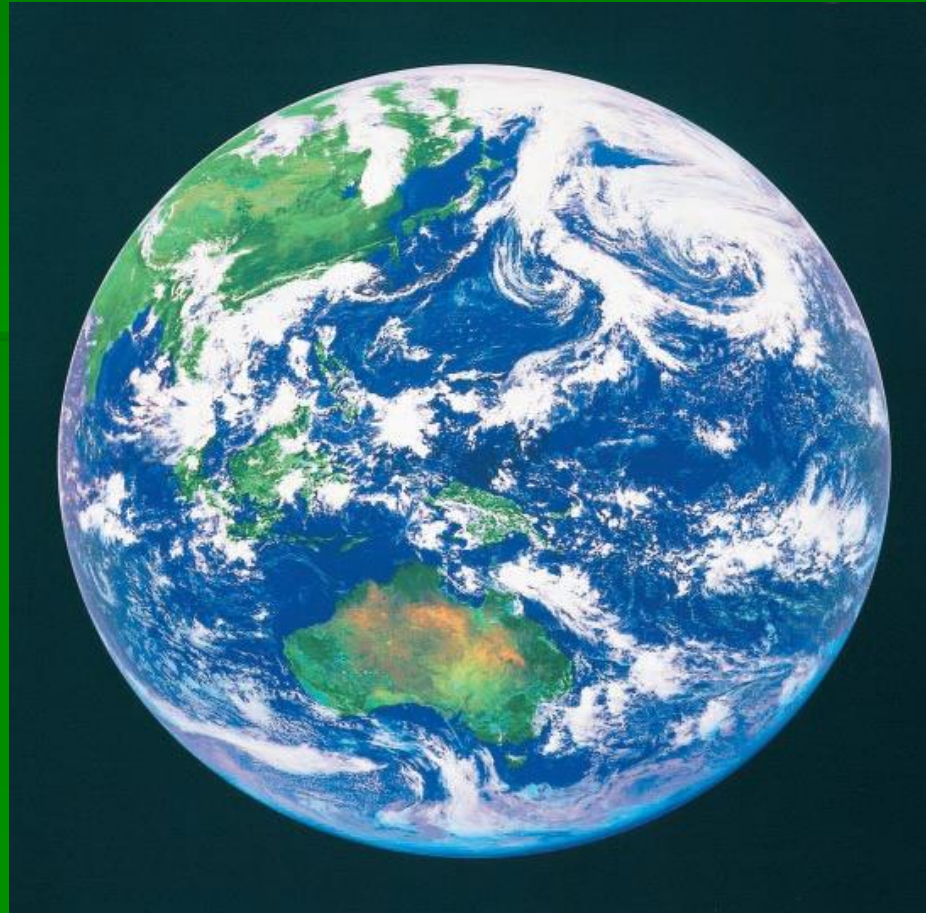


# **AP Biology**

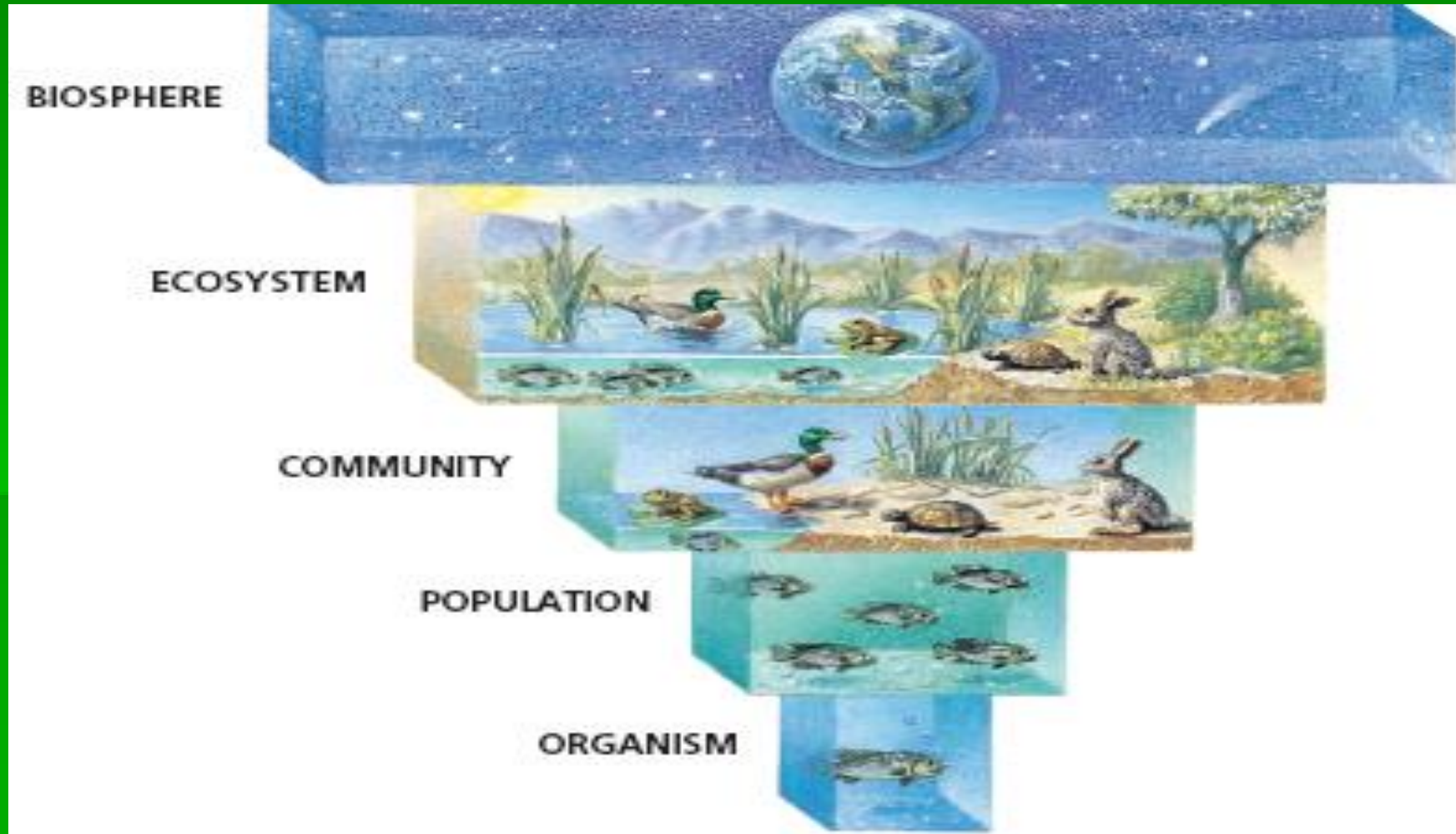
## **Ecology**



# Ecology...

- *.....the study of the interactions between organisms and the living and nonliving components of their environment.*

