Biology
EOC Review
Ecology

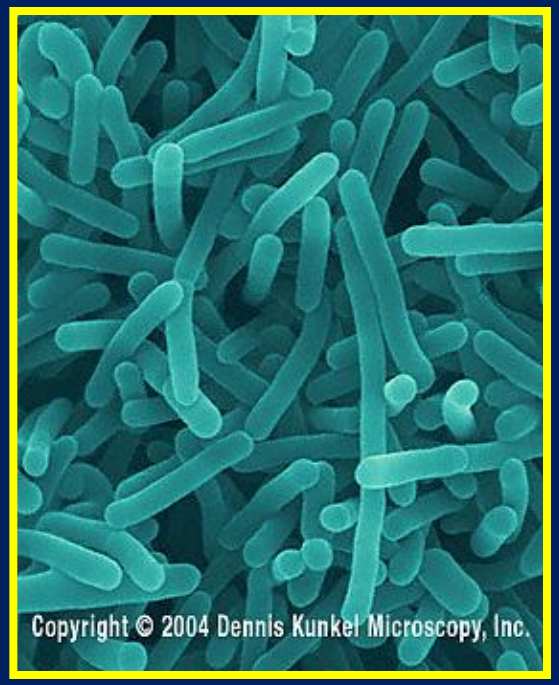
Biology

Biology is the Study of Life

So what exactly is life?

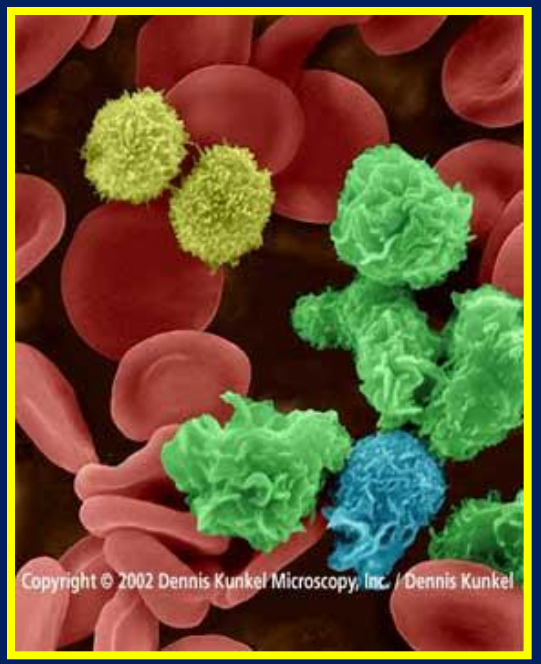
What characteristics do all living things share?

