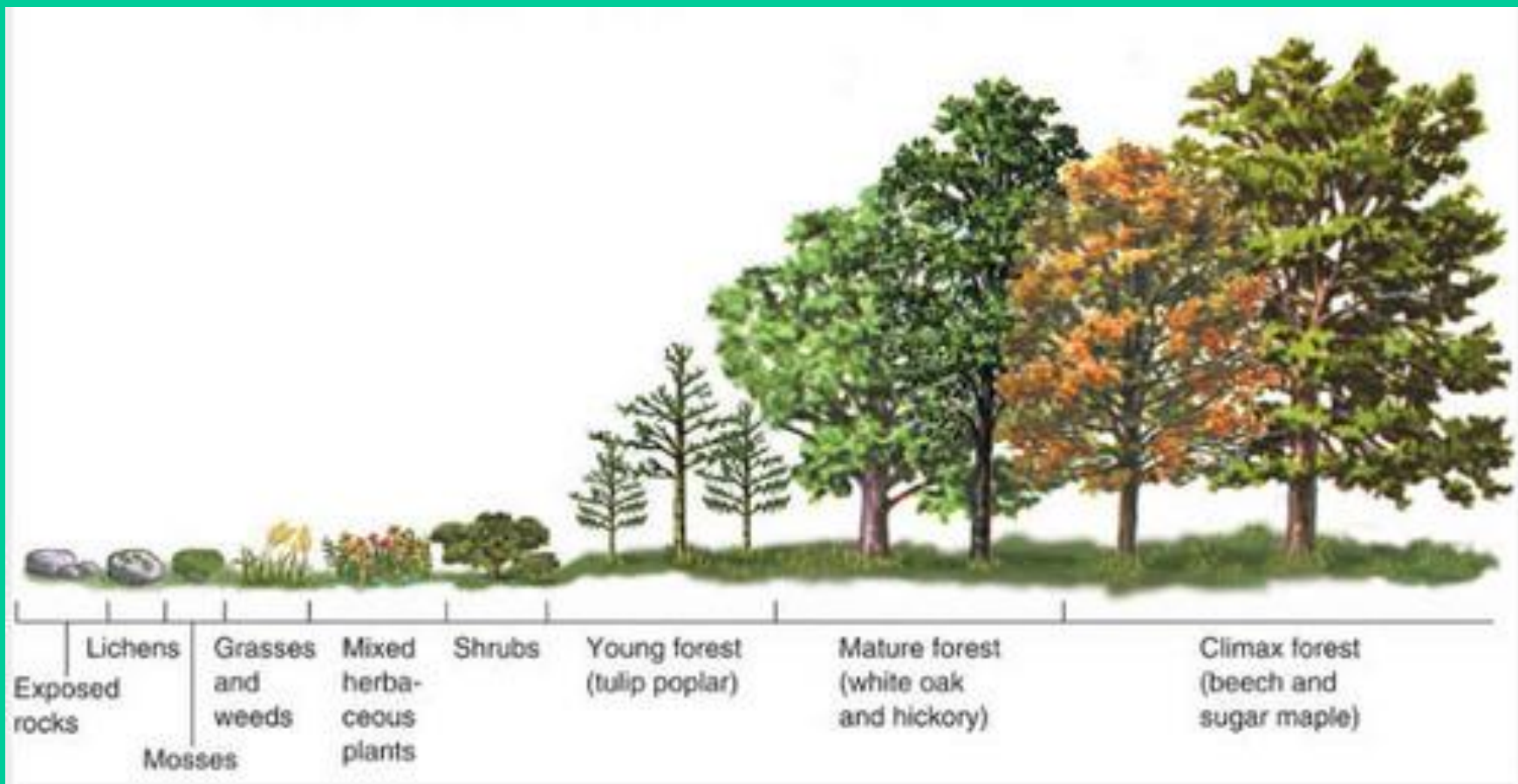
- A ***sequence of biotic changes*** that regenerates a damaged community or a bare, new area
  - What follows a forest fire?
  - What happens after a volcano?
  - What occurred after the asteroid hit the earth?

Before and after  
Mt St Helen's  
erupted in 1980



15. Discuss ecological succession and differentiate between primary and secondary succession. Be certain to mention the pioneer species of each.

Primary: A pattern of plant growth in a place that originally never had plants

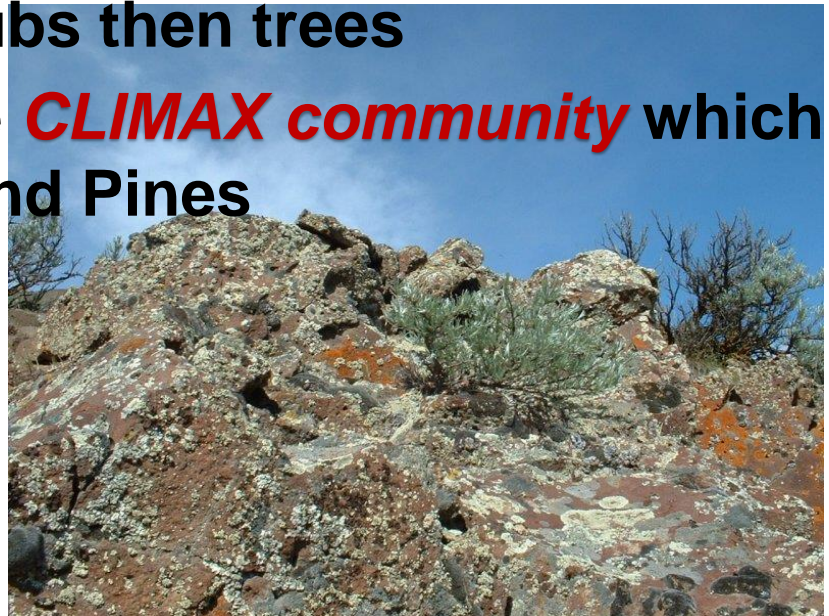


# Primary Succession starts from bare rock

- Pioneer species are the *first to inhabit the area*

## – *Lichens and mosses*

- Break down minerals in rock to allow for soil to build up
- Soil gets thicker and now grasses can start to grow.
- Next comes small shrubs then trees
- Final community is the *CLIMAX community* which are large trees like Oaks and Pines



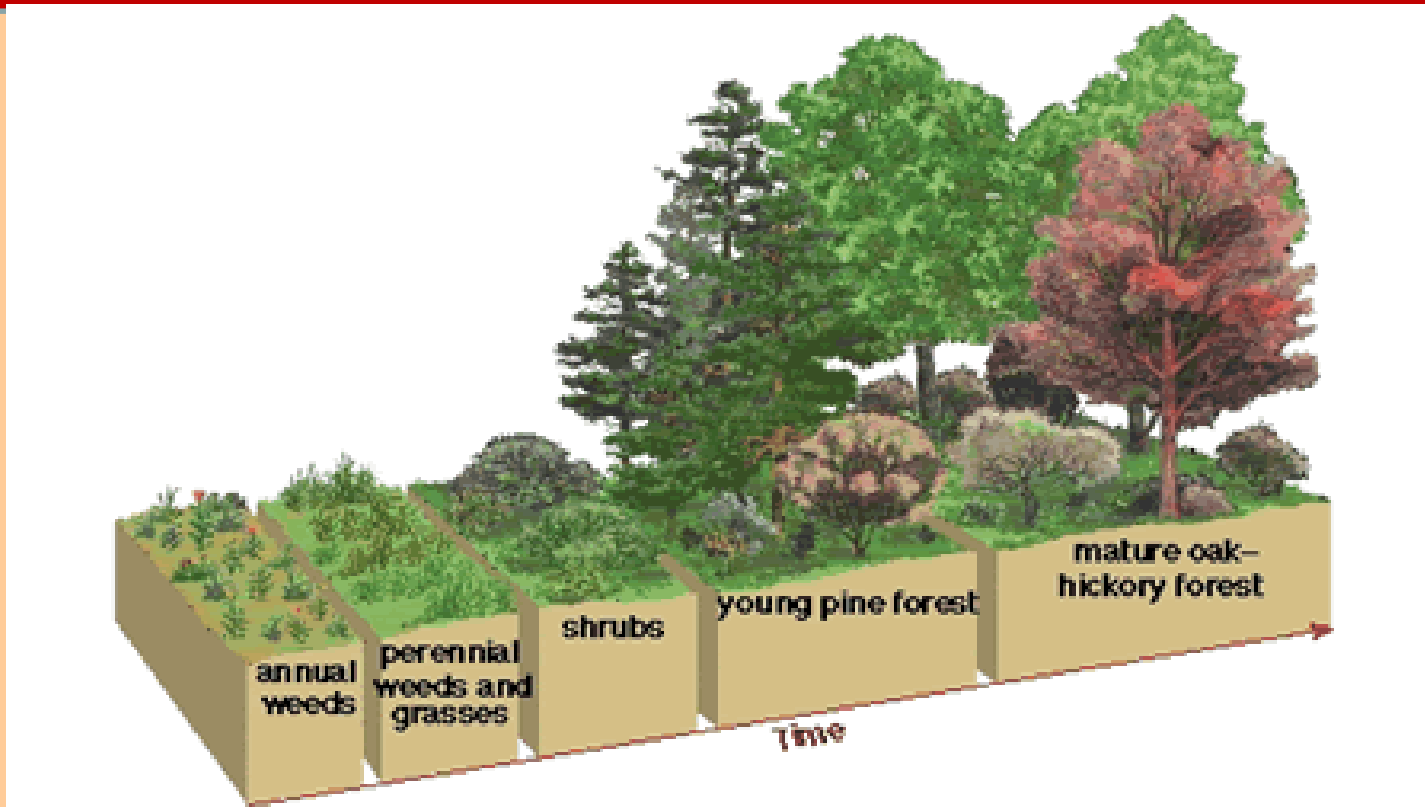
**Climax  
species**

**Pioneer  
species**



15. Discuss ecological succession and differentiate between primary and secondary succession. Be certain to mention the pioneer species of each.

Secondary: A pattern of plant growth in a place that previously had plants. Disrupted by fire, volcano, bulldozing...



# Secondary Succession starts from soil

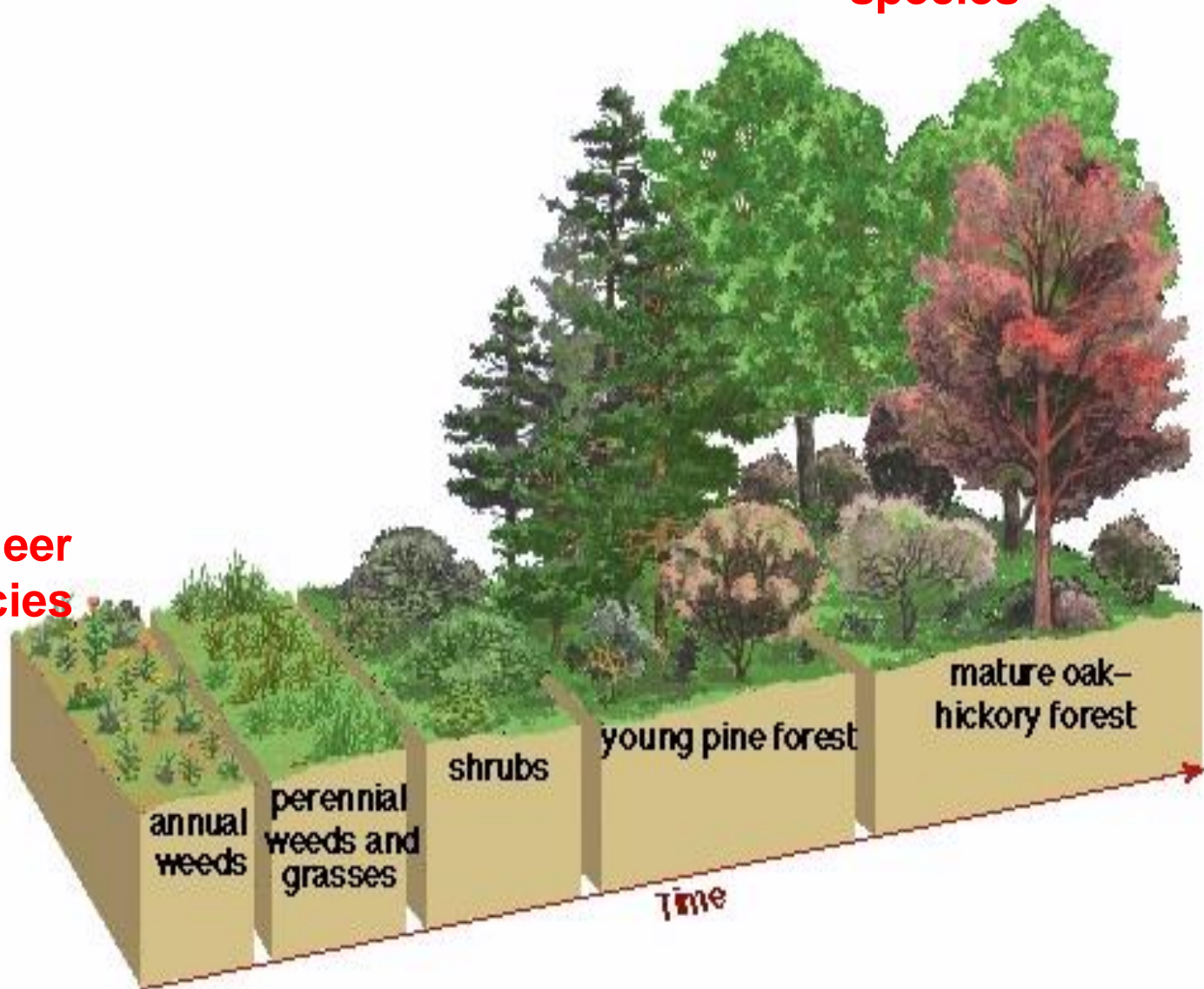
- Usually occurs in areas that have been *disturbed*
  - Bulldozed or cleared area
  - Fire
  - Flood
  - Hurricane