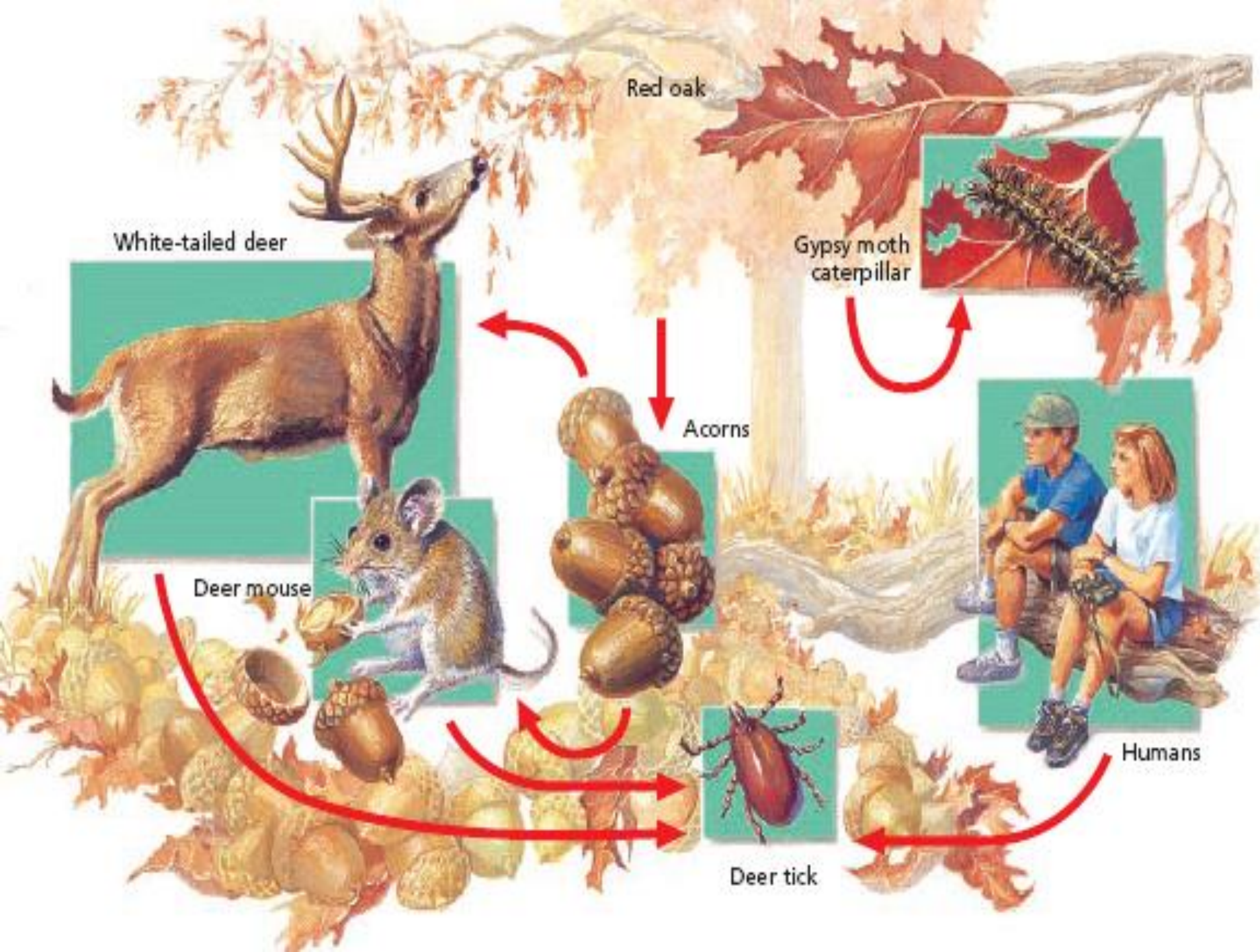
# Levels of Ecological Organization



# A Key Theme In Ecology

- **Interconnectedness or Interdependence: All 5 levels of Ecological Organization , influence by biotic and abiotic factors.**





# Biotic and Abiotic Factors

- **Biotic:** all living things
- **Abiotic:** temperature, humidity, pH, salinity, oxygen concentration, sunlight, nitrogen, and precipitation.

# Properties of Populations

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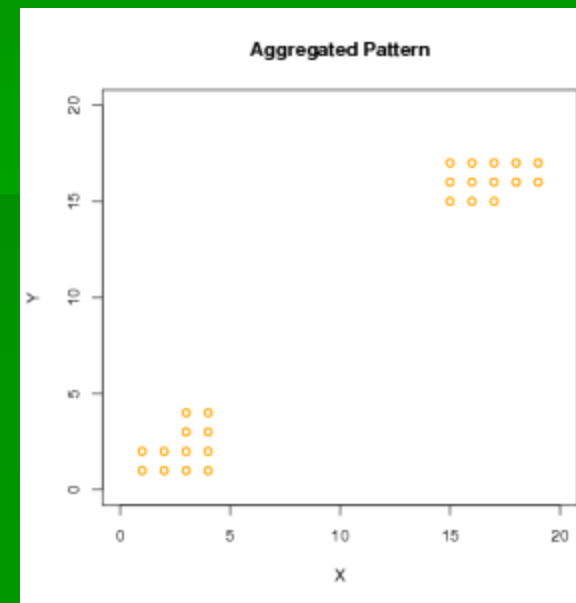
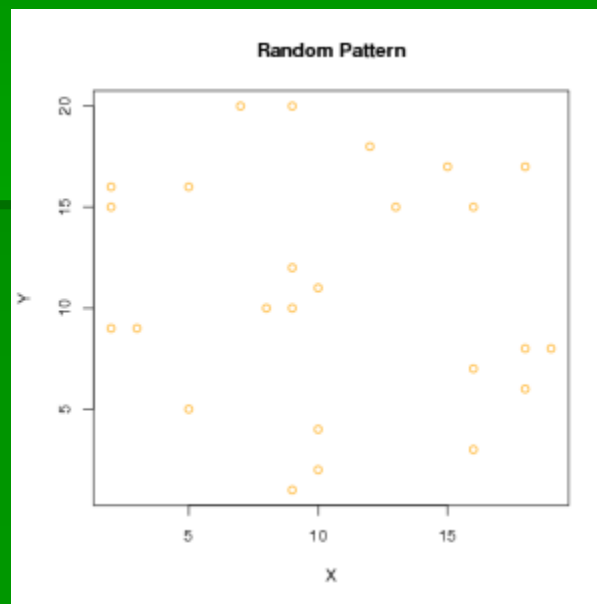
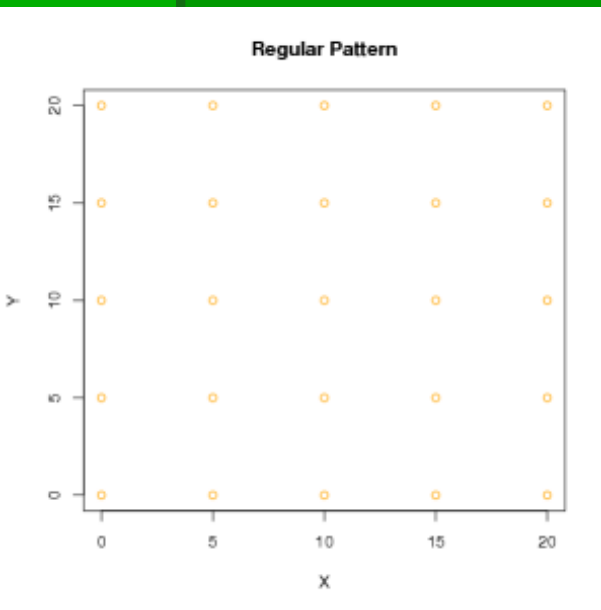
- Size
- Density
- Dispersion
- Can Be Described By:
  - Survivorship Curve
  - Age Structure Diagram

# Properties of Populations

- Size: Total number of individuals in a population.
- Density: Number of individuals per unit area or volume. (Ex: number of ants living in an 1 acre of land)
  - **Sampling Techniques**
    - Mark and Recapture

# Properties of Populations-Dispersion

- Pattern of spacing individuals within the area the population inhabits
- Uniform, Random, Clumped



# Properties of Populations: Survivorship or Mortality Curves

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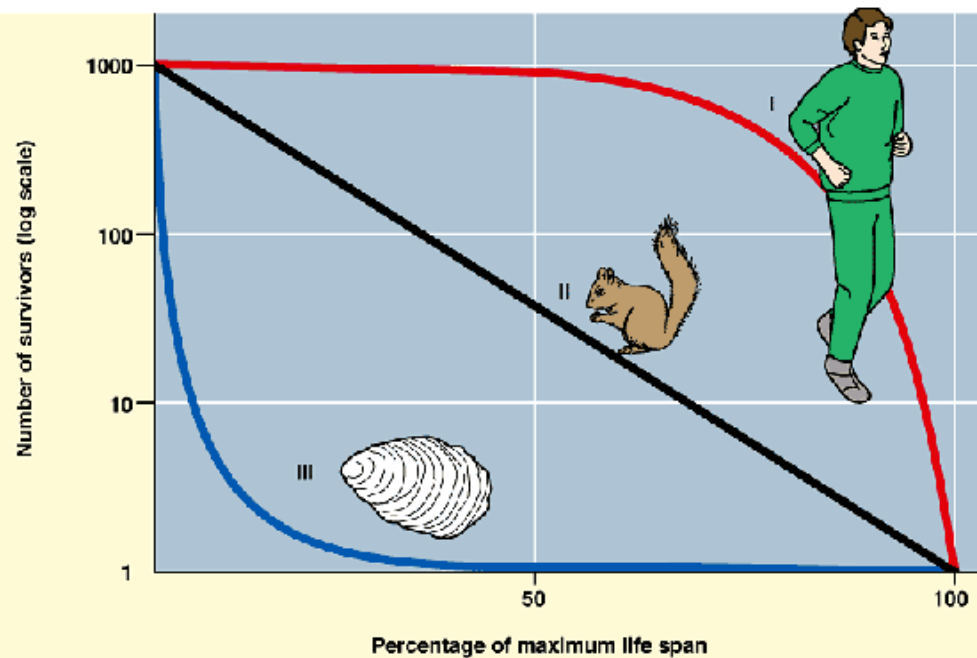
**Type 1 Curve:** Organisms with Low Death Rates, in young and middle age, high in old age. Example Humans