All living things are composed of cells



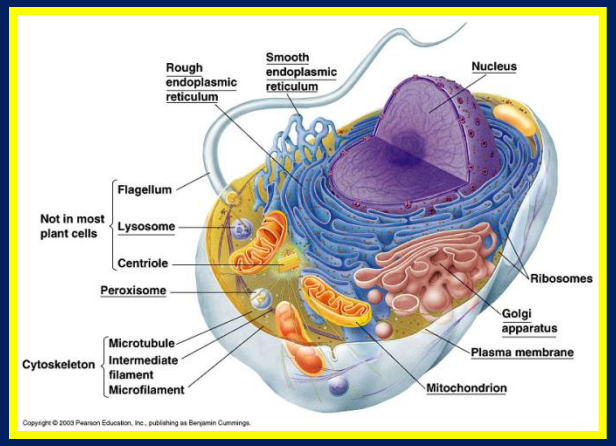
Bacteria Cells

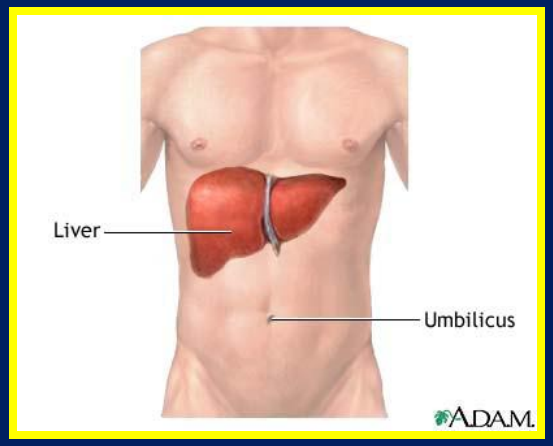
Plant Cells

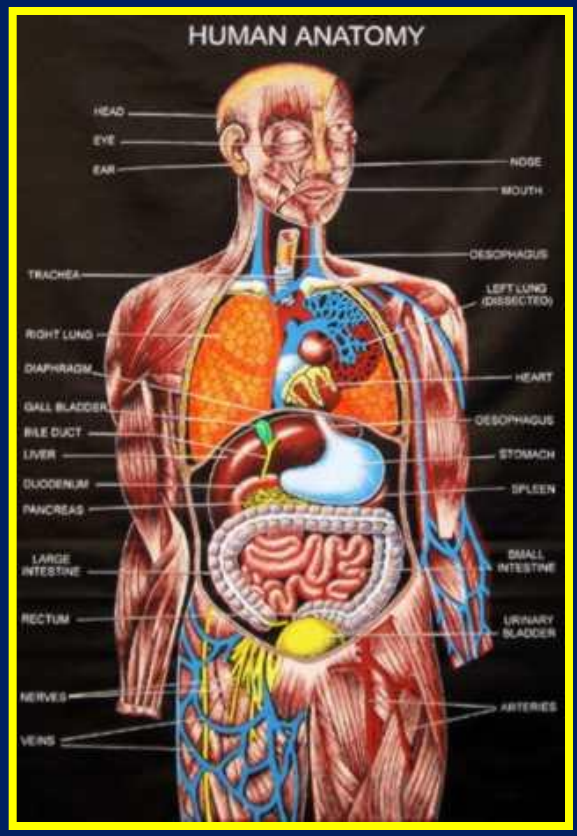


Animal Blood Cells

All living things show an orderly structure or organization

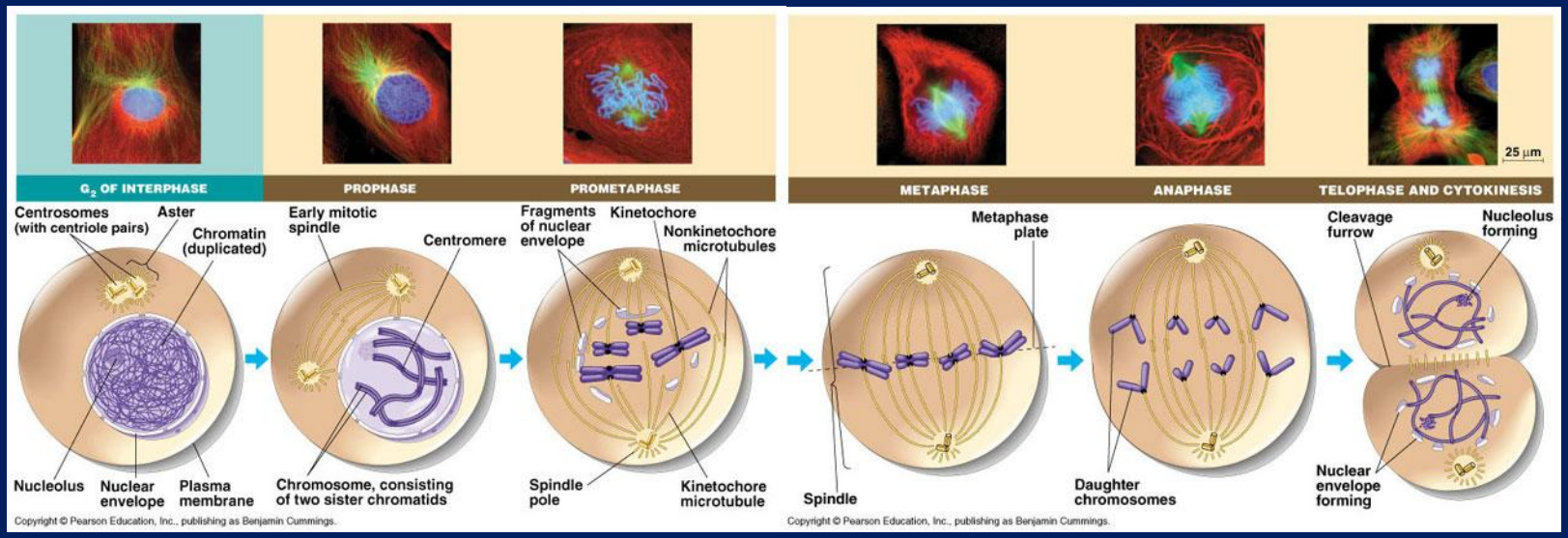






Cells → Tissues → Organs → Organism

All living things grow and develop as a result of cell division and cell enlargement



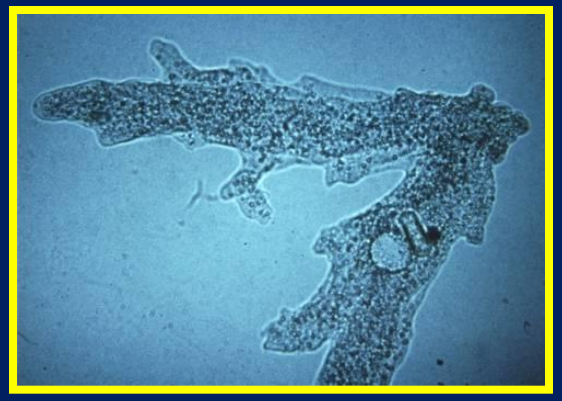
Cell Division is the formation of two cells from an existing cell

All organisms begin as one cell

Unicellular organisms remain as one cell that just grows larger

Multi-cellular organisms grow by producing more cells through cell division

All living things have the ability to reproduce



Not essential to survival of the organism

Essential to survival of the species

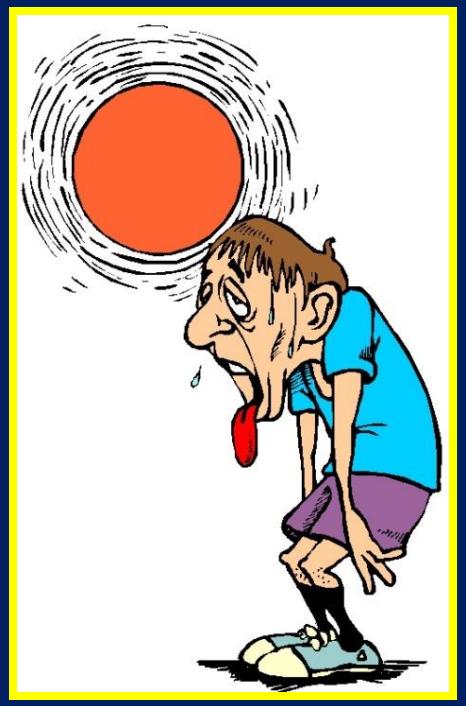
A species is a group of organisms that can interbreed and produce fertile offspring in nature

Male Donkey
62 Chromosomes

Sterile Mule
63 Chromosomes

Female Horse
64 Chromosomes

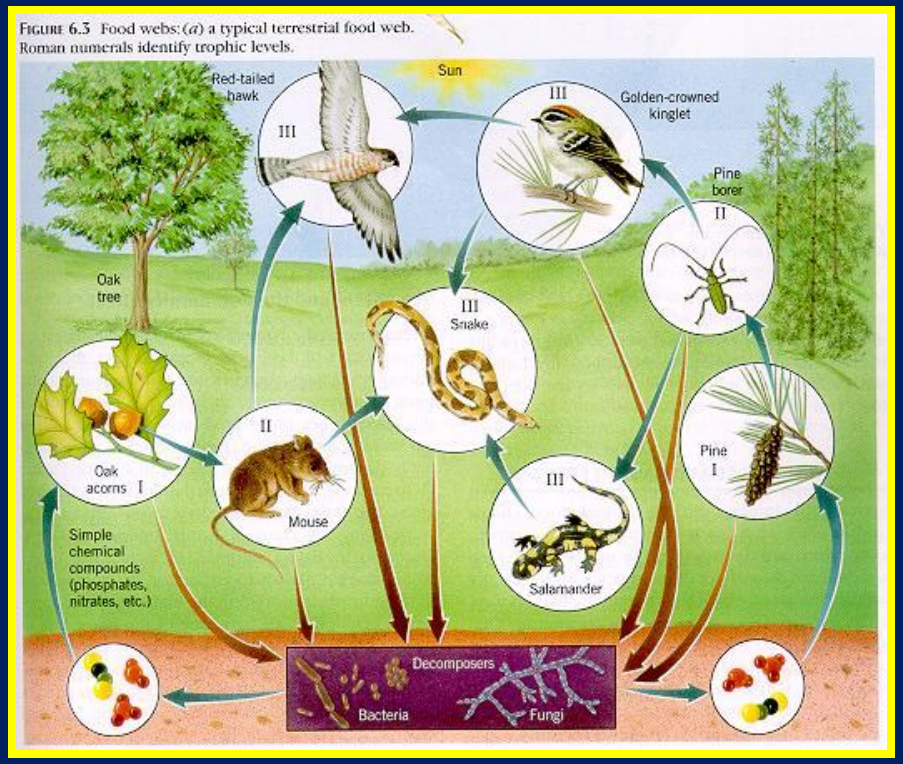
All living things maintain homeostasis



Homeostasis refers to maintaining a stable internal environment

All living things use energy from food to complete the functions necessary to stay alive.