**Climax  
species**

**Pioneer  
species**



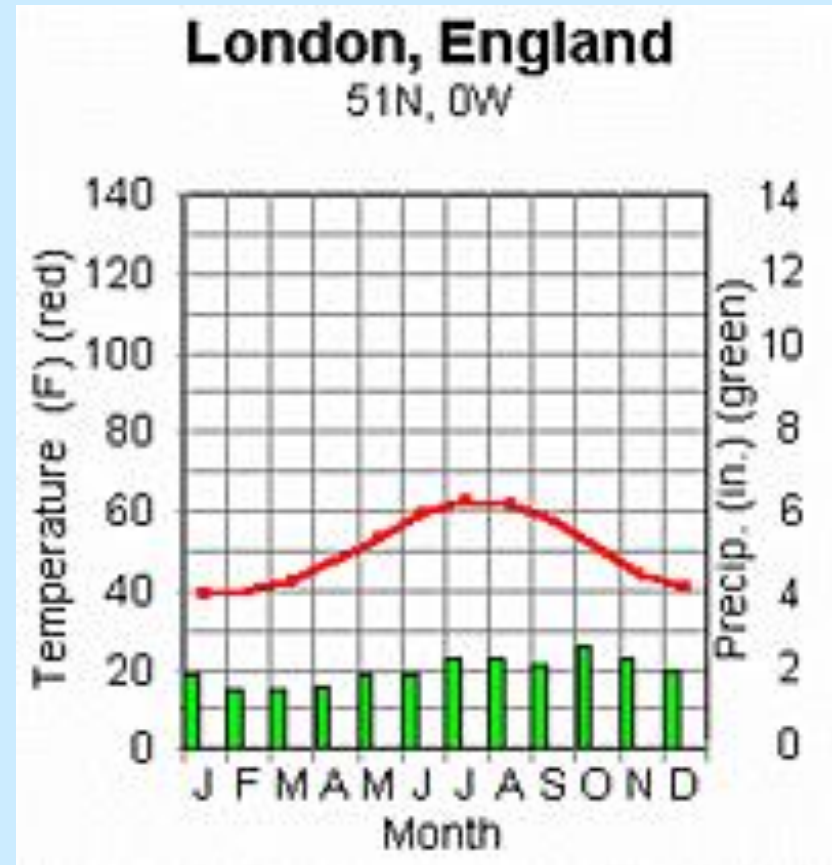
# 17. What factors define a biome?

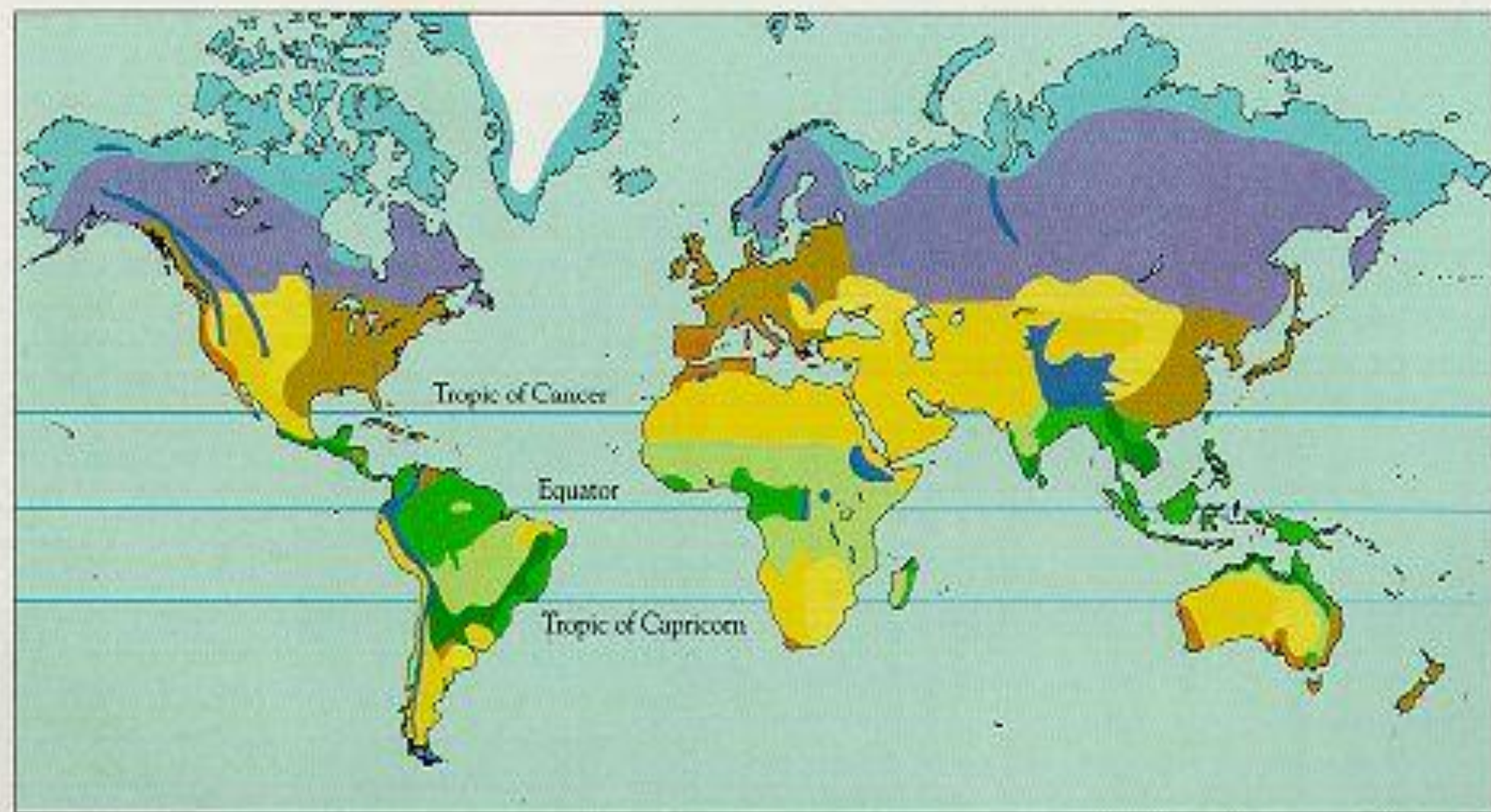
- **Abiotic Factors**

- *Temperature*
- *Precipitation*

- **Biotic Factors**

- *Plants*
- *Wildlife*





## 18. Identify the world's biomes by their abiotic factors, dominant plant and animal life:

- **Tropical Rainforest**

- **Abiotic factors:** hot and wet year-round; Even temperature
- **Dominant plants:** ferns; large woody vines and climbing plants; & orchids
- **Dominant wildlife:** sloths, predators such as jaguars; anteaters; monkeys; birds such as toucans, parrots, and parakeets; insects, piranha, frogs, lizards, snakes
- Geographic distribution:** parts of South and Central America, Southeast Asia, parts of Africa, southern India, and northeastern Australia

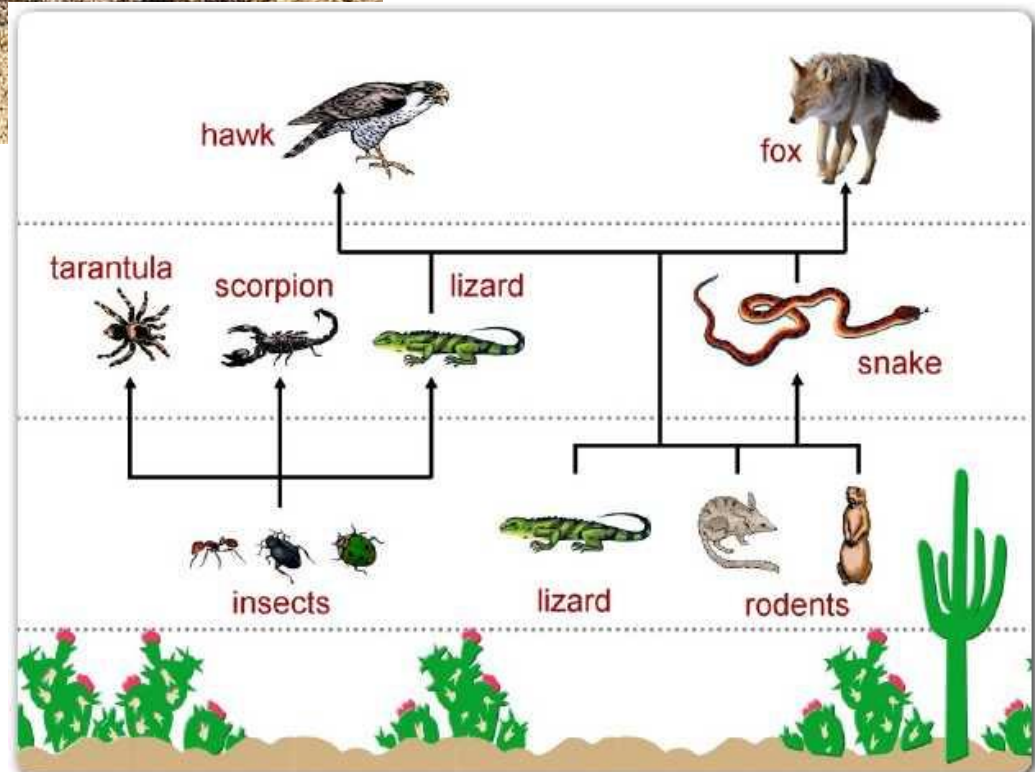


© Hartwig Dellmour

# 18. Identify the world's biomes by their abiotic factors, dominant plant and animal life:

- **Desert**

- **Abiotic factors:** low precipitation; variable temperatures;
- **Dominant plants:** cacti and other succulents
- **Dominant wildlife:** insects such as ants, beetles, butterflies, flies, and wasps; reptiles such as tortoises, rattlesnakes, and lizards
- **Geographic distribution:** Africa, Asia, the Middle East, United States, Mexico, South America, and Australia



# 18. Identify the world's biomes by their abiotic factors, dominant plant and animal life:

## Temperate Grasslands

- **Abiotic factors:** warm to hot summers; cold winters; moderate, seasonal precipitation;
- **Dominant plants:** perennial grasses and herbs; most are resistant to drought, fire, and cold
- **Dominant wildlife:** predators such as coyotes, mule deer, pronghorn antelopes, rabbits, prairie dogs, bison; birds such as hawks, owls, bobwhites, prairie chickens, mountain plovers; reptiles such as snakes; insects such as ants and grasshoppers
- **Geographic distribution:** central Asia, North America, Australia, central Europe, and upland plateaus of South America





# 18. Identify the world's biomes by their abiotic factors, dominant plant and animal life:

- **Temperate Forest – this is here!!**

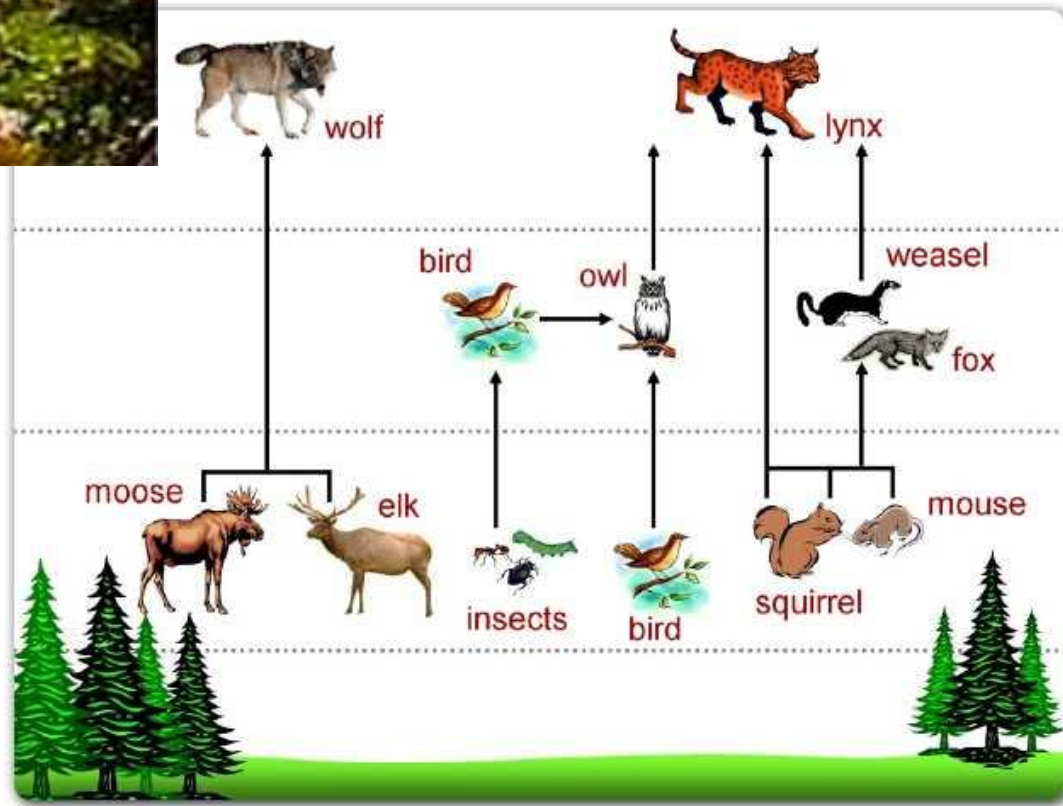
- **Abiotic factors:** cold to moderate winters; warm summers; year-round precipitation
- **Dominant plants:** broadleaf deciduous trees; some conifers; flowering shrubs; herbs; a ground layer of mosses and ferns
- **Dominant wildlife:** Deer; black bears; bobcats; nut and acorn feeders such as squirrels; omnivores such as raccoons and skunks; numerous songbirds; turkeys
- **Geographic distribution:** eastern United States; southeastern Canada; most of Europe; and parts of Japan, China, and Australia