**Type 2 Curve:** Constant Death Rate. Examples: Reptiles & Rodents

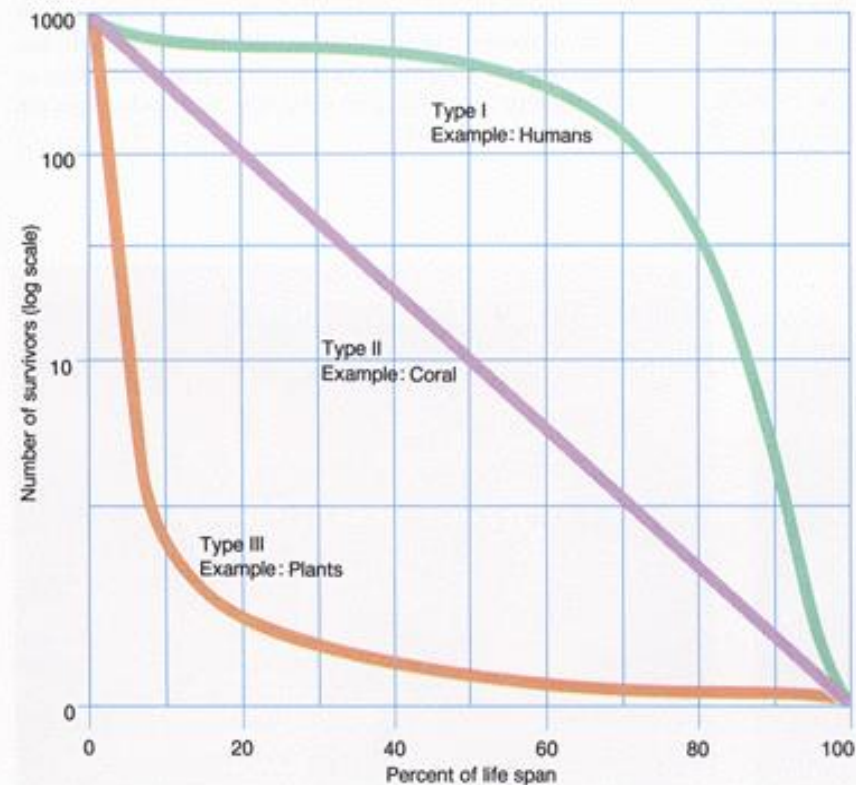
**Type 3 Curve:** High Death Rate in Young then constant rate



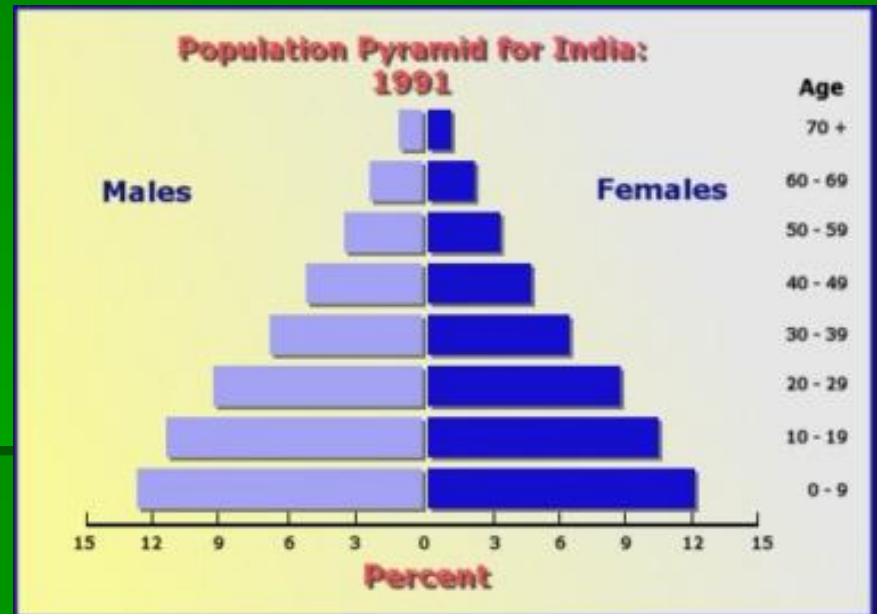
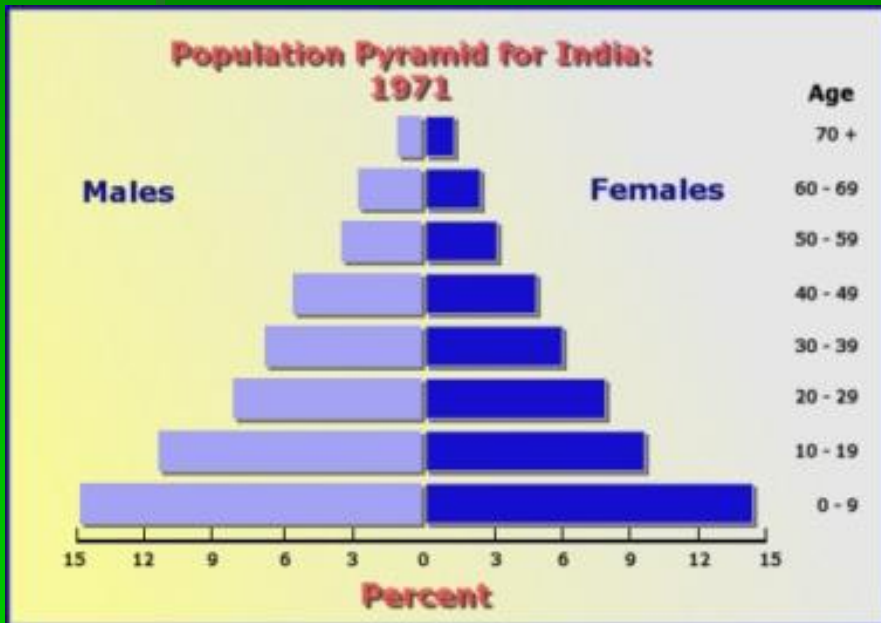
# Example of Survivorship Curves



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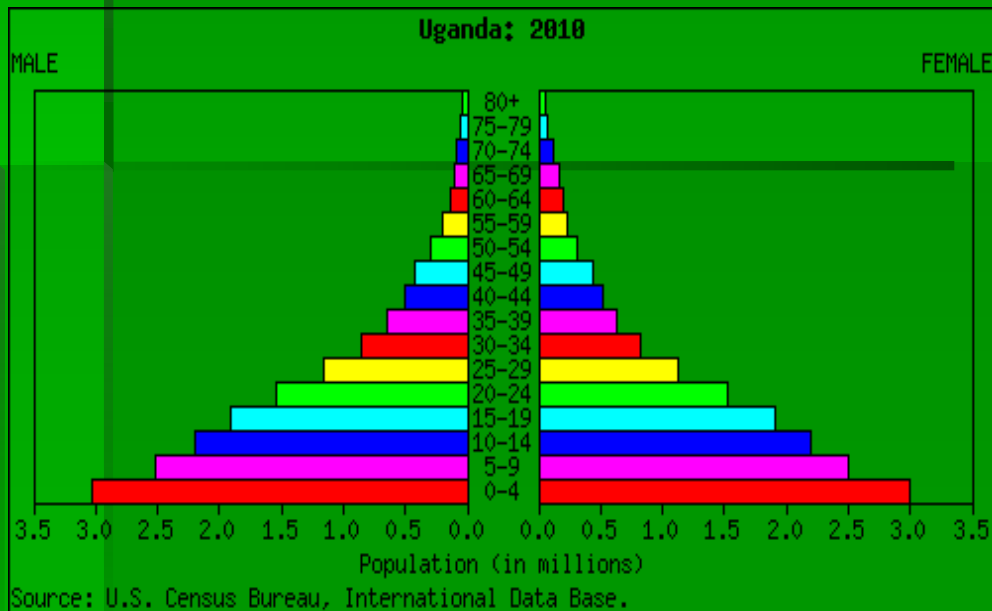
# Properties of Populations- Age Structure Diagrams



# Age Structure Diagram- Uganda vs. Japan

What Problems do these  
Countries Face?

What is Zero Population  
Growth? Which Graph  
Shows It?

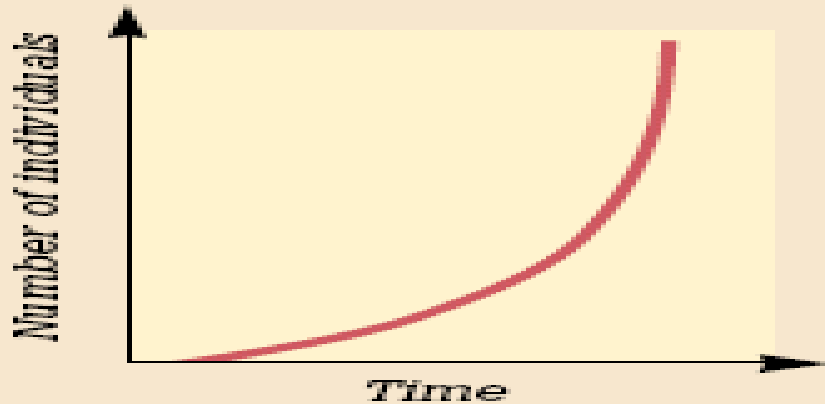


# Population Growth

- **Growth Rate:** birth, death, emigration, immigration
- **Demographers assume immigration and emigration are zero when calculating growth rate.**