Plants make their own food

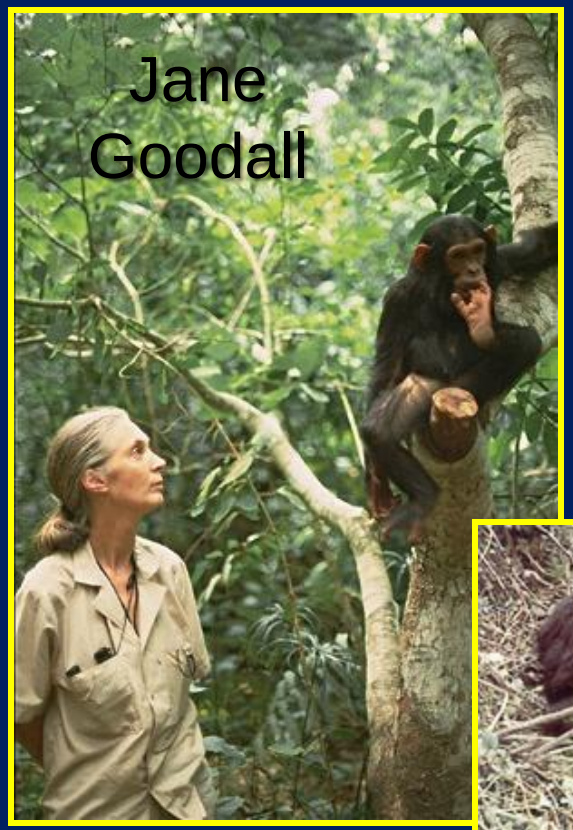


Everything else gets their food from eating plants or other organisms that eat plants

Goal 5: Learner will develop an understanding of the ecological relationships among organisms

Ecology is the study of interactions among living things and their environment

Field studies rely heavily upon observations and sampling techniques



Ecosystems

Objective 5.01: Investigate and analyze the interrelationships among organisms, populations, communities and ecosystems

Abiotic Factors are the non-living parts of an organism's environment

Sand, Rocks, Water, Temperature, Pressure, Light, Oxygen, and Minerals

Biotic Factors are the living parts of organism's environment

Fish, Algae, Coral, Plants, and Bacteria

Levels of Organizations

Ecosystem

Abiotic and Biotic Factors

Community

Biotic Factors

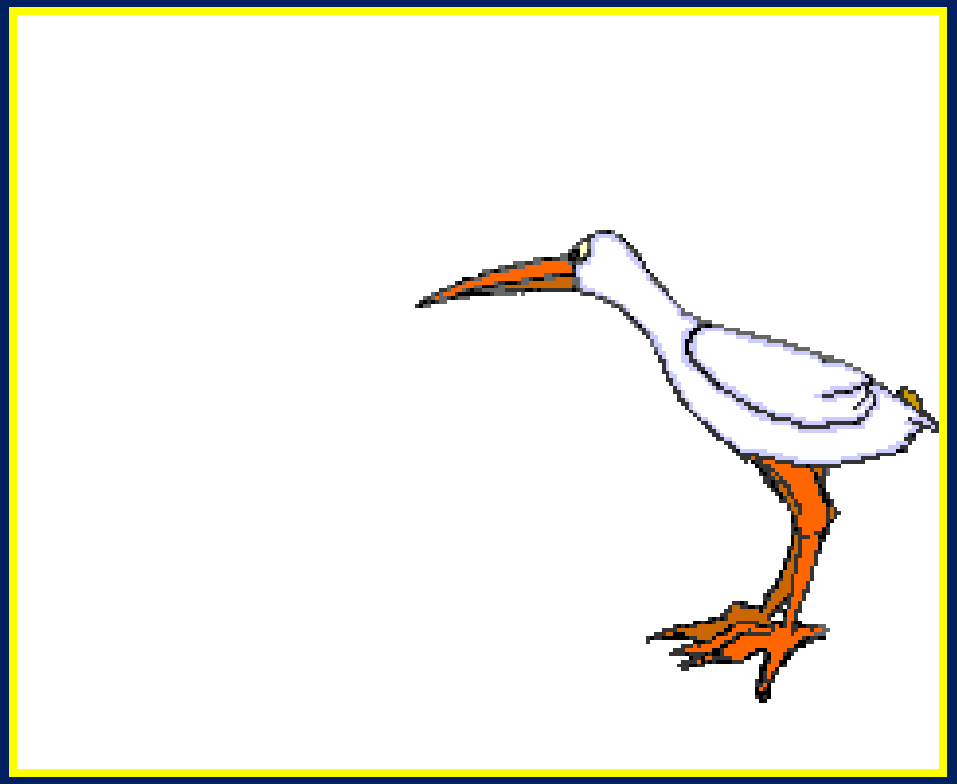
Population

One Species

Organism

One Individual

Interactions in Ecosystems



Objective 5.01: Investigate and analyze the interrelationships among organisms, populations, communities and ecosystems

Competition between species that compete for the same resources can also affect population growth. One species will generally out compete the other causing a decline in their population growth.