# 18. Identify the world's biomes by their abiotic factors, dominant plant and animal life:

- **NW Coniferous forest (Taiga)**

- **Abiotic factors:** long, cold winters; short, mild summers; moderate precipitation; high humidity;
- Dominant plants:** needle-leaf coniferous trees such as spruce and fir; some broadleaf deciduous trees; small, berry-bearing shrubs
- **Dominant wildlife:** predators such as lynxes and timber wolves and members of the weasel family; small herbivorous mammals; moose and other large herbivores; beavers; songbirds and migratory birds
- **Geographic distribution:** North America, Asia, and northern Europe



# 18. Identify the world's biomes by their abiotic factors, dominant plant and animal life:

- **Tundra**

- **Abiotic factors:** **COLD, very low precipitation; permafrost**
- **Dominant plants:** ground-hugging plants such as **mosses, lichens, sedges, and short grasses**
- **Dominant wildlife:** polar bear, **musk ox, Arctic foxes, and caribou; lemmings and other small rodents**
- **Geographic distribution:** northern North America, Asia, and Europe



S. Beck

# Tundra

the maximum temperature it reaches is 17 degrees celcius with an average of -5.9 deg annually

Tundra swarm  
Up north  
Nippy  
Dry  
Red leaves  
Arctic fox

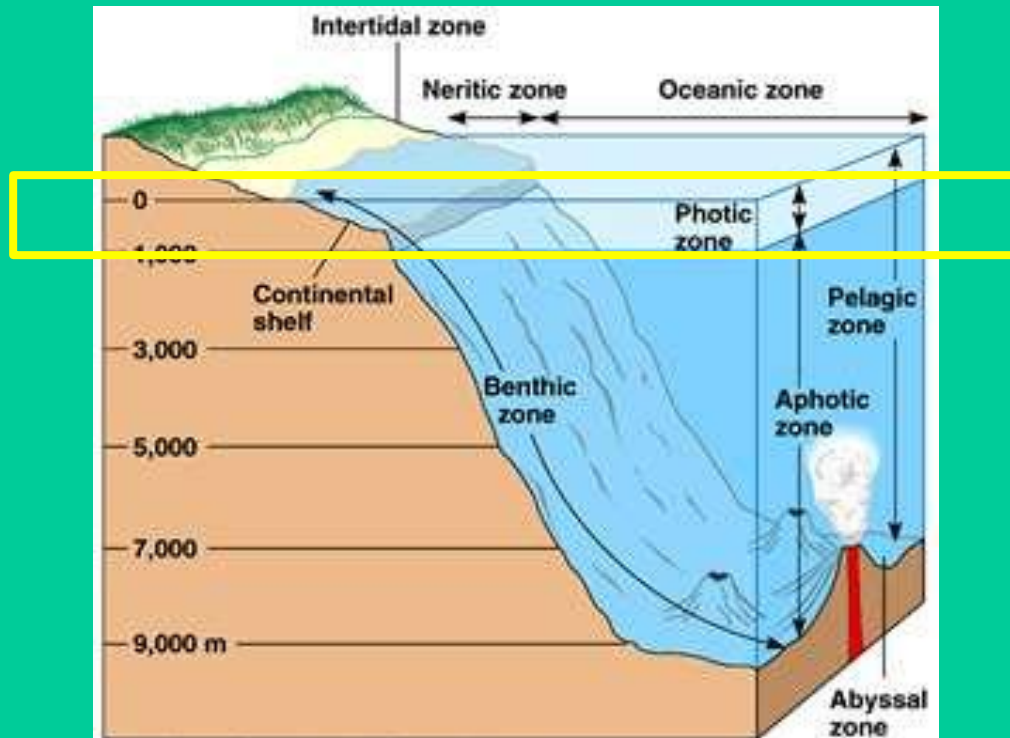
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation (mm)	100	120	140	160	140	120	100	80	60	40	20	10
Temperature (°C)	-15	-12	-8	-4	0	4	17	12	8	4	0	-4

DANGER THIN ICE

# 19. Define each of the following aquatic ecosystem terms:

- **Photic zone**

- **Upper well-lit layer** of a marine ecosystem
- Where **photosynthesis** happens so lots of **phytoplankton**

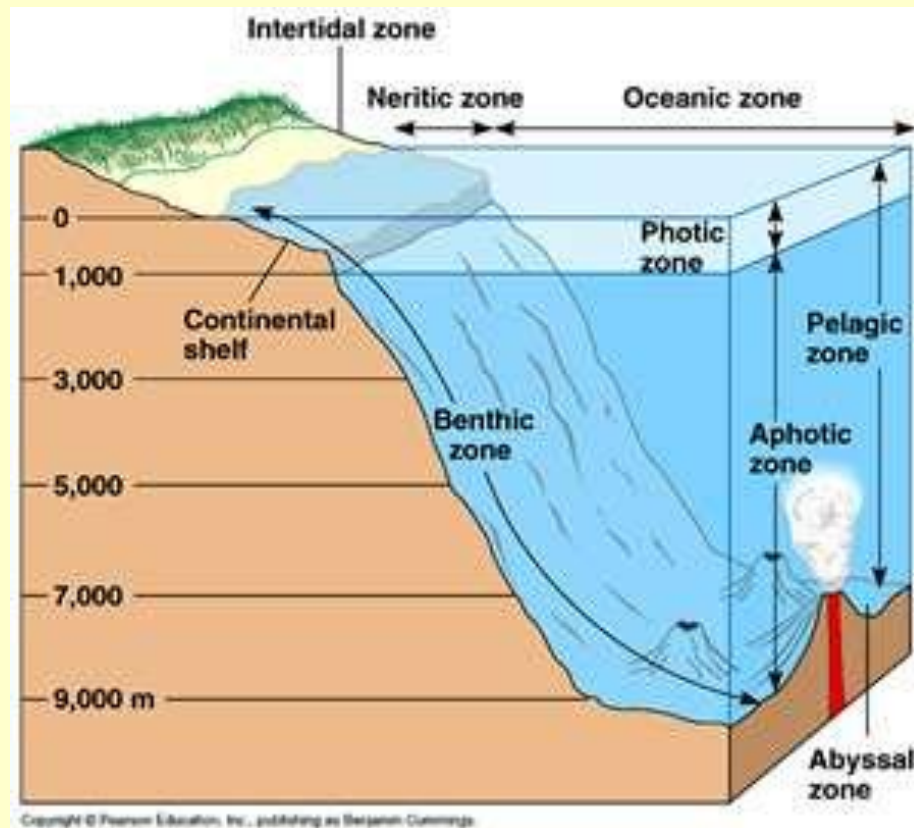




# 19. Define each of the following aquatic ecosystem terms:

- **Benthos**

- Area near or on the ocean floor. **Aphotic**



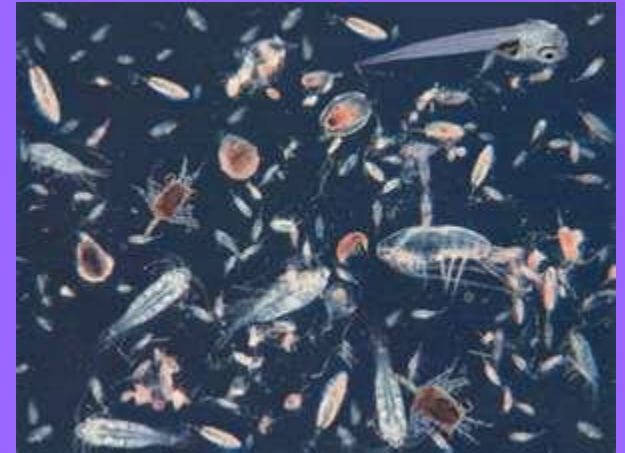
# 19. Define each of the following aquatic ecosystem terms:

- **Phytoplankton**
  - Single-celled algae



# 19. Define each of the following aquatic ecosystem terms:

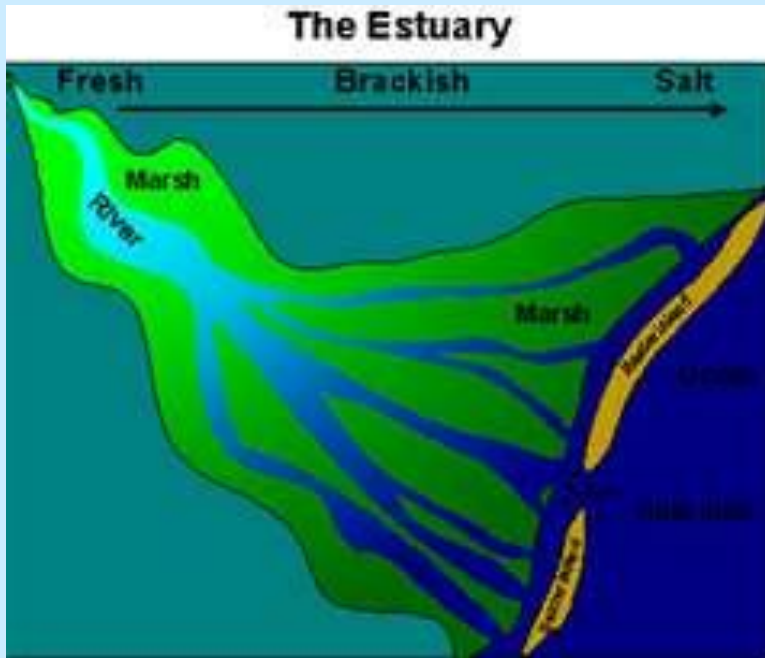
- Zooplankton
  - Planktonic animals
  - Feed on phytoplankton



# 19. Define each of the following aquatic ecosystem terms:

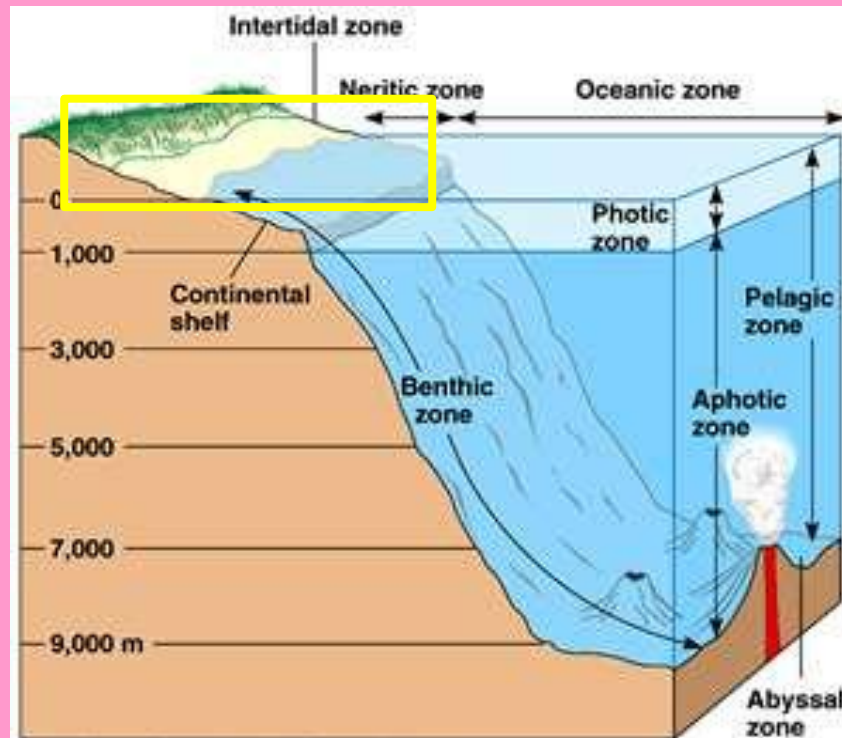
- **Estuary**

- Areas where freshwater and saltwater mix

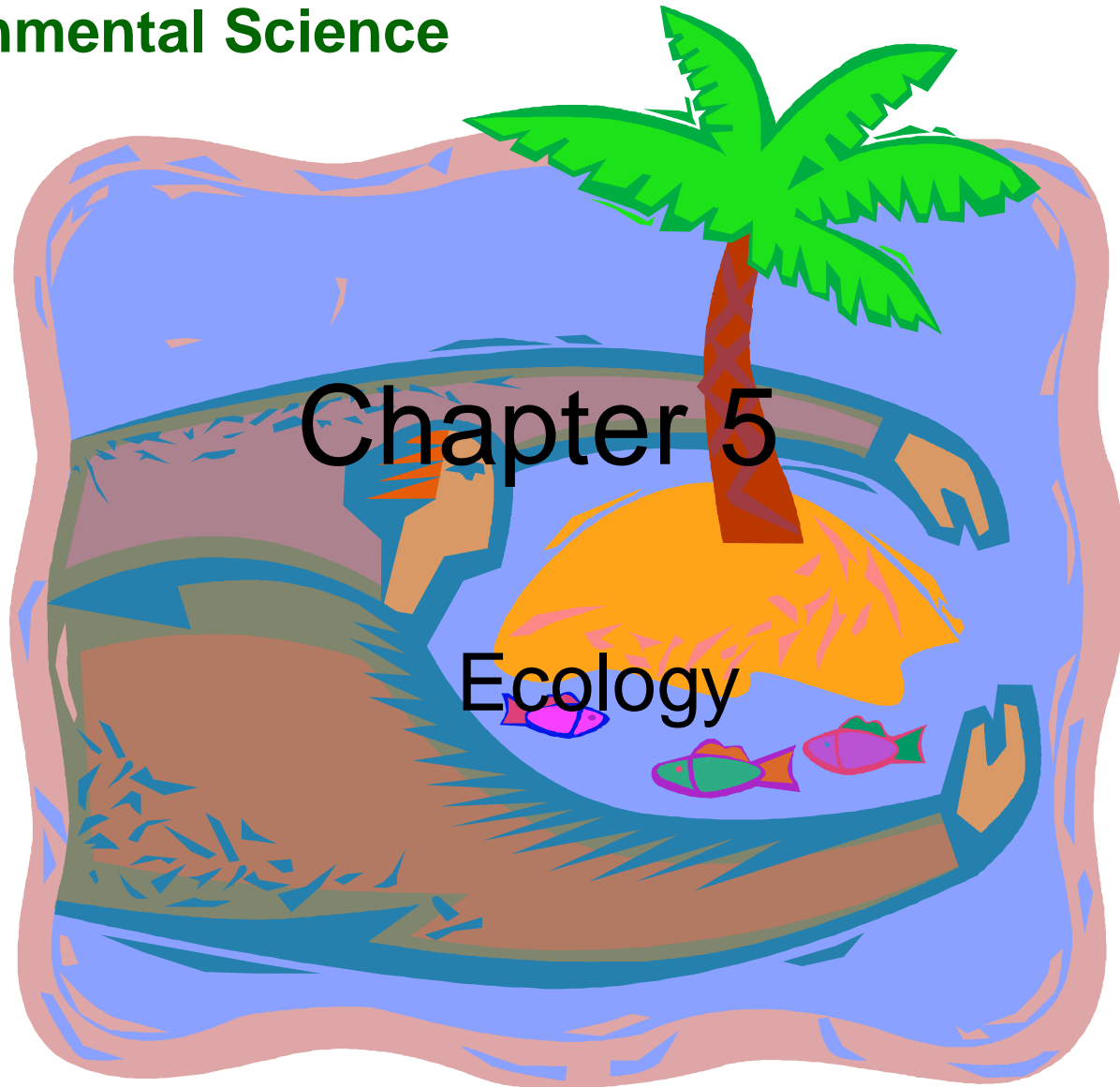


# 19. Define each of the following aquatic ecosystem terms:

- Intertidal zone
  - Areas that are dramatically changed by the daily tides. Clams, crab, seaweed