# Population Growth: The Exponential model

## The Exponential Model



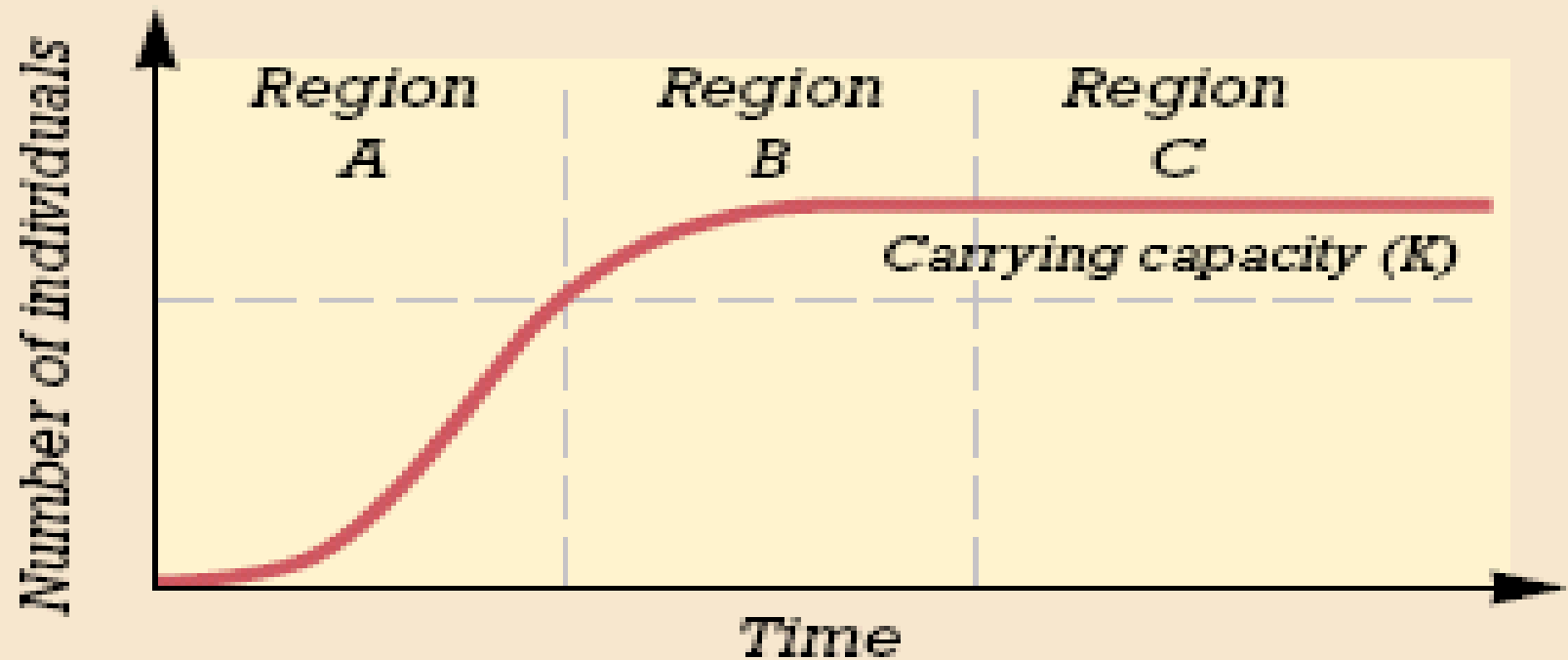
Exponential Growth meets the following conditions: no immigration or emigration, unlimited resources, no predation, parasitism, or competition.

Populations can only grow until they reach their **biotic potential**. The rate that populations could increase at ideal conditions.



# Population Growth: The Logistic Model

## Logistic Population Growth



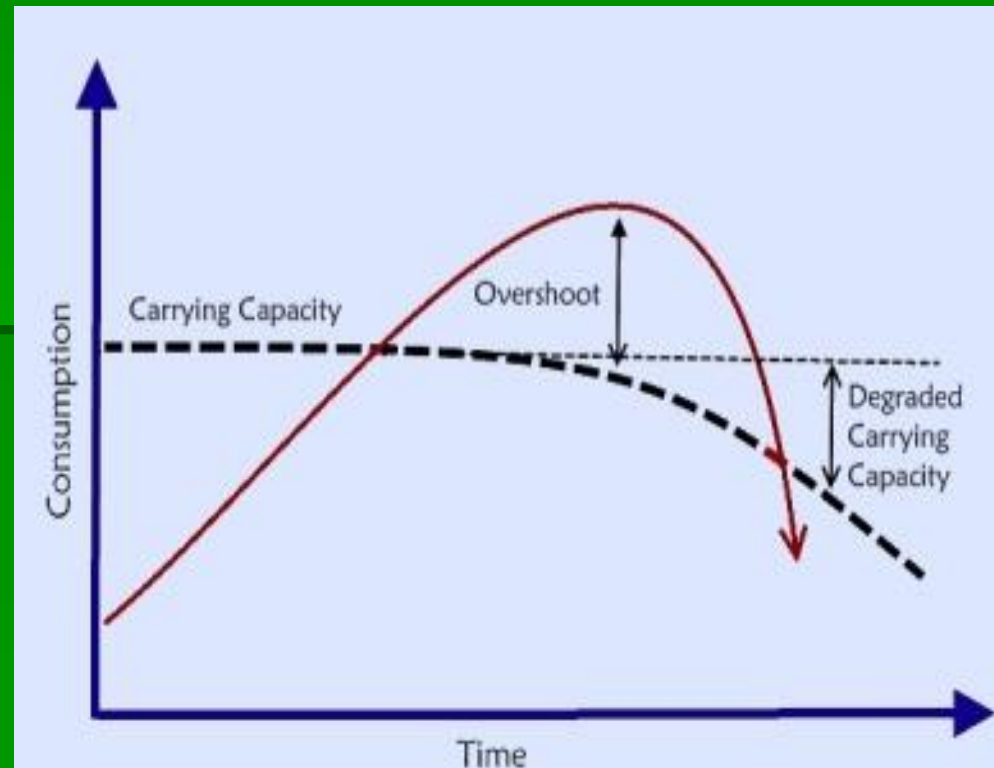
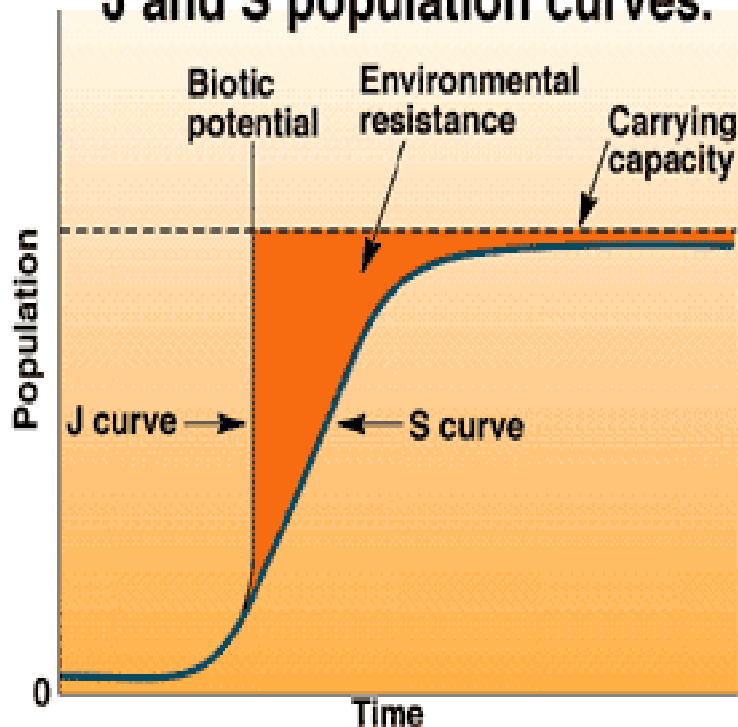


# Population Growth: Carrying Capacity (K)

- The ultimate limit of individuals that can occupy one area at a particular time

Cunningham/Beig, Environmental Science: A Global Concern, 9th ed. © 1999 The McGraw-Hill Companies, Inc. All rights reserved.

**J and S population curves.**



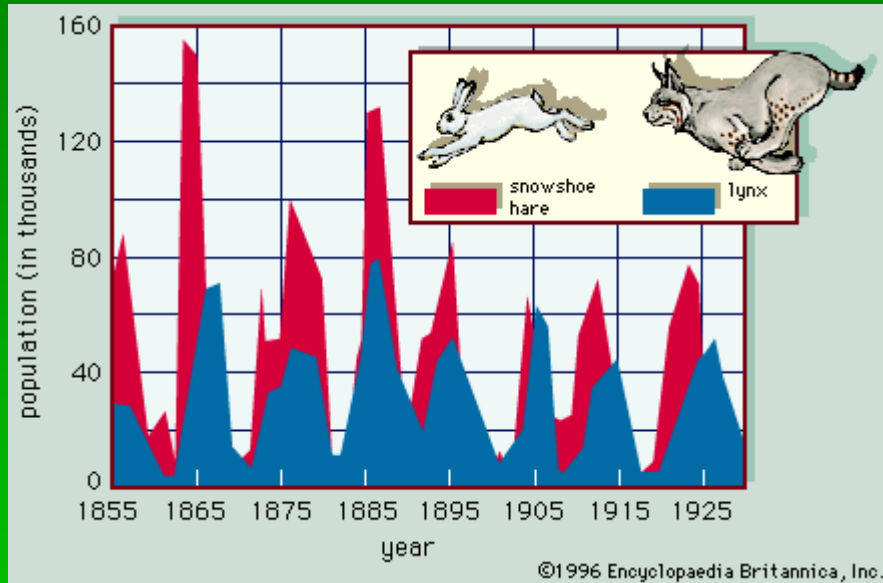
# Population Growth: Limiting Factors

- Factors that limit population growth.
- 2 categories
  - Density-Dependent Factors
    - resource limitations and are triggered by increasing population density. increases. Example: food, shelter, space
  - Density-Independent Factors
    - Factors that are independent of population density. Example: earthquakes, stormes, volcanic activity, etc..