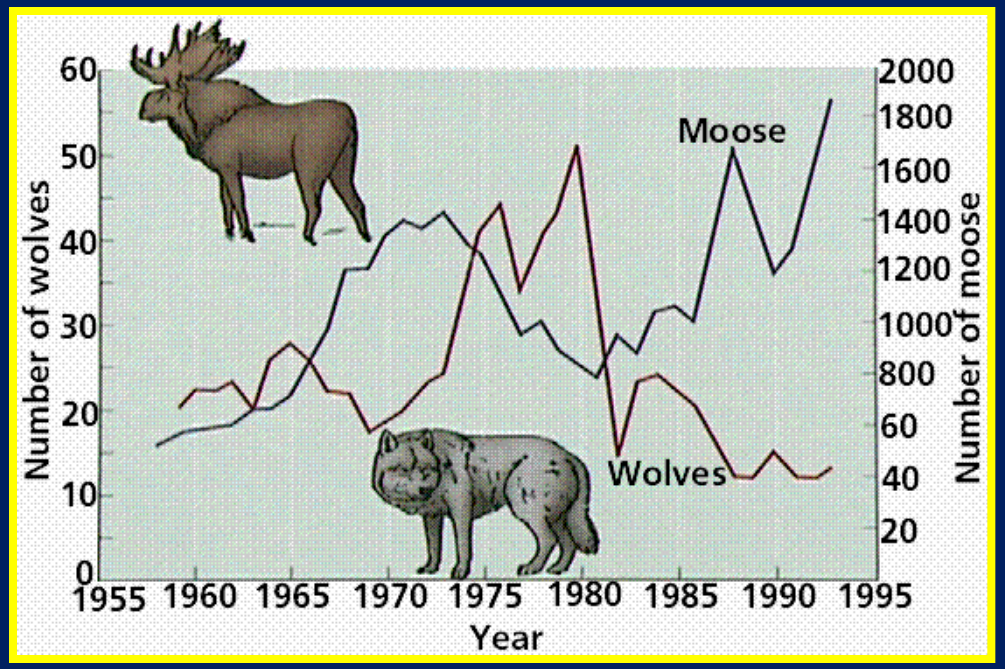
Gray Seal

Sabel Island

Lance Fish

Harbor Seal

Predator – Prey Relationships also affect Population Growth



Increase in predators cause a decrease in prey

Decrease in prey causes a decrease in predators

Decrease in predators cause an increase in prey

Increase in prey causes an increase in predators

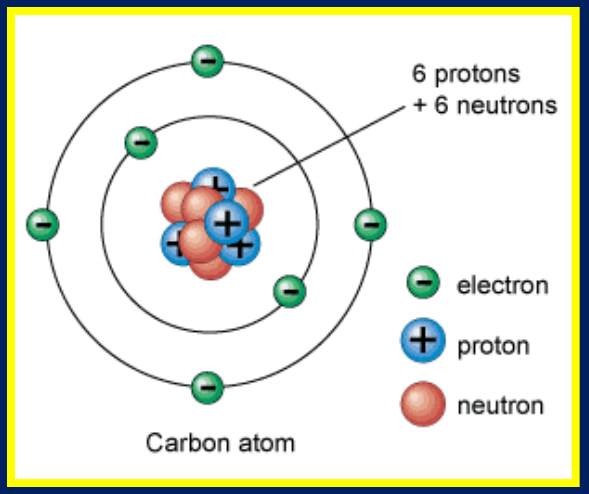
There is always a delayed relationship in growth and decline between the two populations

Symbiotic relationships involve close and permanent relationships between different species.

Mutualism is when both species benefit

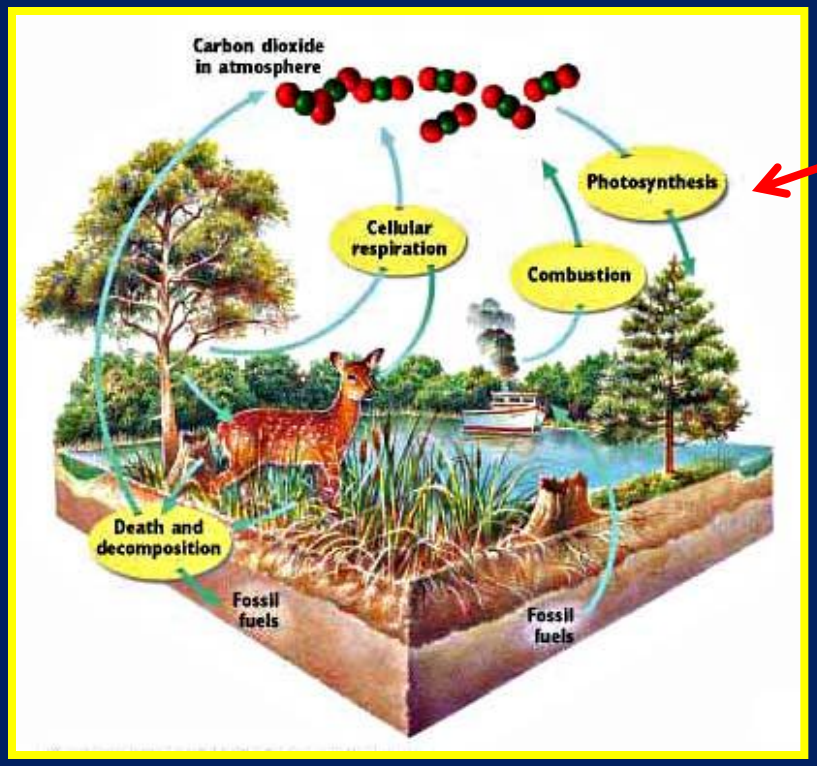
Parasitism is when one species benefits and the other is harmed

The Carbon Cycle



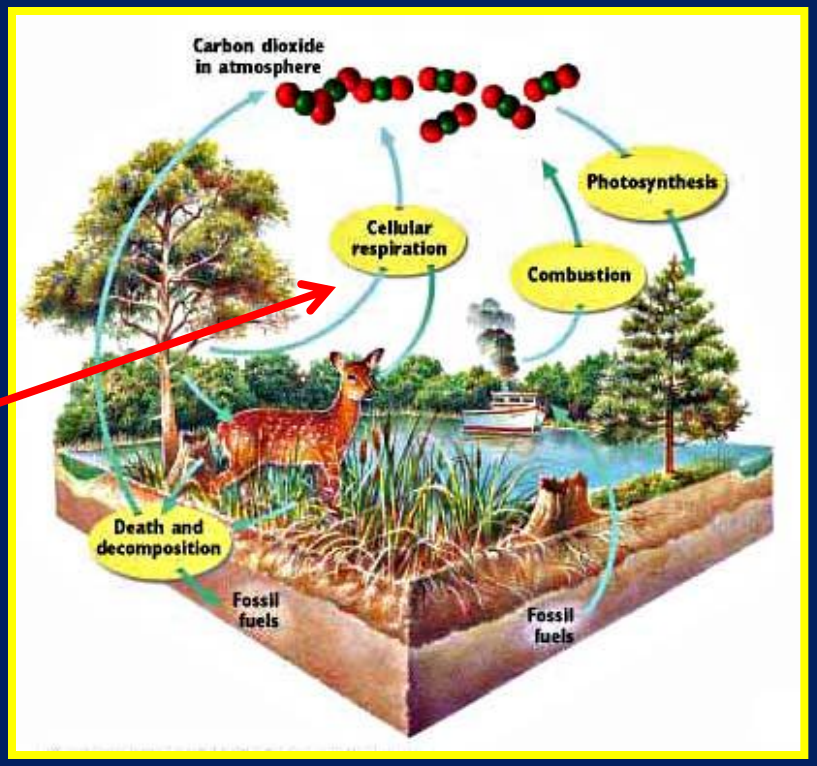
All living things are made up of organic molecules that contain carbon. Just like water, the amount of carbon on Earth has not changed since the formation of Earth, it has just been recycled.