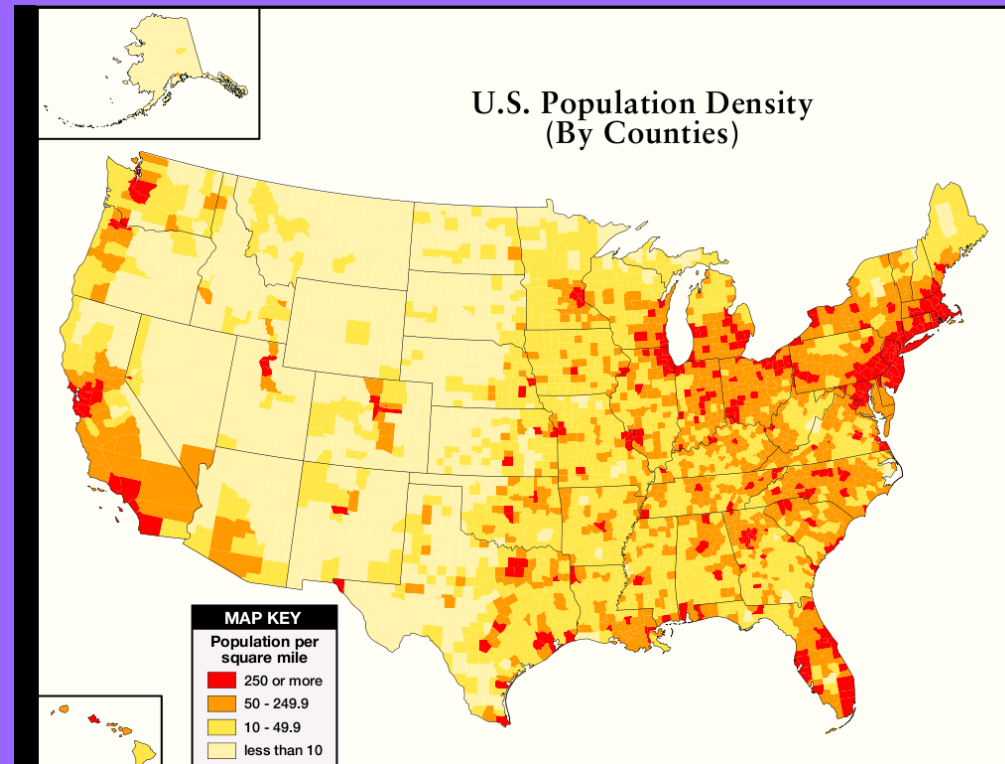


**This is really the beginning  
of Environmental Science**



# 20. Define the term: Population density

- Measurement of the population per unit of volume
  - For example, dividing the total US population of 281,421,906 by the total land area of 3,537,438.44 gives a density value of 79.6 people per square mile.

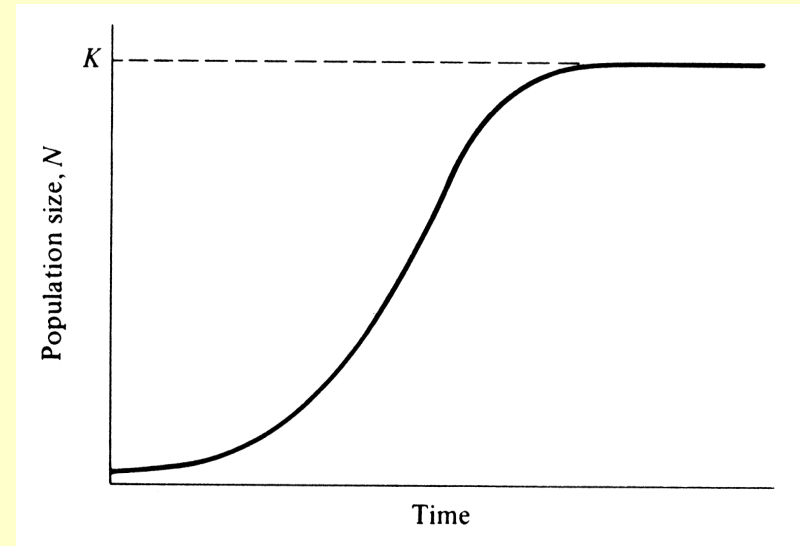
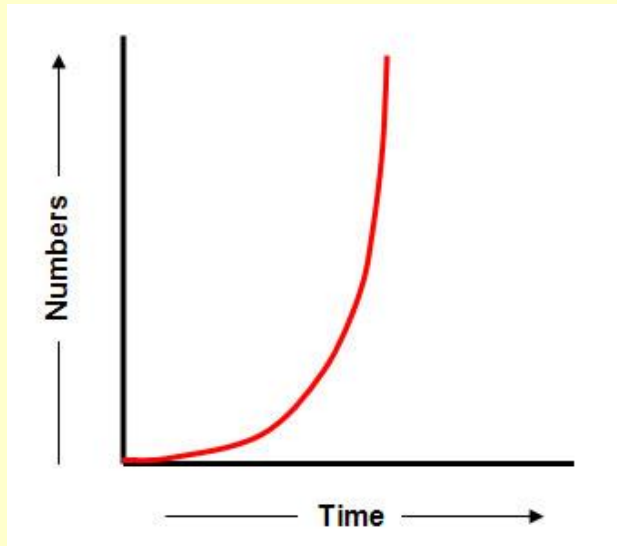


# 21. Discuss the three factors that affect a population's size

- Birth rate/ death rate
- Immigration/Emigration
- Limiting Factor
- Carrying capacity



# 22. Label the exponential growth curve, the logistic growth curve, and what each represents

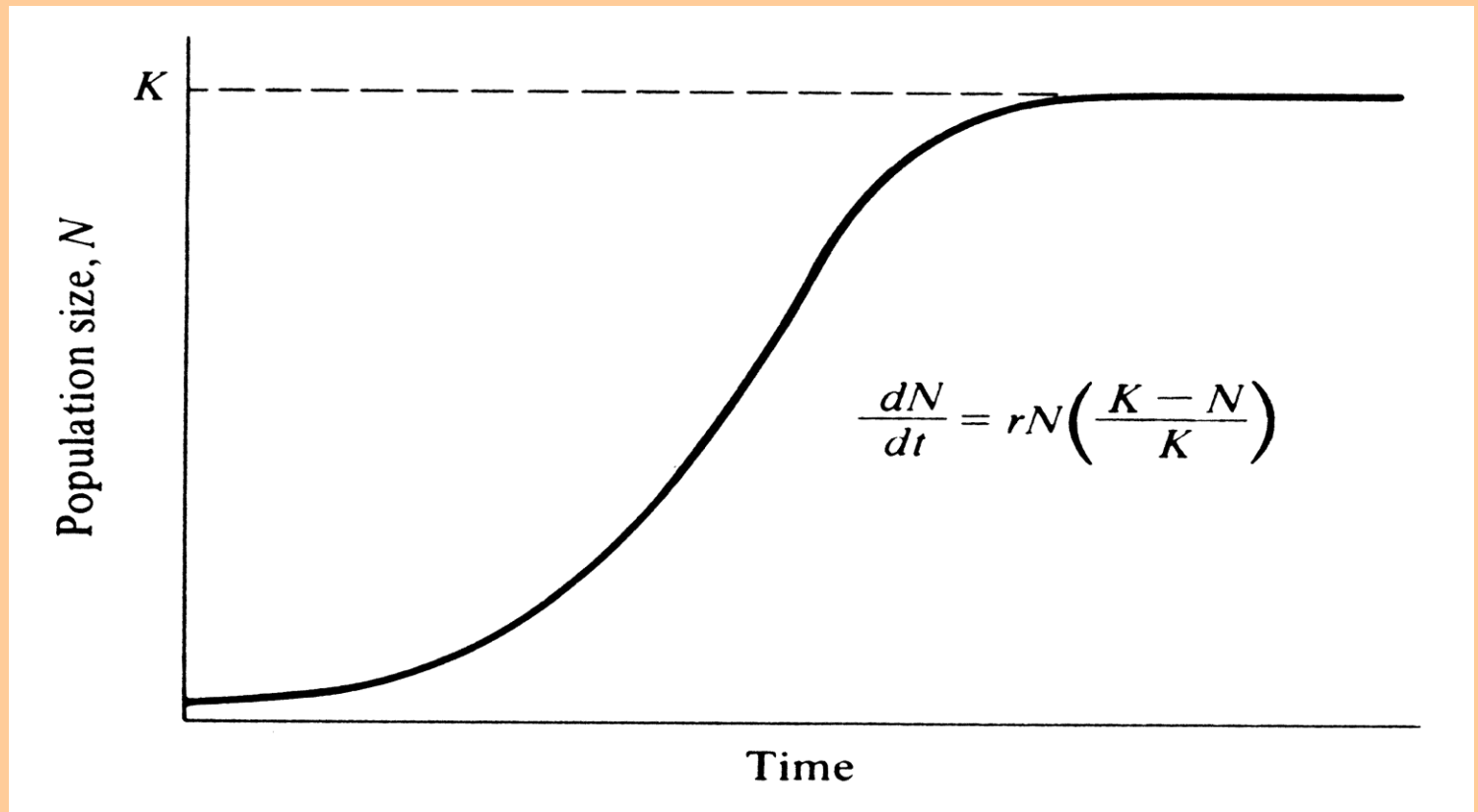


Left: **Exponential curve**-- limitless supply of nutrients; "J" curve shows growth explosion, initial "lag" is due to adjusting to new habitat

Right: **Logistic curve**--limited supply of nutrients; sigmoid curve shows adjustment, growth, and then stasis due to limits hit

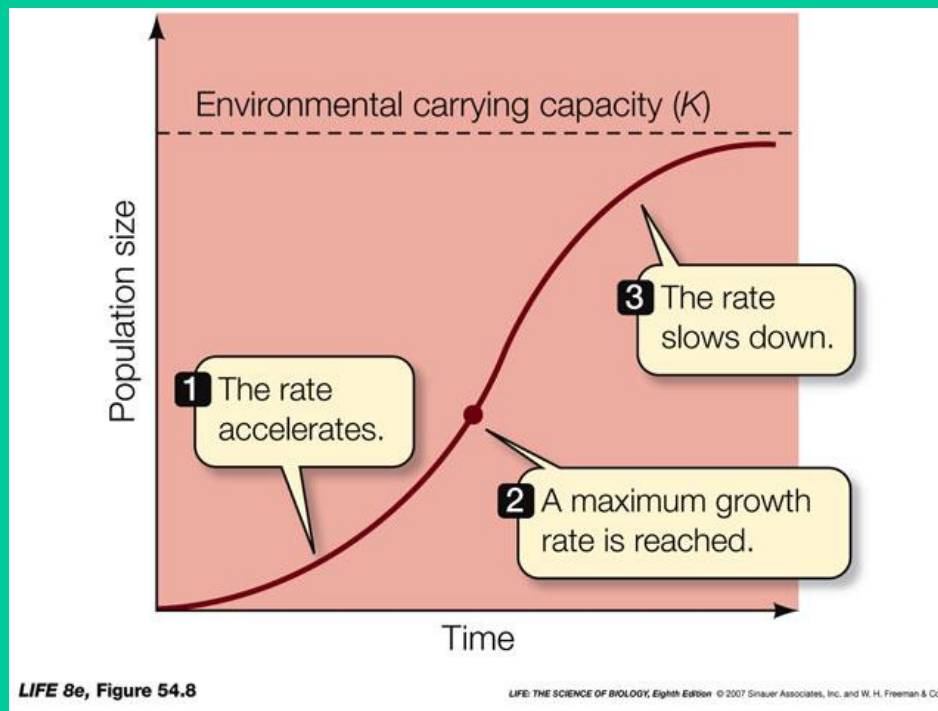
# 23. What does $K$ represent?