# Growth Patterns: K-Strategists vs. r-Strategists

<p><b>r</b></p> <p><b>Unstable environment, density independent</b></p>	<p><b>K</b></p> <p><b>Stable environment, density dependent interactions</b></p>
small size of organism	large size of organism
energy used to make each individual is low	energy used to make each individual is high
many offspring are produced	few offspring are produced
early maturity	late maturity, often after a prolonged period of parental care
short life expectancy	long life expectancy
each individual reproduces only once	individuals can reproduce more than once in their lifetime
type III survivorship pattern in which most of the individuals die within a short time but a few live much longer	type I or II survivorship pattern in which most individuals live to near the maximum life span

# Population Growth-Case Study: The Hare and the Lynx

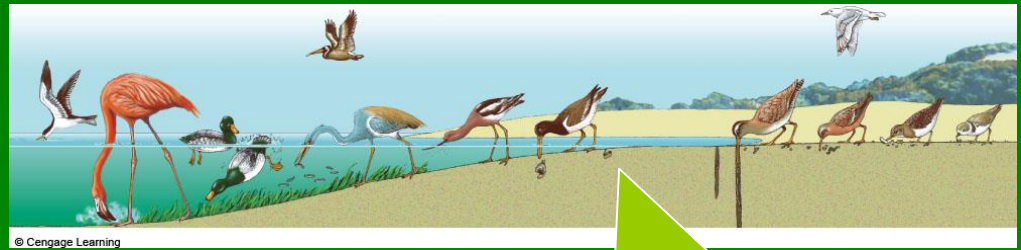


# Species Interactions

- Competition
- Predation
- Mutualism
- Commensalism
- Parasitism

# ■ Competition

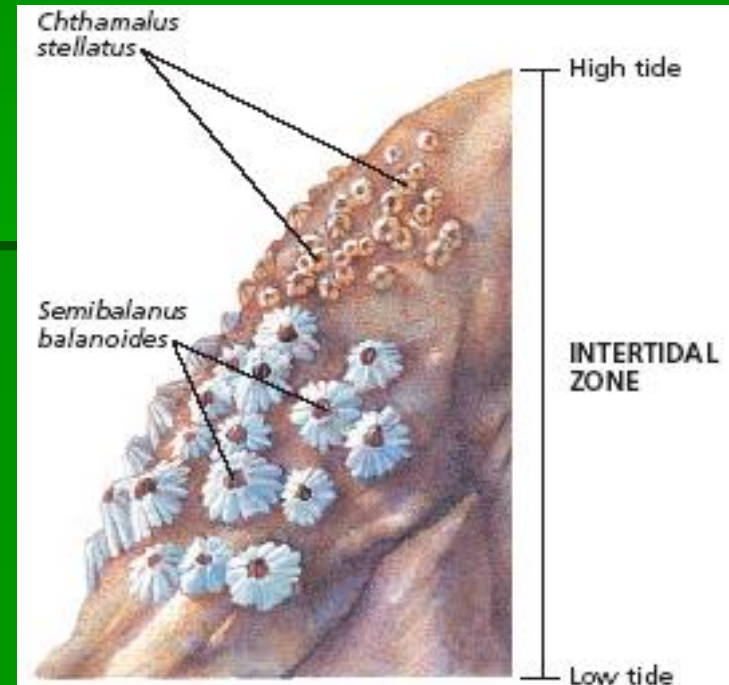
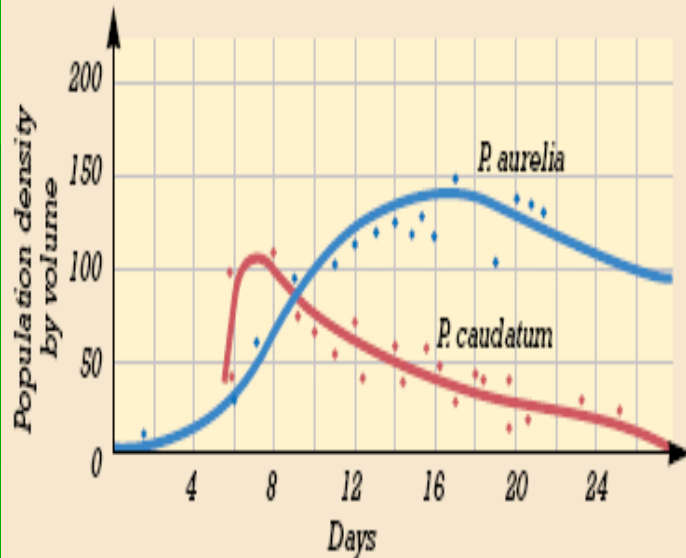
## ....Competitive Exclusion



These birds have different niche

2 Species coexist in a community if they share a niche. Niche= resources used

Competitive Exclusion in Paramecia





# What will happen to species in an environment of competitive exclusion?

- (1) Extinction of one species (Ex. Paramecium)

- (2) Resource Partitioning: the
  - evolution of one species to
  - exploit different resources.



- (3) Character Displacement: A divergence in body structure. (i.e. the Galapagos Island Finch Beaks)

# Predation: that which has been eaten.



spines

- How not to be eaten:
  - Plants: evolve spines, thorns, and chemical poisons. (Plant poisons: strychnine, morphine, nicotine)
  - Animals: evolve
    - Active defenses: hide, flee, defend (High energy)
    - Passive defenses: camouflage, cryptic coloration
    - **Aposematic coloration:** warning colors
    - **Batesian mimicry:** monarch deadly, viceroy harmless
    - **Mullerian mimicry:** two poisonous species look alike



thorns

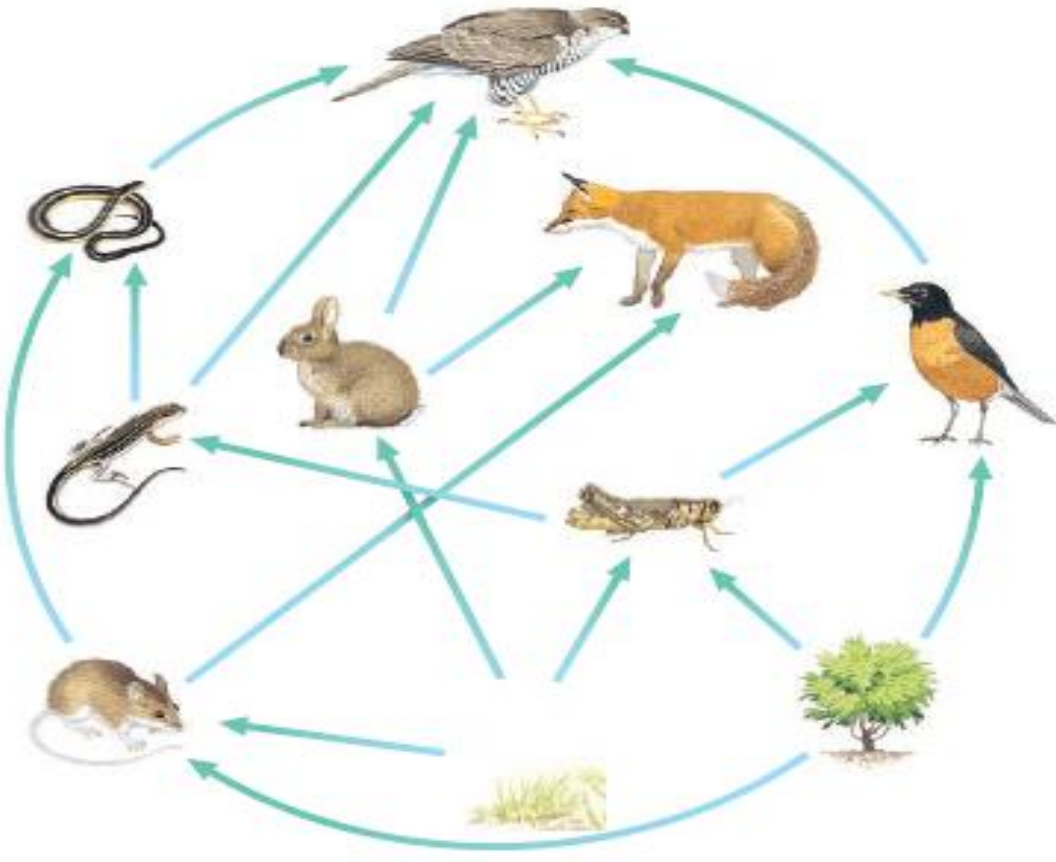


# The three symbiotic relationships: Mutualism, Commensalism, and Parasitism

- **Mutualism:** both benefit. You and the 1.5 lbs of bacteria living in your gut. The bird and the Croc. The cleaner rass and their fish.
- **Commensalism:** one benefits, the other is unaffected. The cattle egret and the cow.
- **Parasitism:** One benefits the other is harmed. You and your athlete's foot. The leach and the fish or you.