The Carbon Cycle



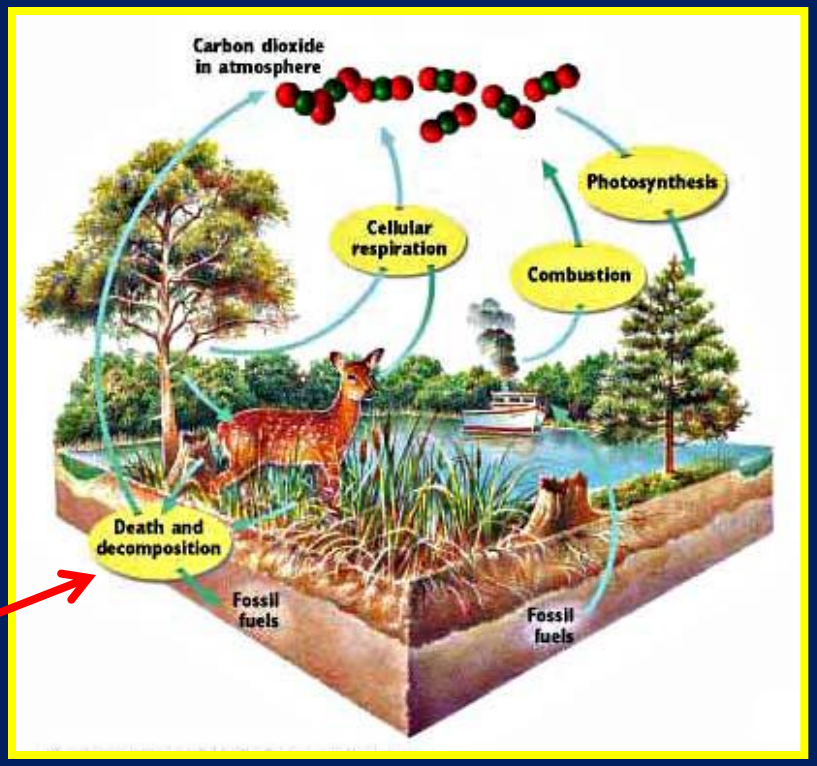
Plants remove carbon dioxide from the atmosphere, during photosynthesis, and convert it into glucose.

The Carbon Cycle



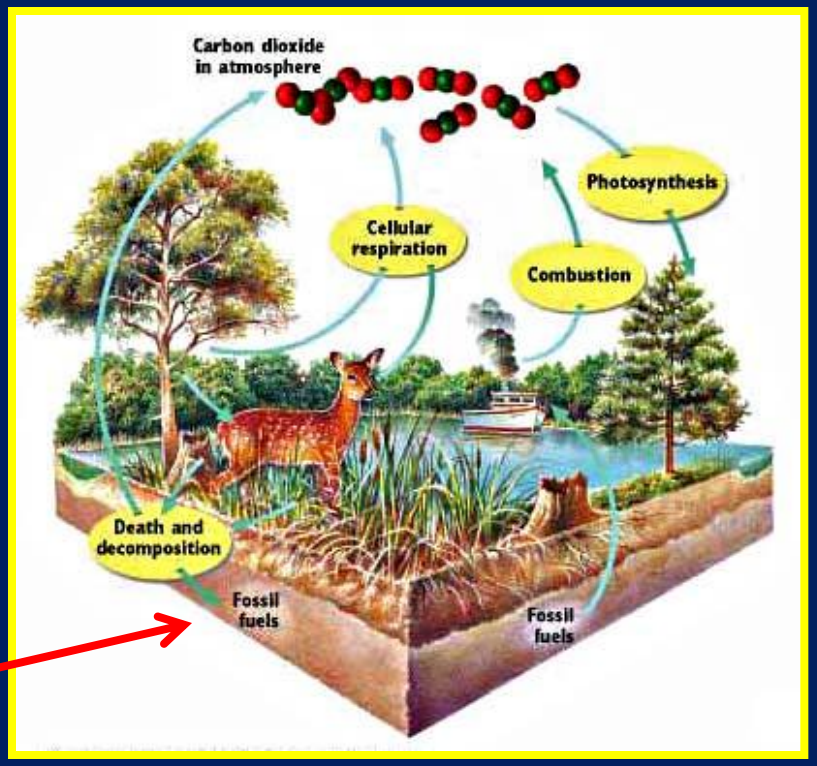
Consumers break down glucose during cellular respiration and release carbon dioxide back into the atmosphere

The Carbon Cycle



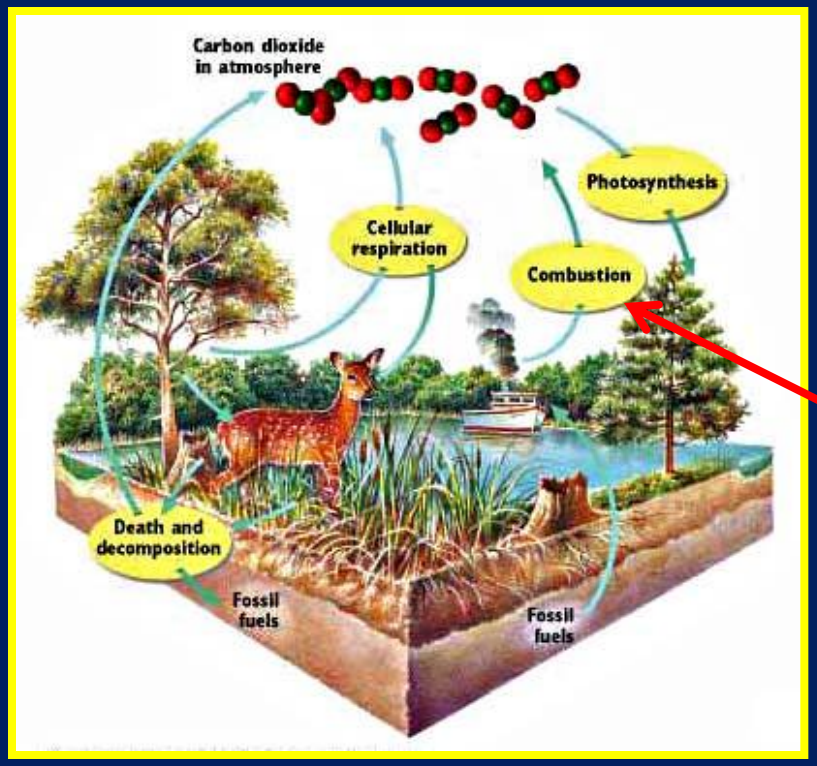
During <u>decomposition</u> of organic wastes, carbon dioxide is also released into the atmosphere

The Carbon Cycle



Organic wastes that are not decomposed are buried and converted into fossil fuels