- The carrying capacity



# 24. Explain what is meant by the term *carrying capacity*

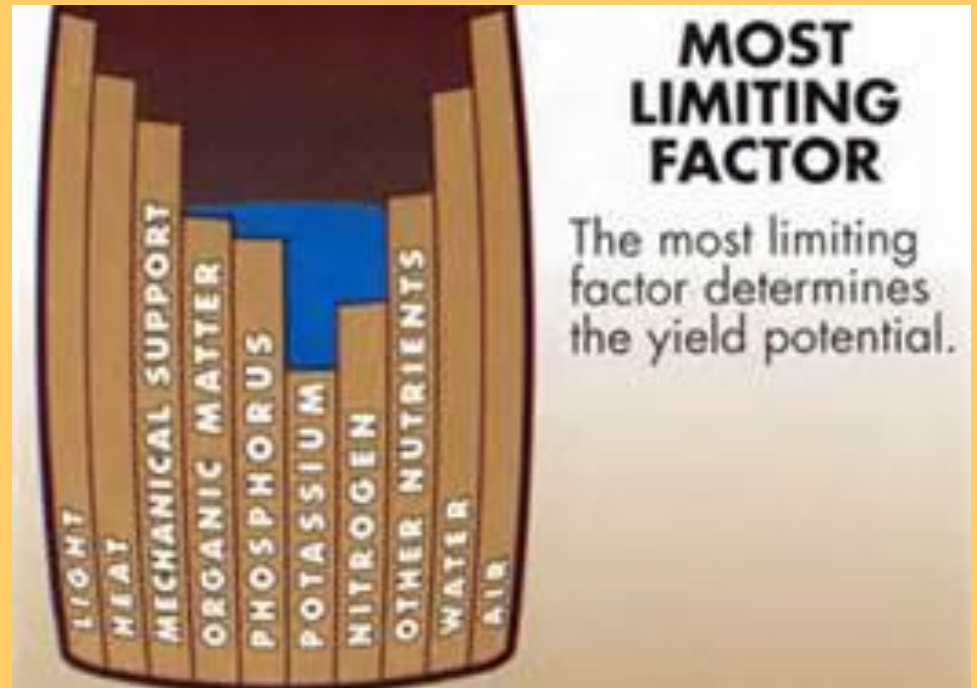
- Maximum population that an area can support as long as conditions do not change



Environment can only support so many species

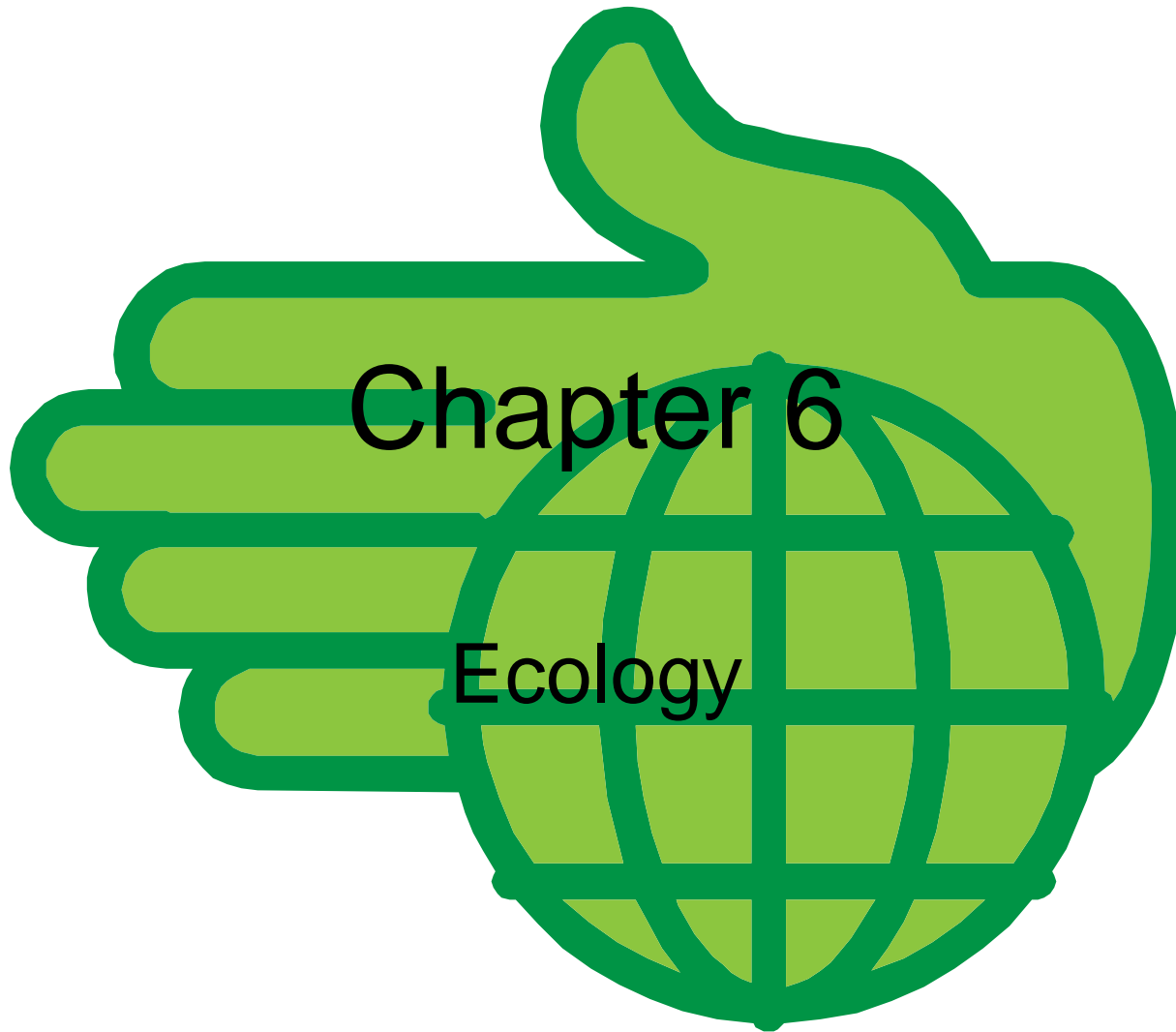
## 25. Define and then give an example of a limiting factor

- **Limiting factor**—any factor that causes the growth of a population to decrease
  - Light
  - Water
  - Food
  - Physical space



26. Differentiate between a density-dependent limiting factor and a density-independent limiting factor. Give an example of each.

- **Dependent**—depends on population size
  - Food
  - Space
  - Wastes
- **Independent**—does not depend on population size
  - An abiotic factor influencing population size
    - Temperature



# Chapter 6

## Ecology

# 27. What are the major human activities that have transformed the biosphere?

- Hunting and gathering
- Agriculture
- Industrial Growth and Urban development



# 28. What is a renewable resource and give an example of one.

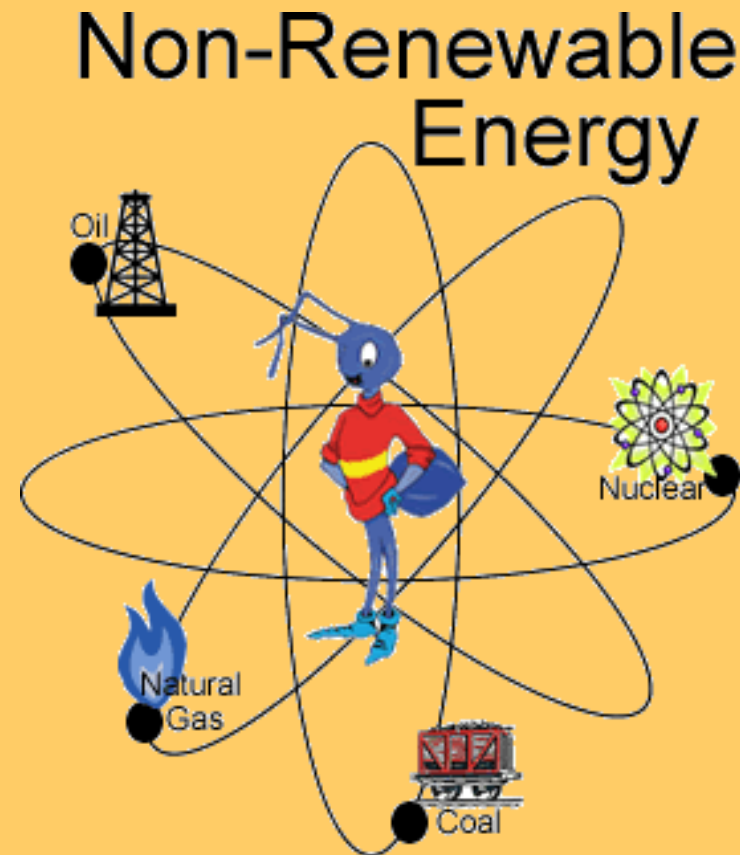
- A resource that is remade often
  - Wind
  - Water
  - Sun
  - Geothermal





# 29. Identify a non-renewable resource and explain what they are.

- Resources that cannot be remade or are formed too slowly
  - Nuclear
  - Fossil fuels



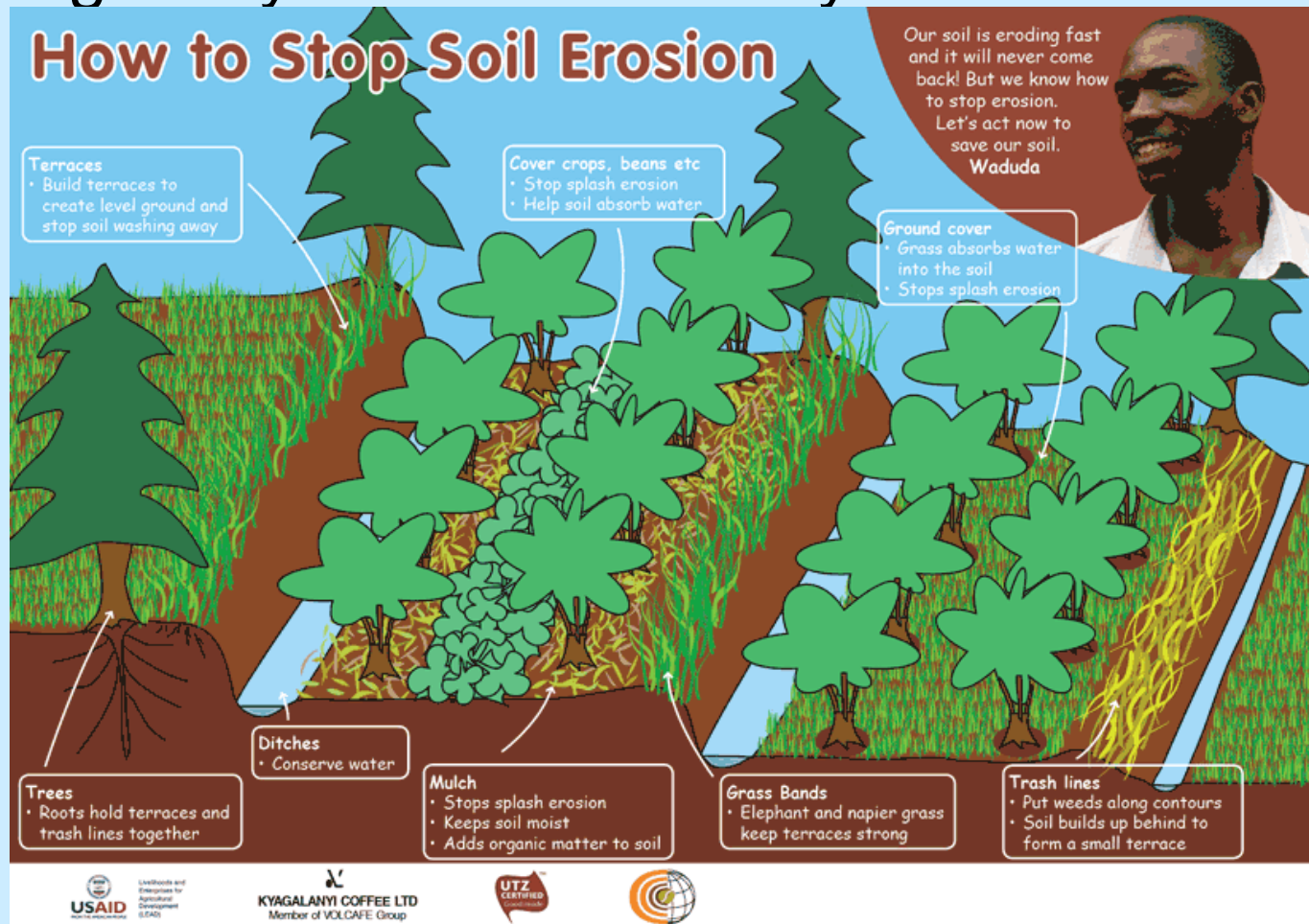
# 30. What is meant by sustainable use?