# The food web: you can occupy different trophic levels depending on what you eat!



## Biological

**Magnification:** In this food web, who has the most DDT in their bodies?

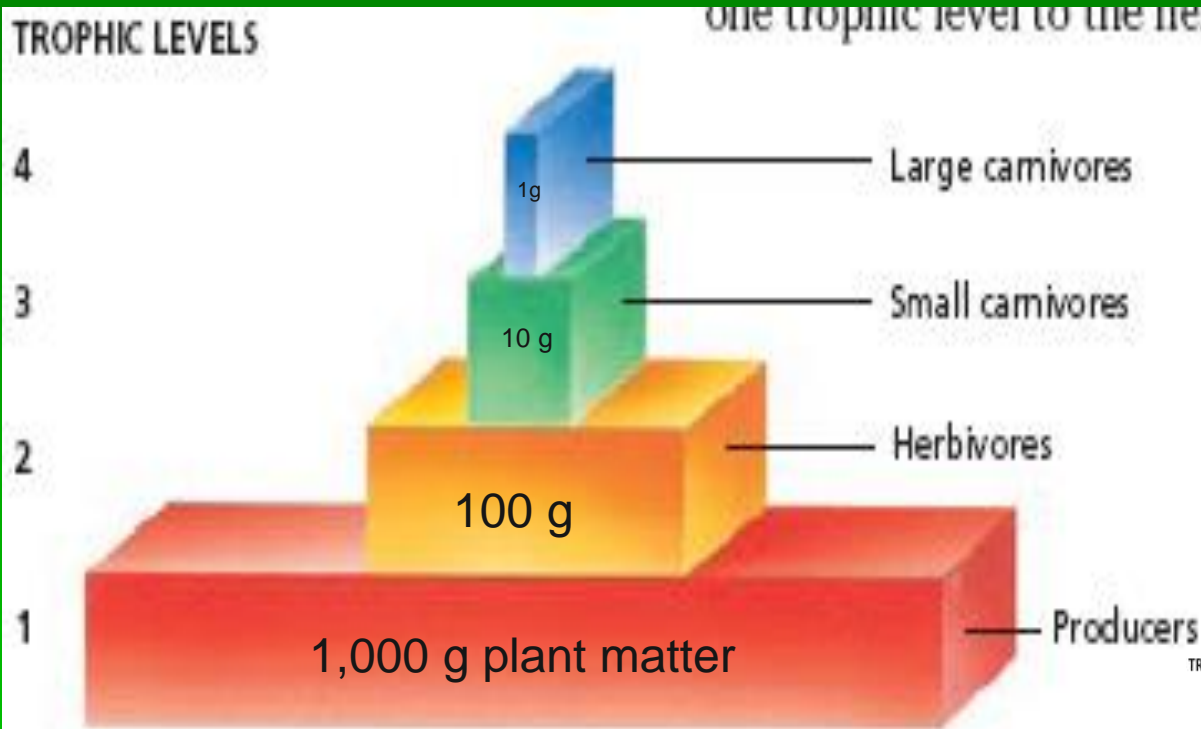
Is there a problem with being human?

## Decomposers:

Bacteria and Fungi  
Recycle nutrients into the soil that plants later use.



# The food chain: Who eats who



**Producer:** Plants, most biomass

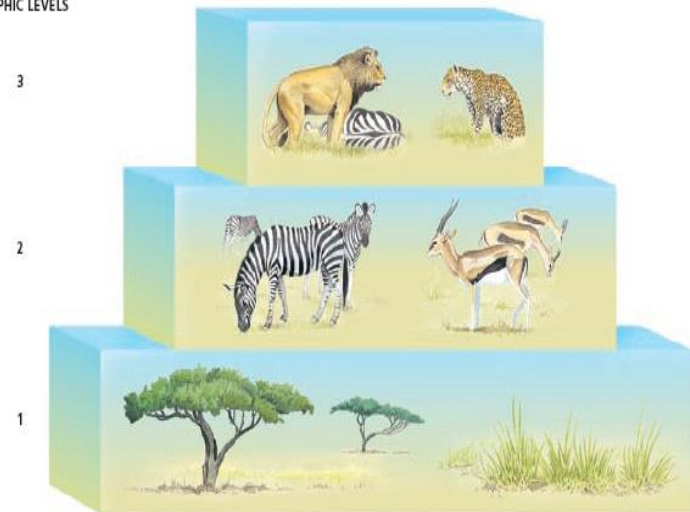
**Primary consumers:** herbivores

**Secondary consumers:** Carnivores

**Tertiary consumers:** least biomass, top of food chain,

**10 % rule:** only 10% of the energy stored in any trophic level is converted to organic matter.

TROPHIC LEVELS



# Ecological Succession

For More  
Detail click  
here

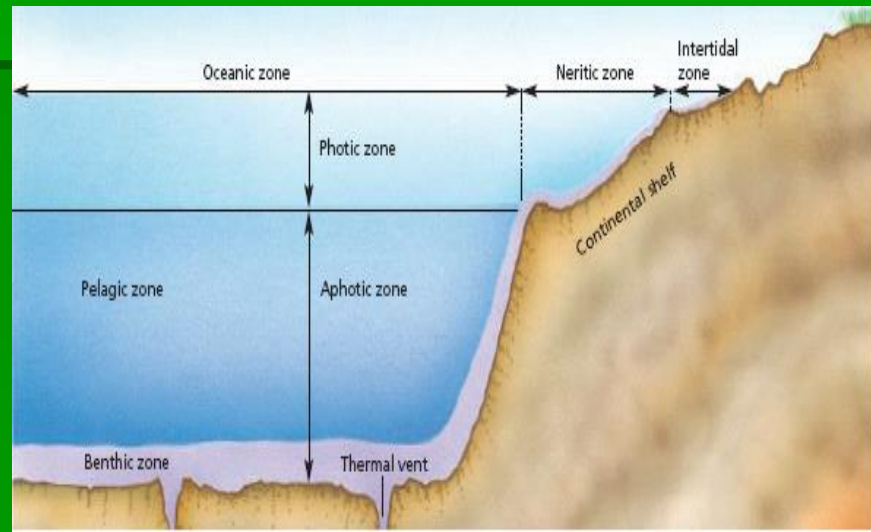
- Primary Succession
- Succession
- Climax Community: Destroyed by Blowout
- Secondary Succession