The Carbon Cycle

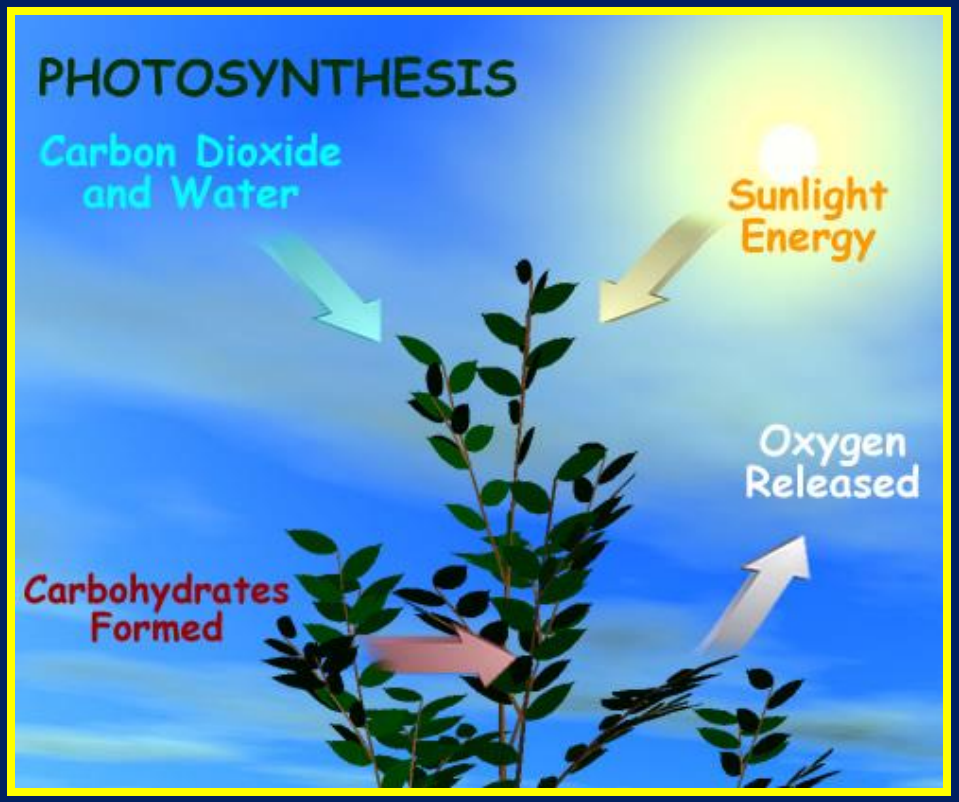


The burning of fossils fuels for mechanical use, during combustion, also releases carbon dioxide into the atmosphere

Flow of Energy in Ecosystems

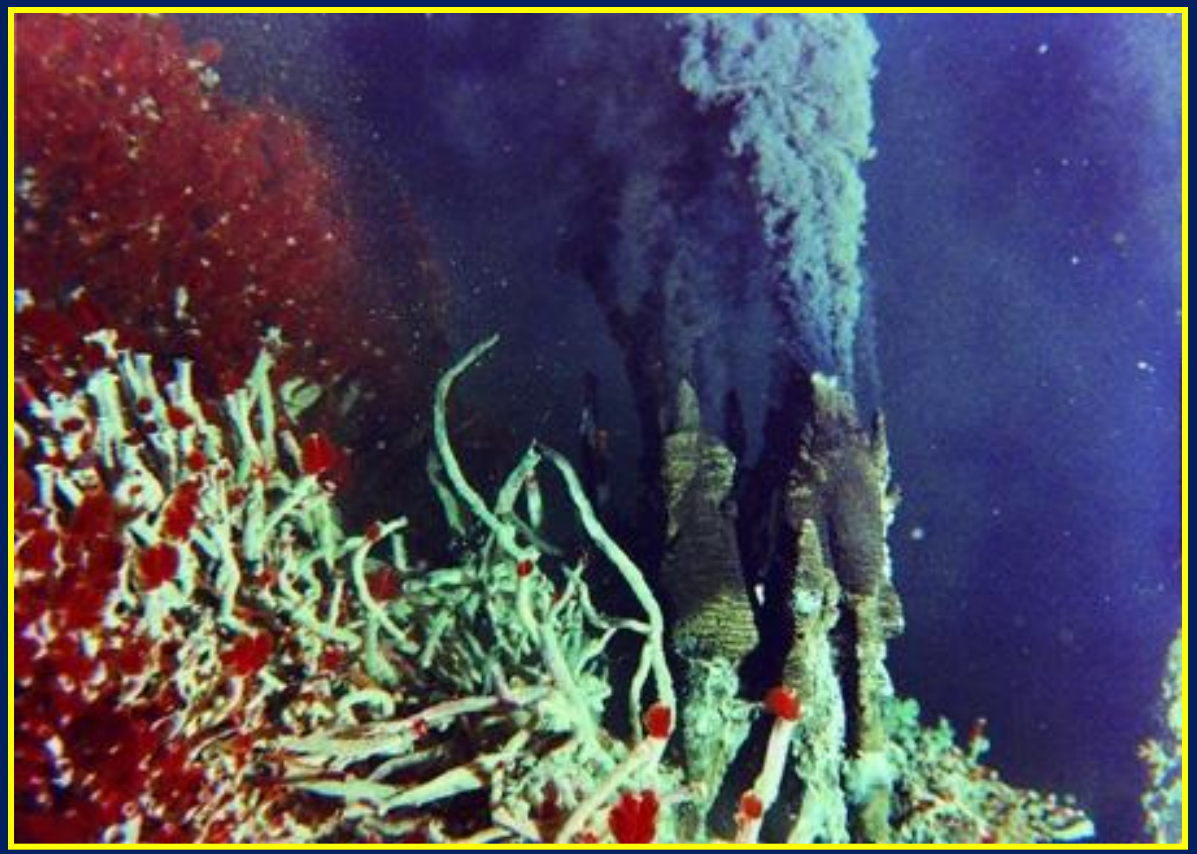
Objective 5.02: Analyze the flow of energy and the cycling of matter in ecosystems

The energy in most ecosystems enters as radiation from the Sun

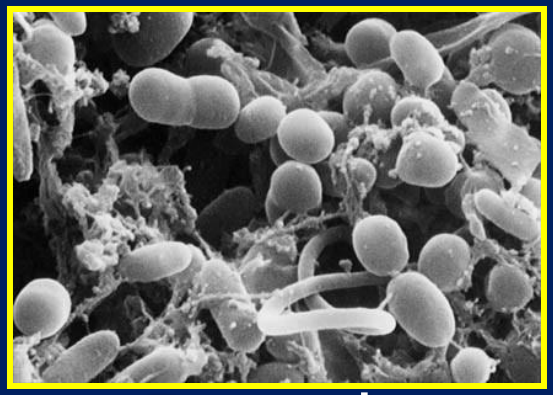


Plants and algae capture the energy from the Sun and use it to produce simple carbohydrates in a process called photosynthesis