- Way of using natural resources without depleting them



# 31. Explain what each of the following mismanaged land resource is:

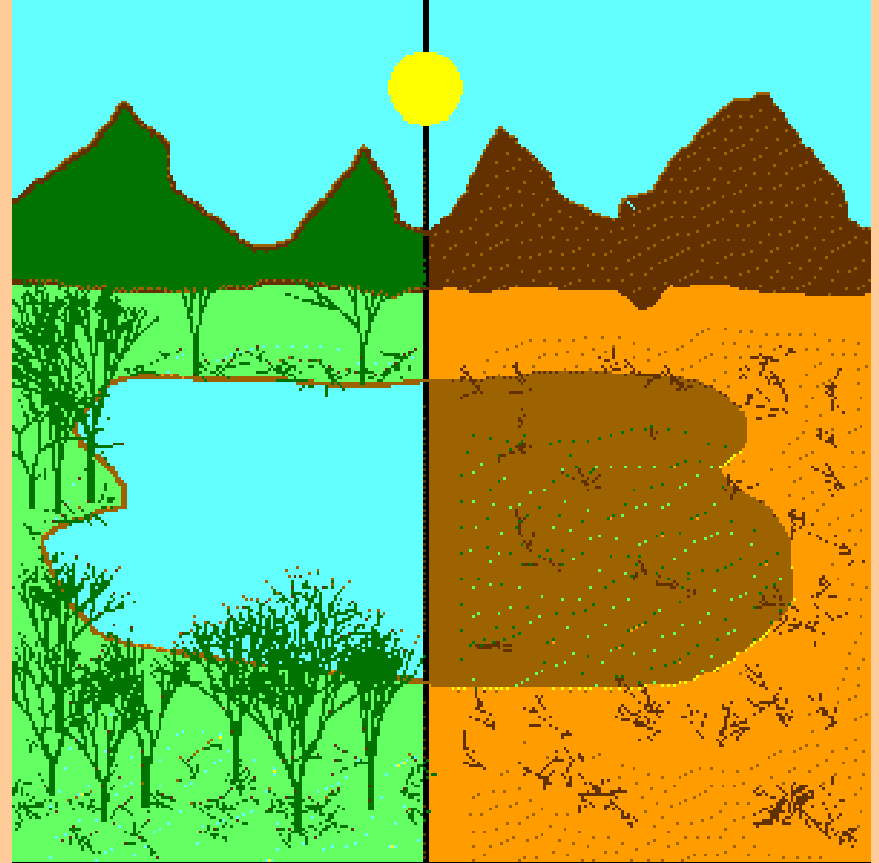
- Soil erosion
  - Wearing away of surface soil by water and wind



# 31. Explain what each of the following mismanaged land resource is:

- **Desertification**

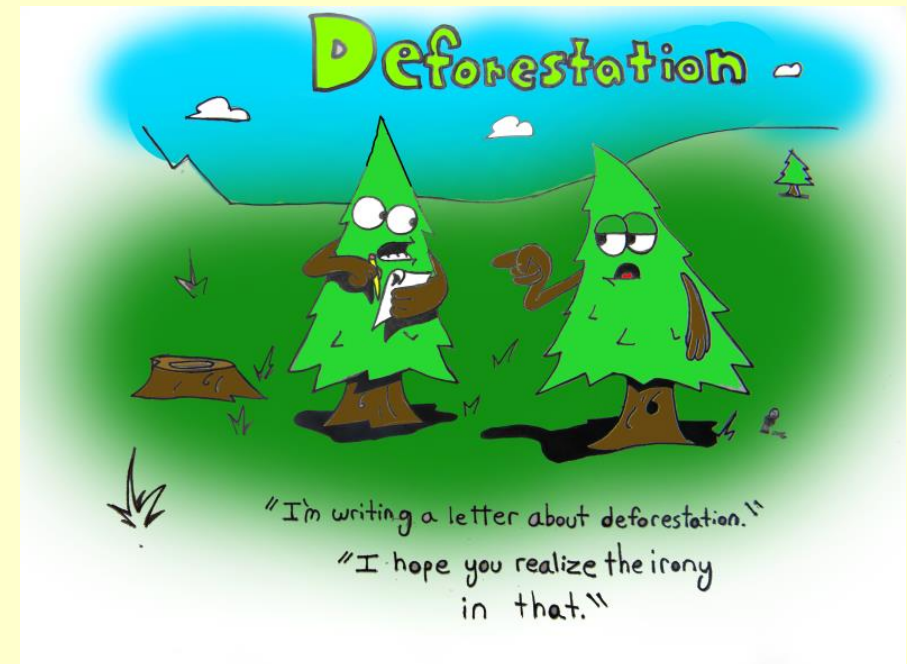
- Combination of farming, overgrazing, and drought turns good areas into deserts



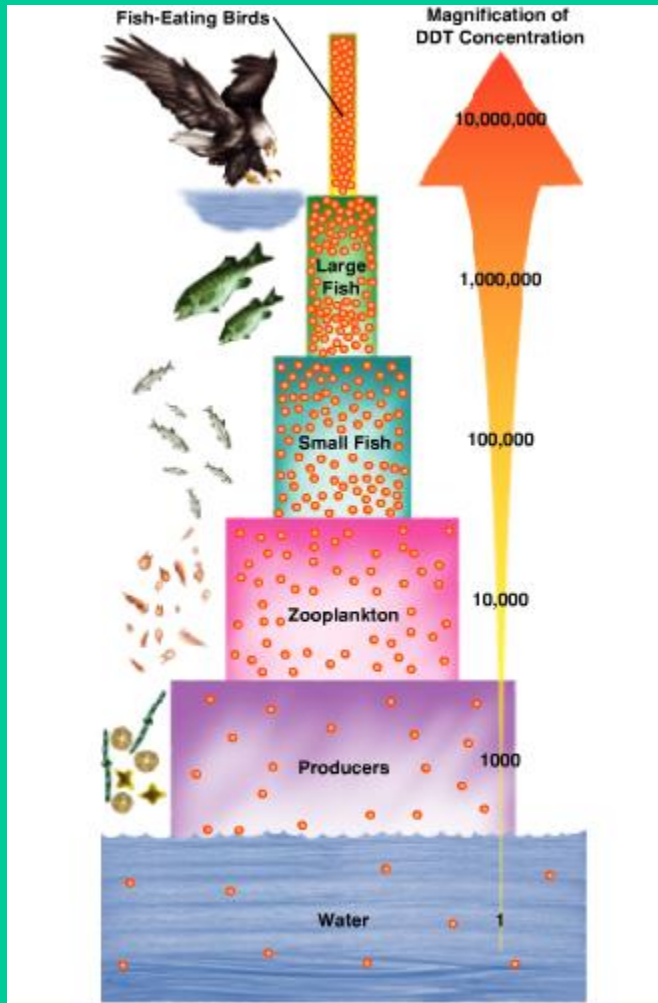
# 31. Explain what each of the following mismanaged land resource is:

- **Deforestation**

- Loss of forests without replacing them
- Loss of habitats



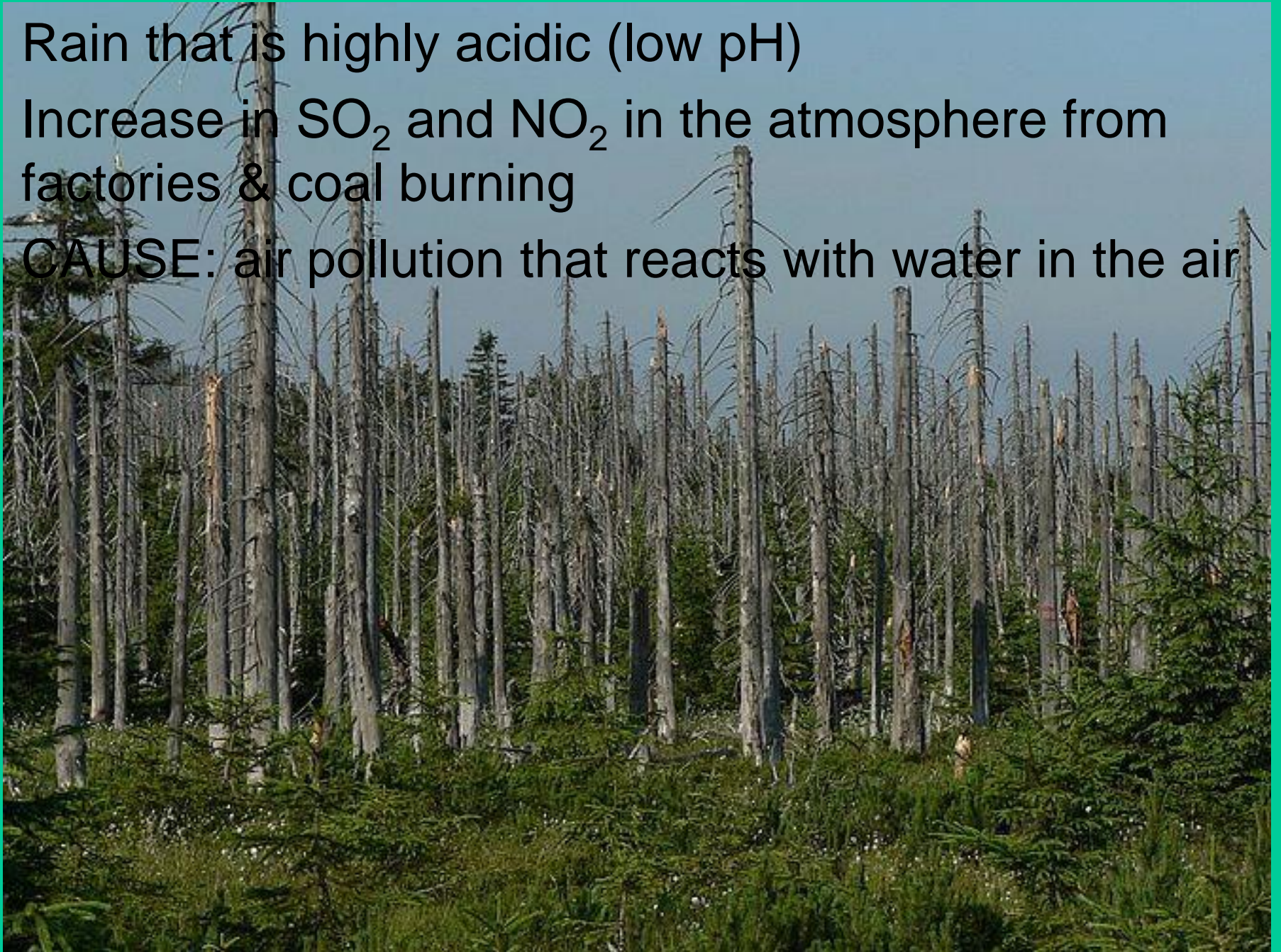
# 32. Using figure 6-16, explain biological magnification and its influence of organisms.



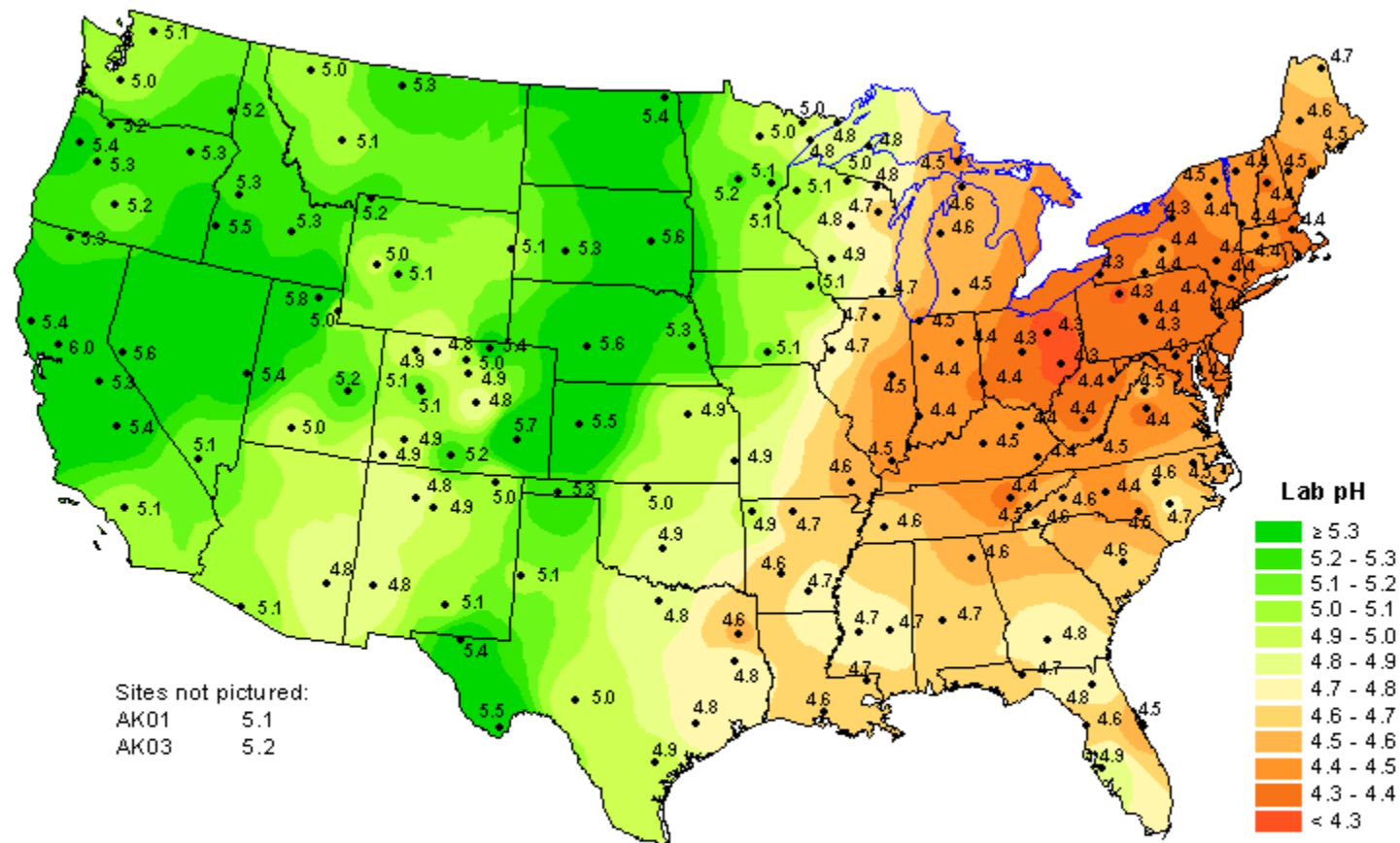
- Higher up in food chain, higher amount of toxins building up
- “magnifies” as you go up a food chain

### 33. What is acid rain and what is the major cause of it?

- Rain that is highly acidic (low pH)
- Increase in  $\text{SO}_2$  and  $\text{NO}_2$  in the atmosphere from factories & coal burning
- **CAUSE:** air pollution that reacts with water in the air