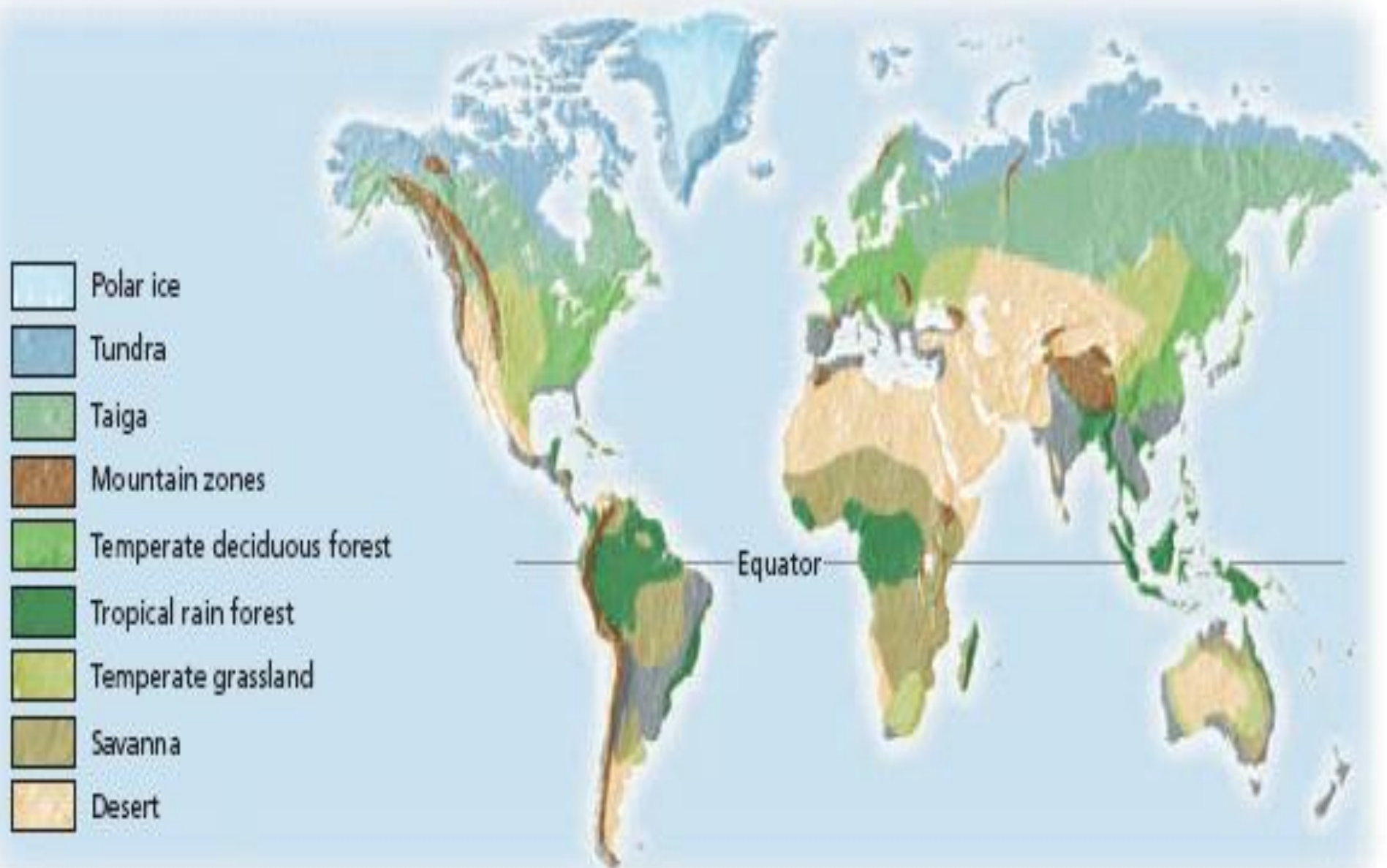


# Biomes

- Temperature and Rainfall Dependent
- Characterized by Vegetation and Animals
- Largest Biome is Marine (3/4 of Earth)
  - Most Stable due to water high heat capacity
  - Most of Earth's Food and Oxygen
  - Divided by distance from shore, water depth, and sunlight



# Terrestrial Ecosystems



Biome	Average yearly temperature range	Average yearly precipitation	Soil	Vegetation
Tundra	−26°C to 12°C	<25 cm	moist, thin topsoil over permafrost; nutrient-poor; slightly acidic	mosses, lichens, dwarf woody plants
Taiga	−10°C to 14°C	35–75 cm	low in nutrients; highly acidic	needle-leaved evergreen trees
Temperate deciduous forest	6°C to 28°C	75–125 cm	moist; moderate nutrient levels	broad-leaved trees and shrubs
Temperate grassland	0°C to 25°C	25–75 cm	deep layer of topsoil; very rich in nutrients	dense, tall grasses in moist areas; short clumped grasses in drier areas
Desert	7°C to 38°C	<25 cm	dry, often sandy; nutrient-poor	succulent plants and scattered grasses
Savanna	16°C to 34°C	75–150 cm	dry, thin topsoil; porous, low in nutrients	tall grasses, scattered trees
Tropical rain forest	20°C to 34°C	200–400 cm	moist, thin topsoil; low in nutrients	broad-leaved evergreen trees and shrubs

# Biomes- Tropical Rainforest vs. Desert



## ■ Tropical Rainforest

- High Rainfall, Humidity & Stable Temperatures
- 4% of Land Surface, 20% of Carbon Fixation
- Most Diverse Biome, Trees form Canopy
- Epiphytes: Cling to Trees (i.e. Spanish Moss)

## ■ Desert

- Less than 10 in. of rain per year
- Highest Temperature Fluctuations (158° °F- 30°F)
- Drought Resistant Plants (CAM), Small Animals- Nocturnal



# Biomes:

## Temperate Grassland vs. Temperature Deciduous Forest

- Temperate Grassland

- Covers Large Areas (Great Plains)
- Seasonally Unevenly Low Rainfall
- C-4 Plants, Think: Bison, Prairie Dogs, and Wildebeest



- Temperature Deciduous Forest

- Northern Climates: Trees drop leaves, Rich Soil
- Hibernating Animals
- Vertical Stratification: Species live on the ground, low branches, and tree tops





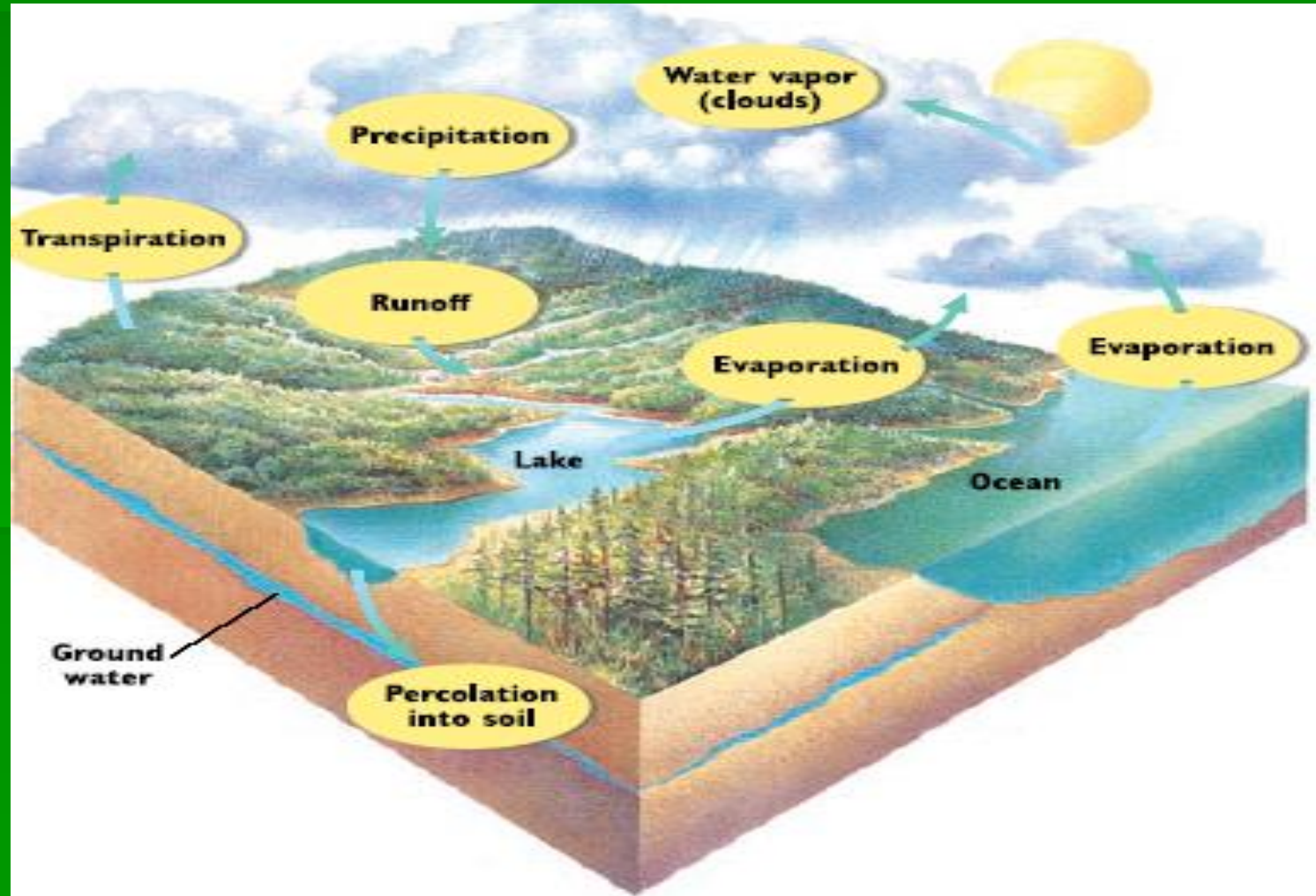
# Biomes: Conifer Forest-Taiga vs. Tundra



- Conifer Forest-Taiga
  - Northern Canada, Pine trees
  - Largest Terrestrial Biome, Very Cold Winters
  - Think: Moose, Bear, Lynx, Porcupine, Birds, and Mosquitoes
- Tundra
  - Permafrost- Permanently Frozen Ground
  - Frozen Desert= Little Rain
  - Bugs and Birds, Reindeer, Caribou, & Polar Bears