In a few ecosystems, where no light is available, thermal energy is used



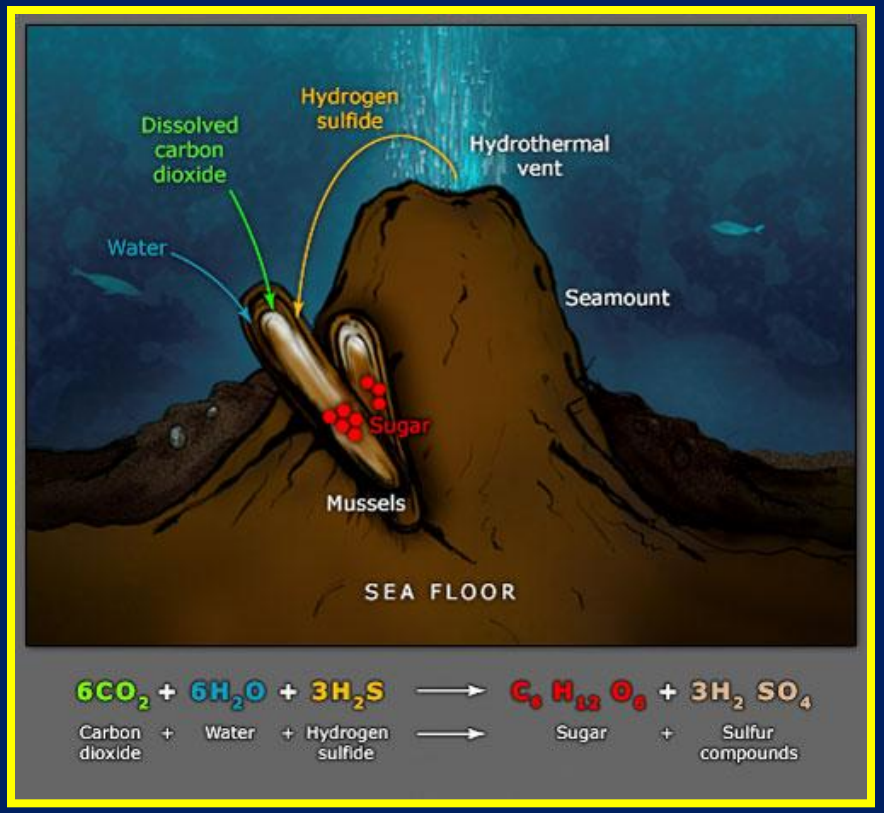
Hydrothermal Vent



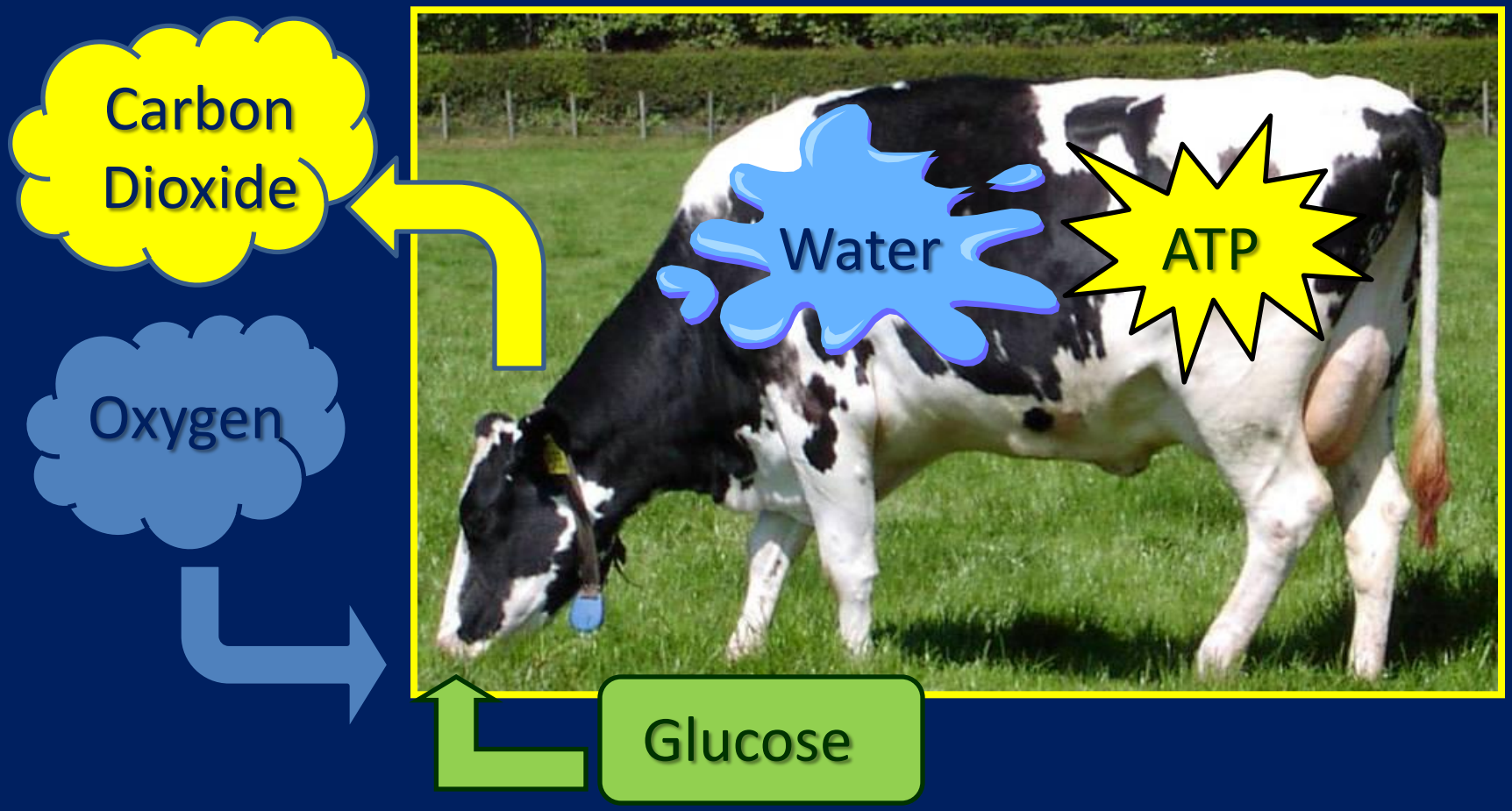
Bacteria

Tube Worms

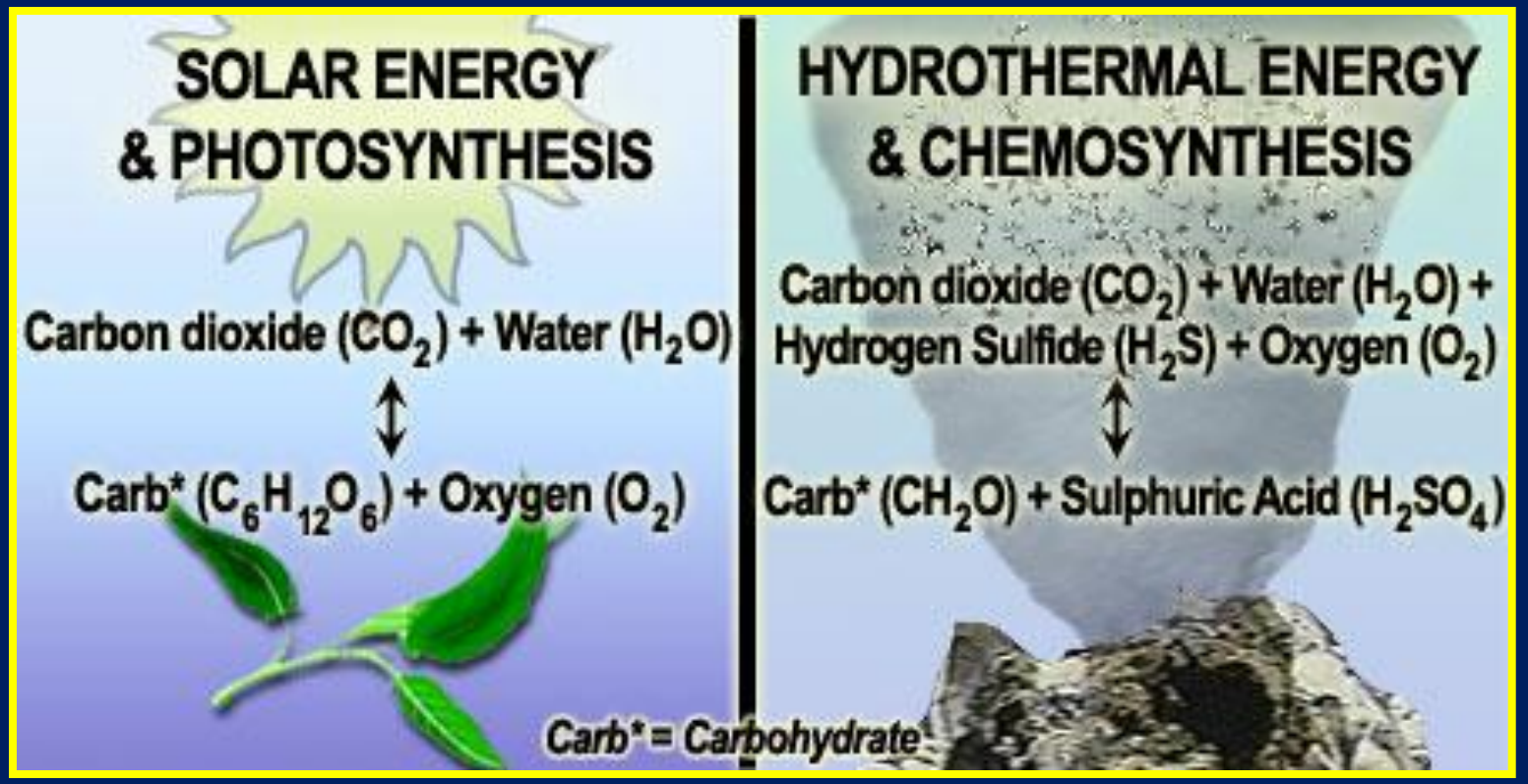
Bacteria use thermal energy and inorganic molecules, such as sulfates compounds, to produce simple carbohydrates in a process called chemosynthesis