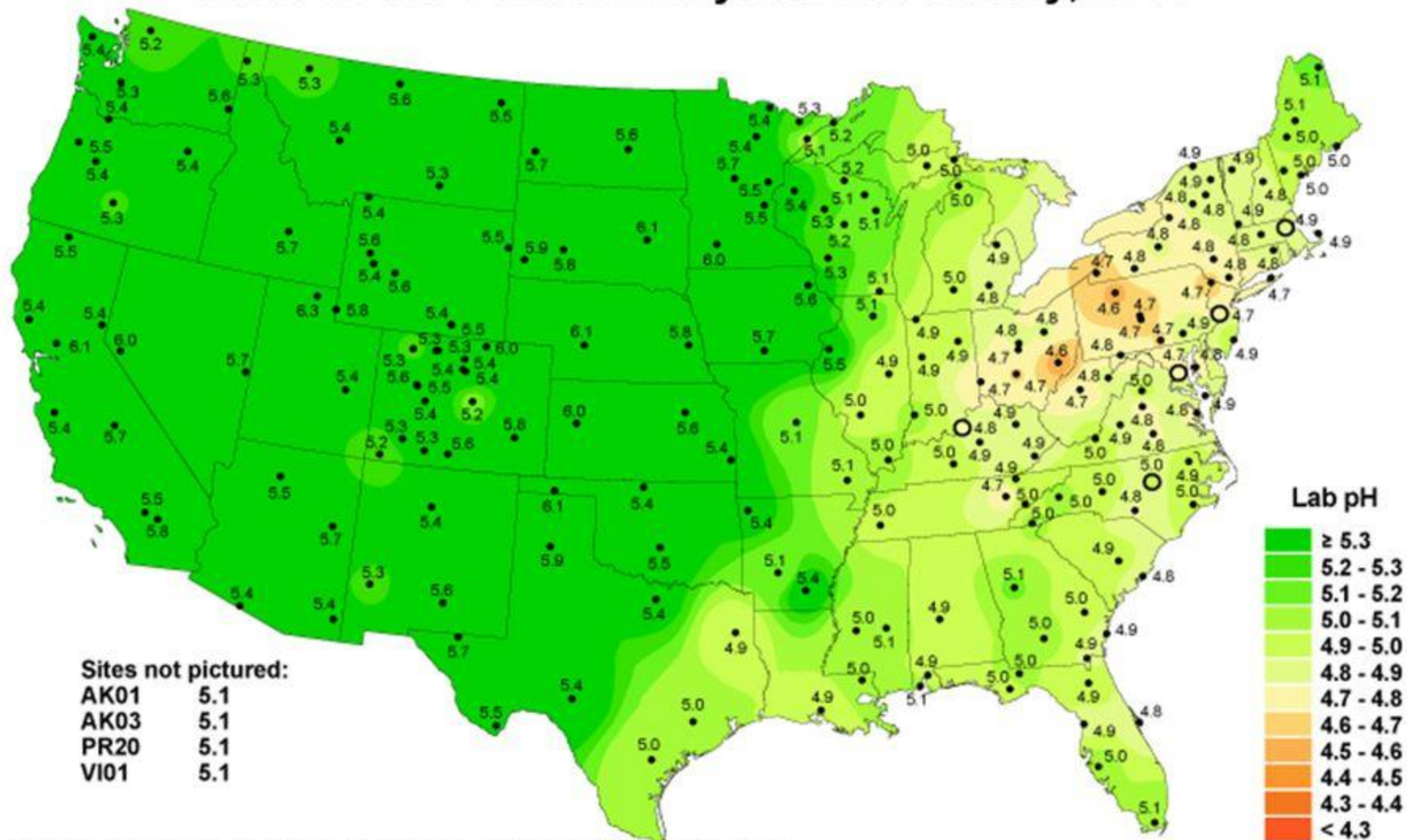
## Hydrogen ion concentration as pH from measurements made at the Central Analytical Laboratory, 1997



National Atmospheric Deposition Program/National Trends Network  
<http://nadp.sws.uiuc.edu>



# Hydrogen ion concentration as pH from measurements made at the Central Analytical Laboratory, 2009



National Atmospheric Deposition Program/National Trends Network

# 34. Define biodiversity.

- Sum total of the genetically based variety of all organisms in the biosphere



# 35. Explain the importance of earth's great biodiversity.

- These species provide us
  - Food
  - Industrial products
  - Medicines
  - Recreation
  - Aesthetic Beauty



# 36. How can humans reduce biodiversity?

- Changing habitats
- Poaching
- Overhunting/Overfishing
- Pollution
- Invasive Species

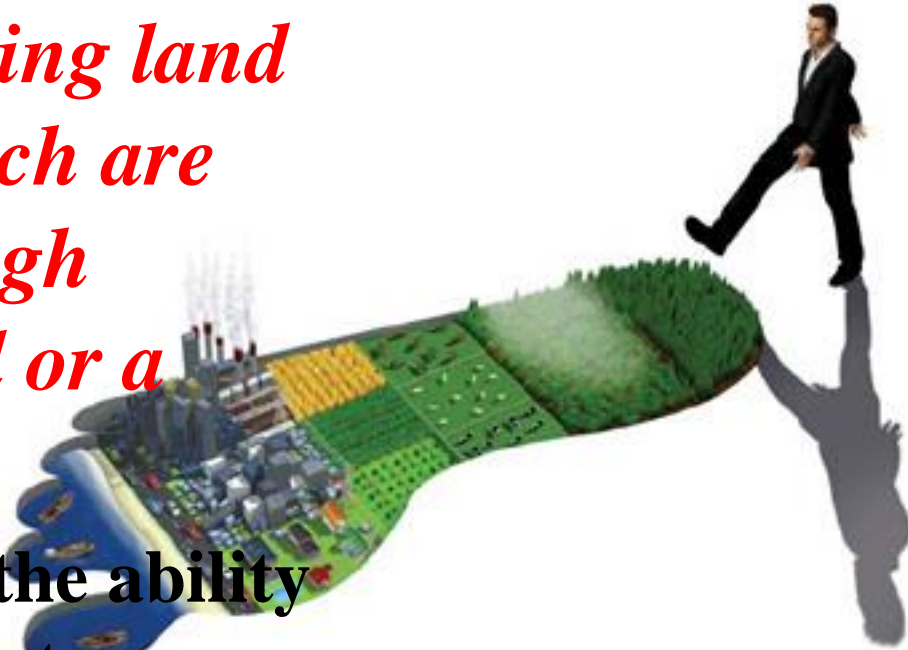


# 37. Ecological Footprint

- World population

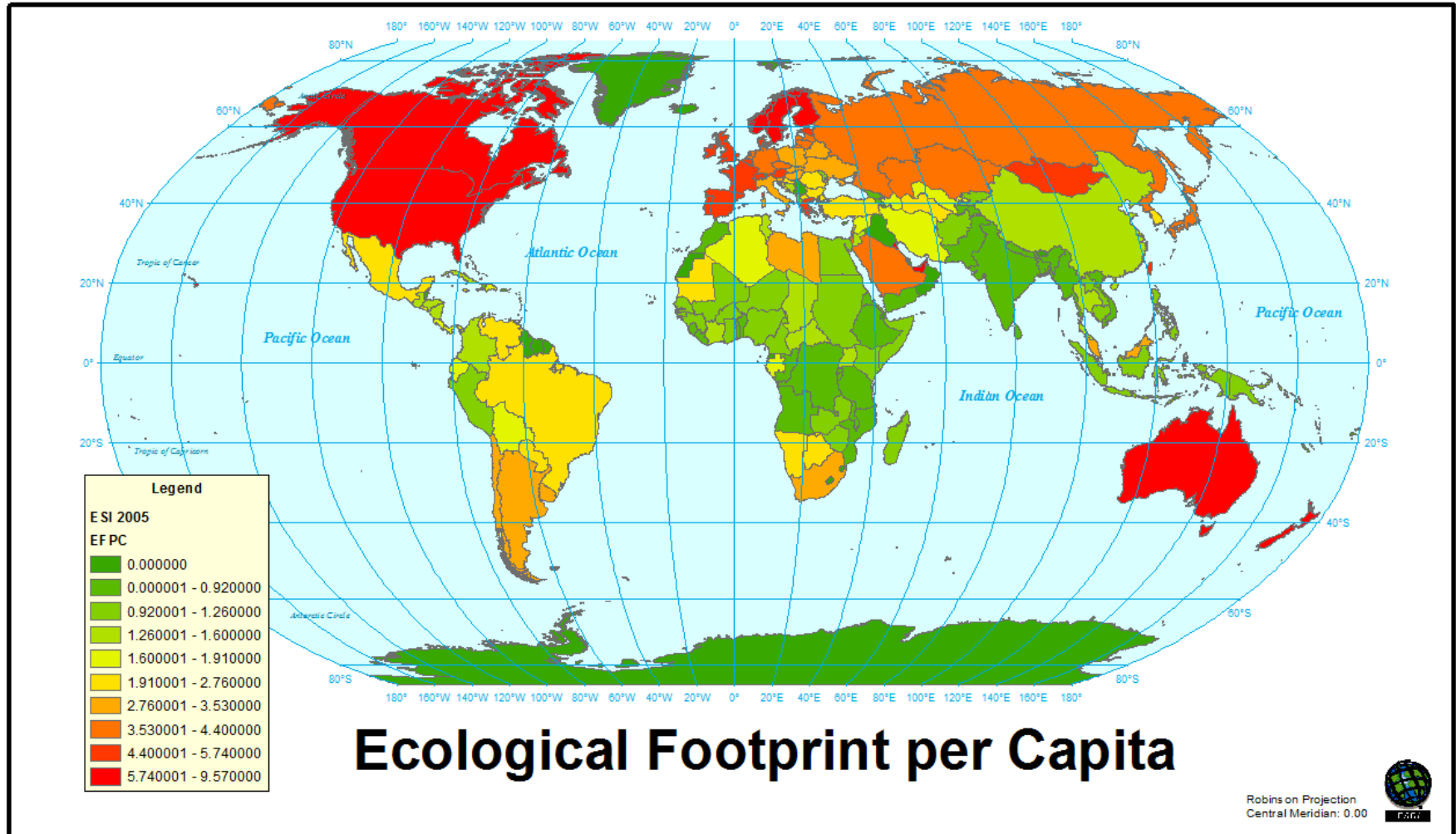
- *The total area of functioning land and water ecosystems which are necessary to provide enough resources to an individual or a population.*

- It also takes into account the ability to absorb or turn wastes into a harmless form.
- Considers the amount of resources needed such as energy, food, water, shelter and breakdown of wastes.



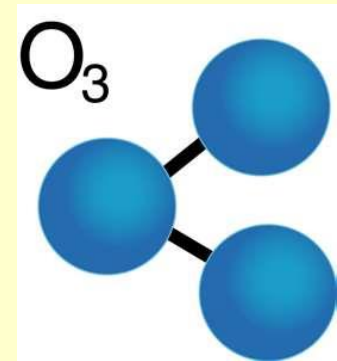
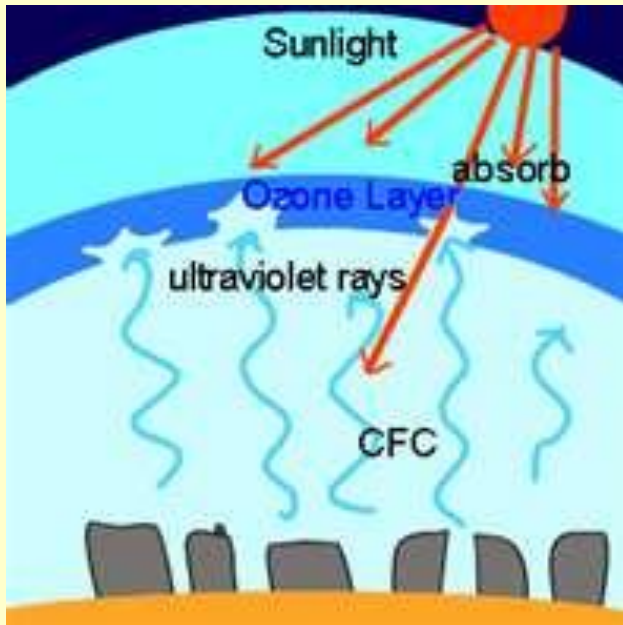
# 38. Use for Ecological footprint?