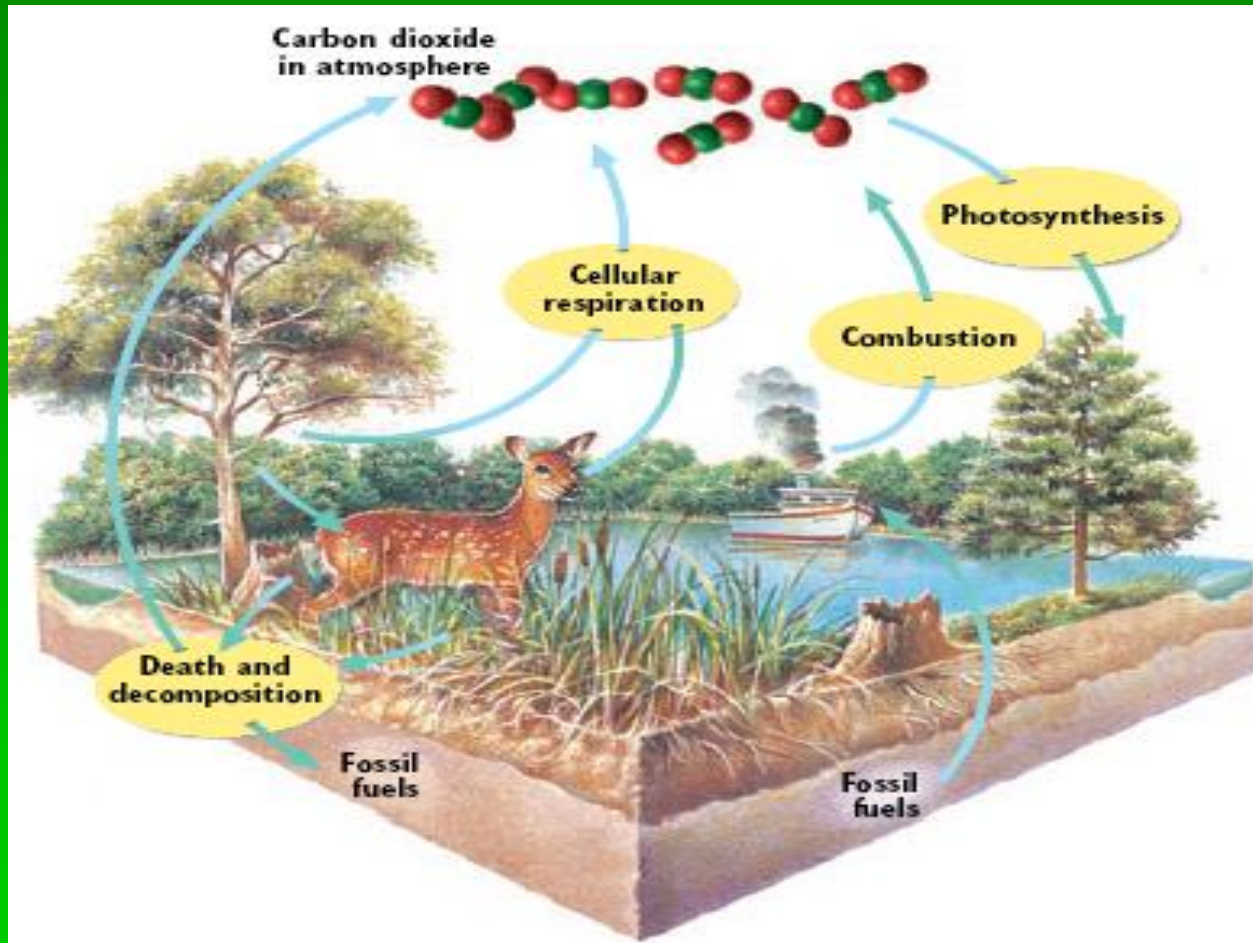
# Chemical Cycles- The Water Cycle





# Chemical Cycles-

## The Carbon Cycle



**Photosynthesis**

Remove CO<sub>2</sub> Adds O<sub>2</sub>



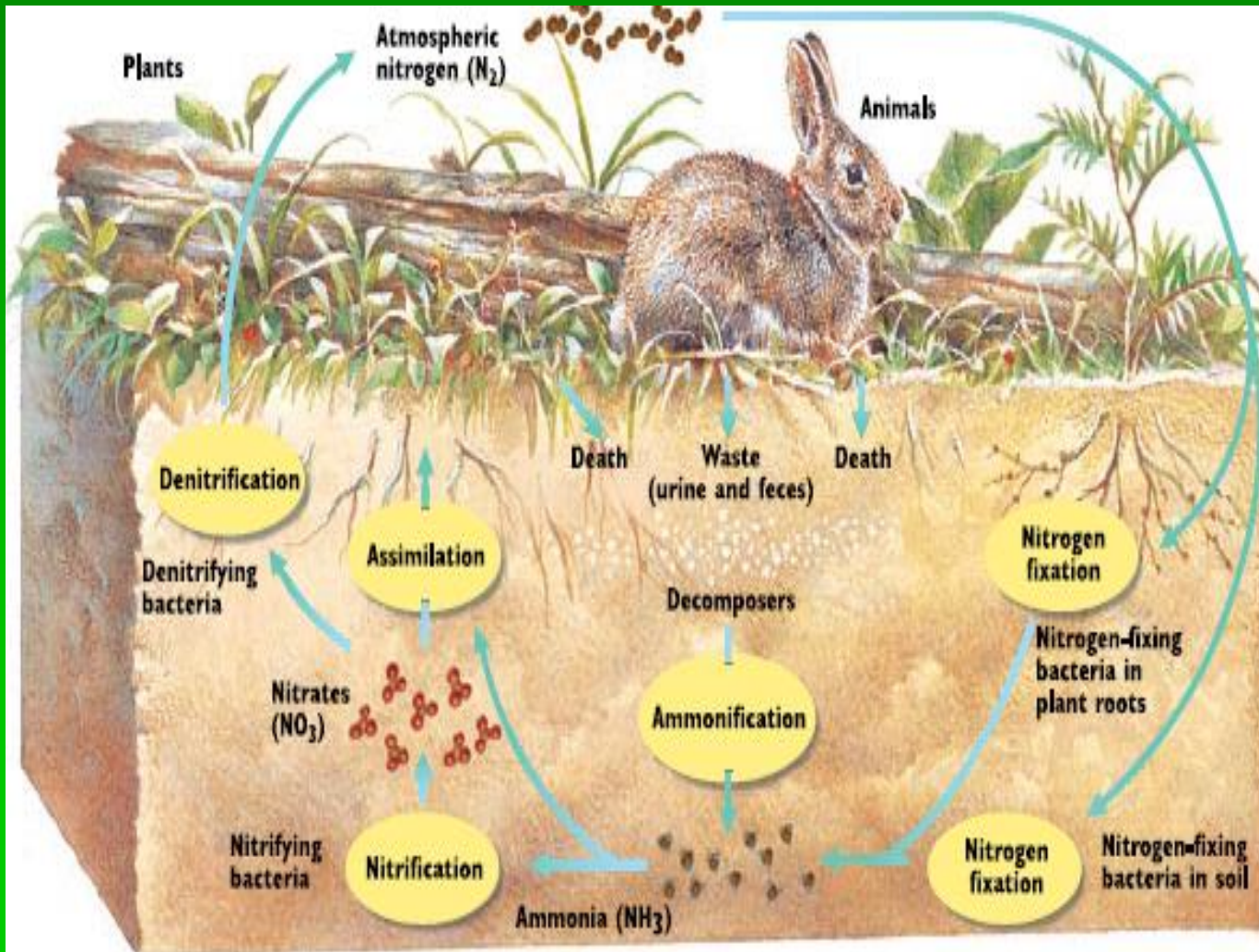
**Respiration**

Bacteria, Animals, &

Burning Fossil Fuels

Remove O<sub>2</sub> Adds CO<sub>2</sub>

# Chemical Cycle: The Nitrogen Cycle

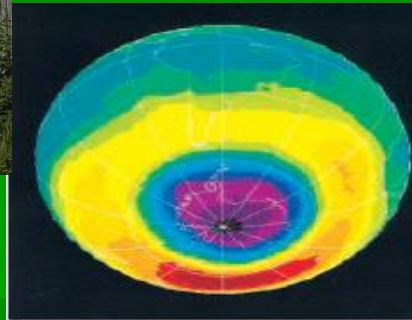
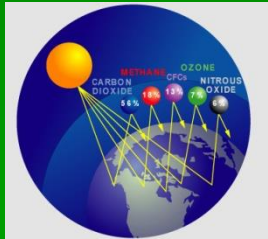


Most N Fixed  
By Bacteria



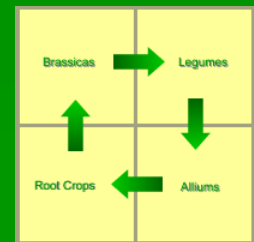
# The Effects of Humans: The Bad and The Ugly

- Eutrophication: Runoff
- Acid Rain
- Toxin: DDT
- Global Warming
- Loss of Ozone
- Introduction of New Species: Kudzu
- Pesticide vs. Biological Control



**FIGURE 19-3**

The ozone shield over Antarctica fluctuates in density seasonally, sometimes to a low of half the original density. The ozone shield is diminishing all over the planet as well.



# ■ Sixth Mass Extinction

....Loss of habitat, pollution, over hunting and fishing.

## Oil Rig Disasters...oops!





# The Great Pacific Garbage Patch