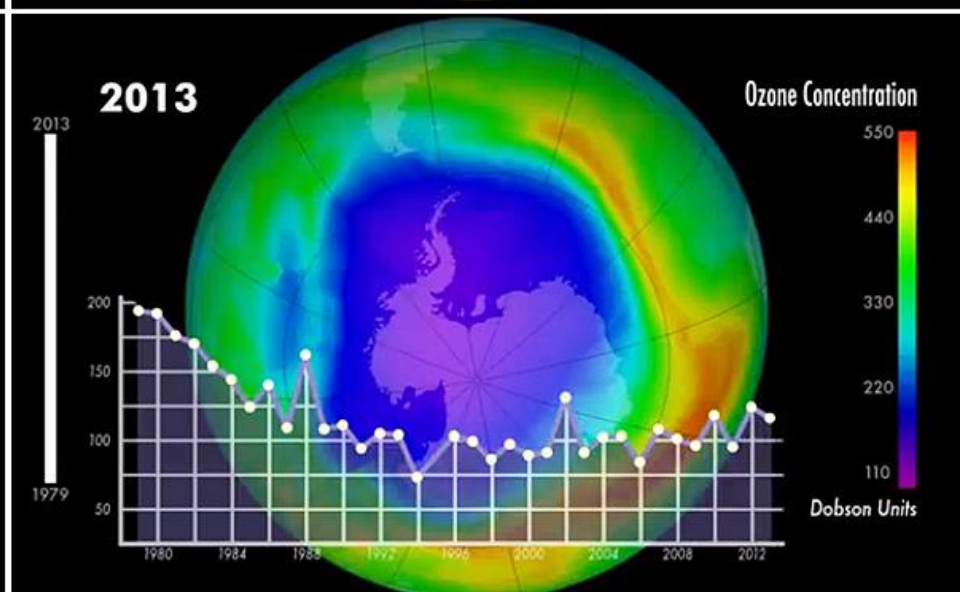
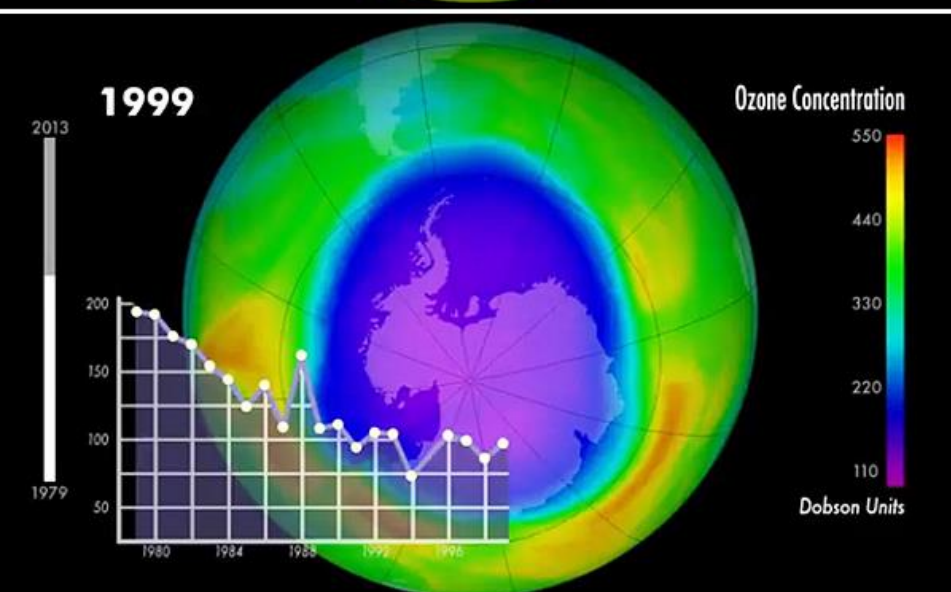
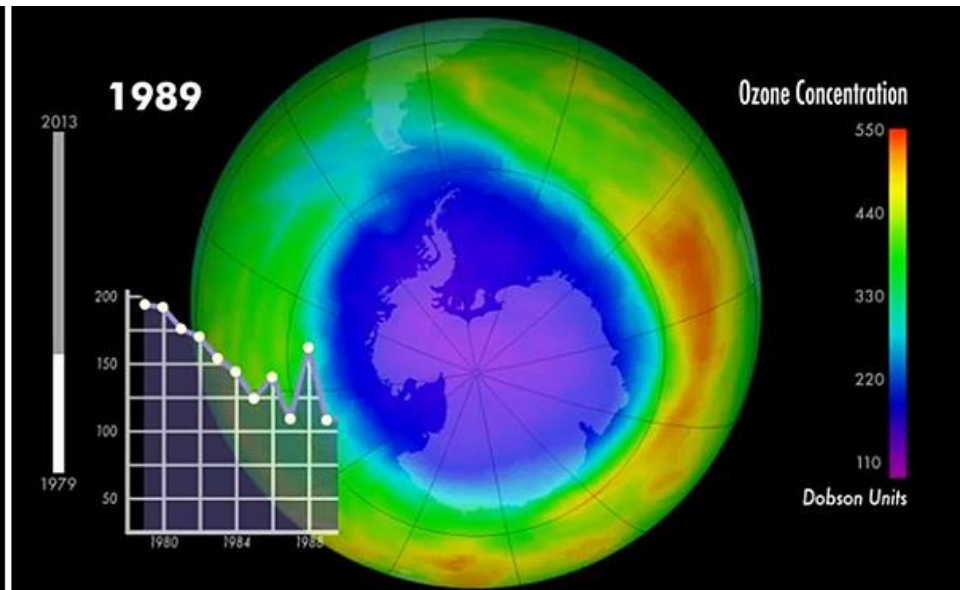
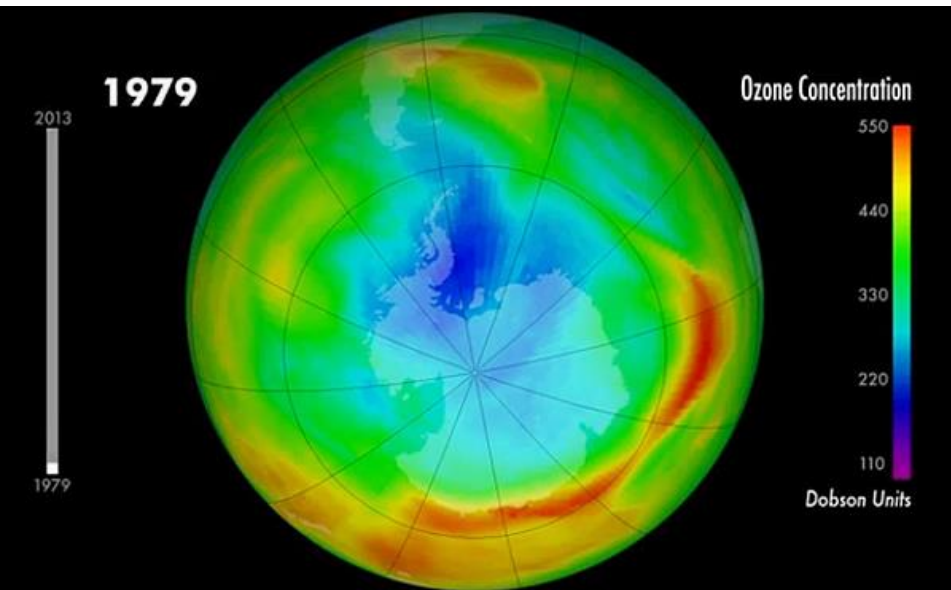
- Used to make comparisons among different populations
- U.S. EFP is 4x that of the global average



# 39. What is the ozone layer and how does it protect us?

- Layer in the atmosphere that contains molecules of ozone gas
- Absorbs UV light!







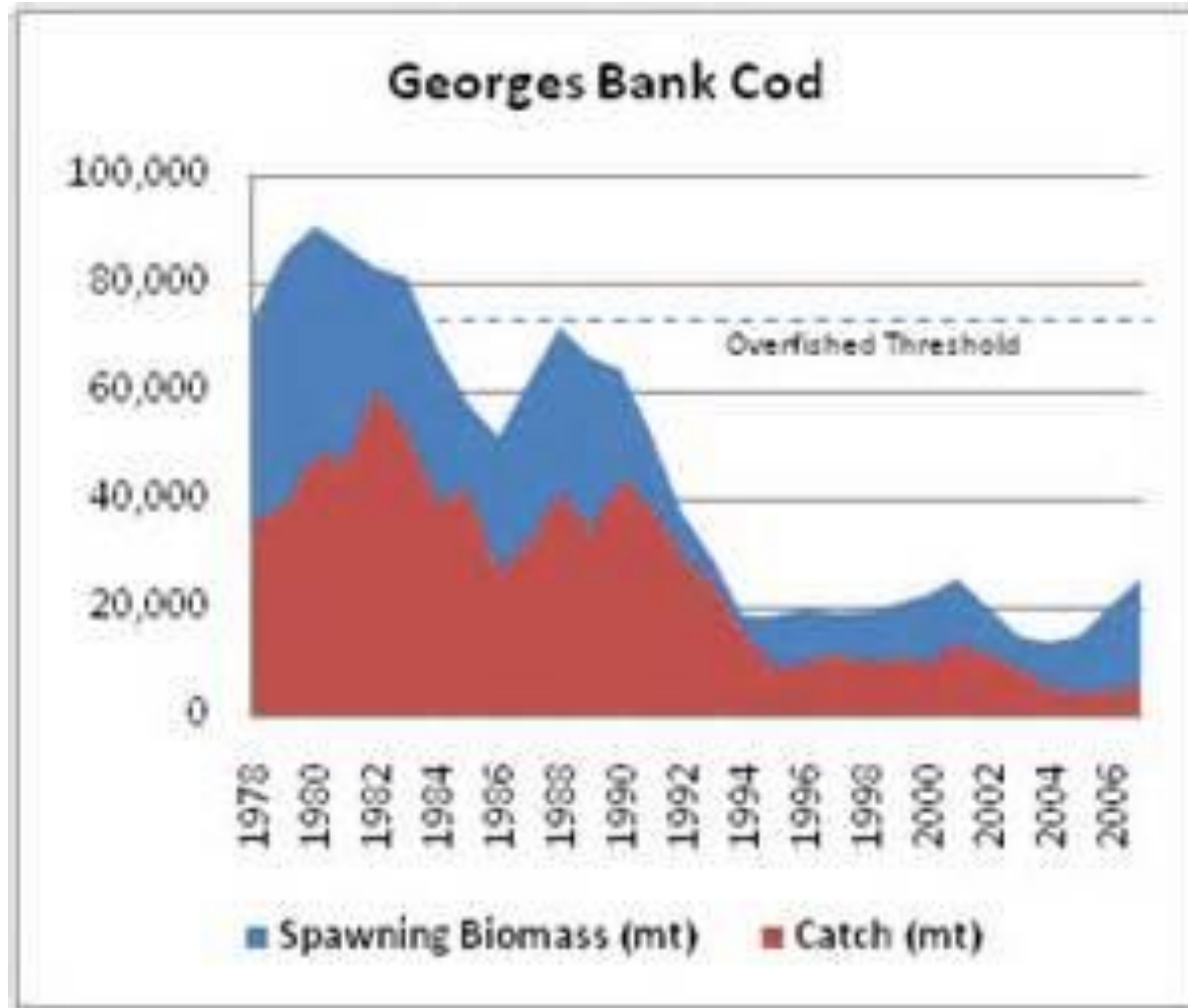
40. What has been happening to the ozone layer since the 70's and what problem does this present?

- The ozone layer is being depleted
  - CFCs

With current actions now in place, ozone hole expected to be restored by 2050

## 41. Biomass vs catch (figure 6-27)

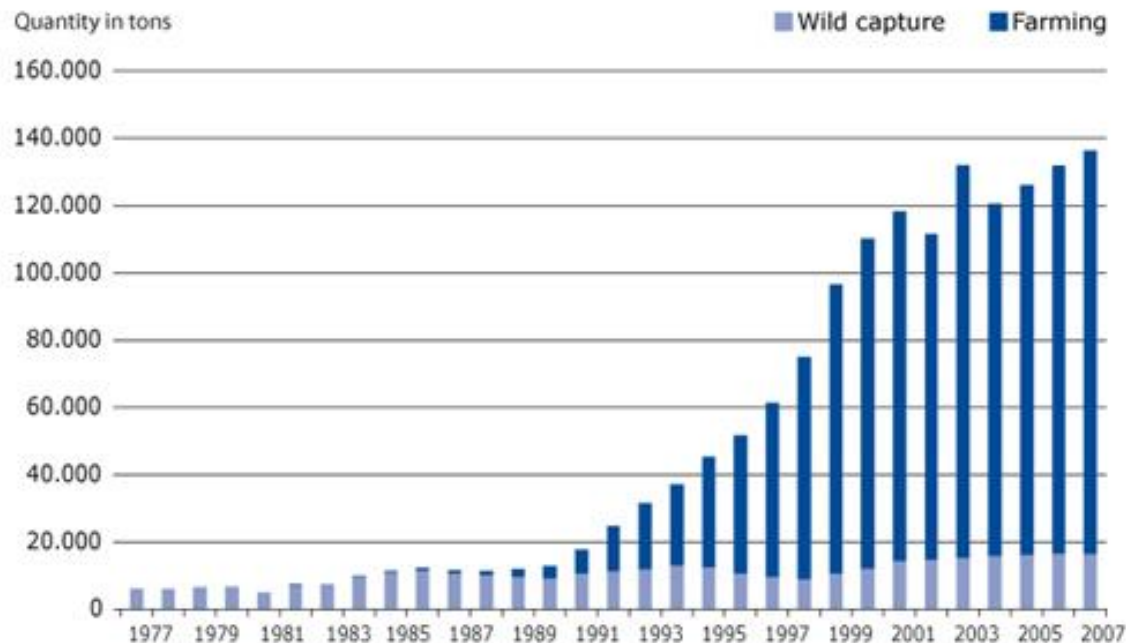
- Plenty of cod until around 1990. Then # dipped due to catch need (consumer needs)



## 42. *What has the increased need for fish caused?*

- Since the 1990's, there has been an increased in fish demand.
- Causes depletion and destruction of sea
  - New laws regulating what fish can be caught and how many
  - Aquaculture – farming fish

**Global wild catch and farming of sea bass and sea bream**



# 43. There has been a lot of talk/press about global warming. What is global warming?

- Global climate change
  - Warmer places
  - Colder places
  - More severe storms
  - Global flooding
  - Decreased agricultural productivity



# 43. What are the major causes of global warming?

- Humans? Or a natural cycle?

- Too much CO<sub>2</sub> and other greenhouse gases in atmosphere



# .Differentiate between an endangered species and an extinct species.

- Endangered—population is dropping; may become extinct



- Extinct—completely disappears from its area of the planet



34. What is an invasive species and how do they effect the native population of organisms? Give an example.

- Species that are not native to a habitat
  - When brought in, they take over
- Zebra Mussels
- Loosestrife
- Stink bug



**NOT WANTED**

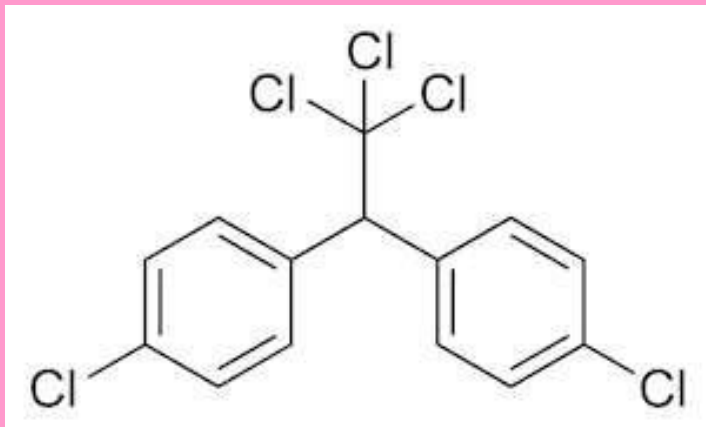


**Zebra Mussel**

Threats to the West ~ Why Be Concerned?

# 33. What is the most important form of pollution that has threatened earth's biodiversity?

- When toxic compounds accumulate in the tissues of organisms





# Pesticides on/in foods

[2016 list of 48 fruits and vegetables  
with pesticide residue data](#)