During aerobic respiration oxygen is used to break down glucose into carbon dioxide, water and ATP energy for cell use

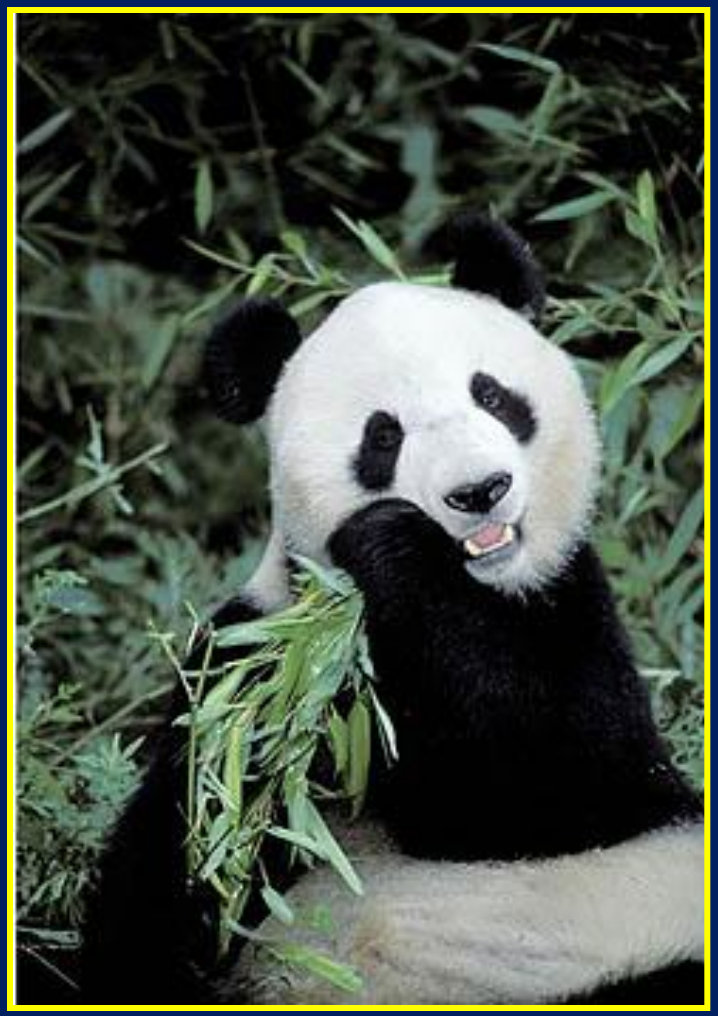


Autotrophs or Producers capture the energy from the sun or heat to produce their own food



Heterotrophs or consumers must obtain energy from the food they eat

Herbivores eat only plants



Carnivores eat other animals

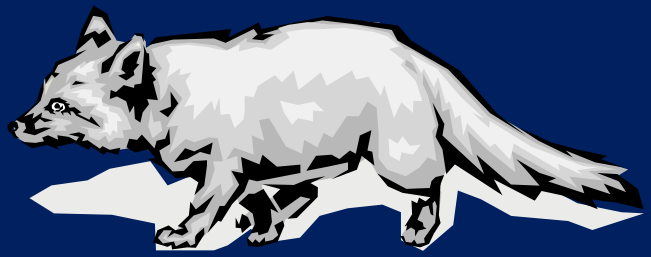
Omnivores eat both animals and plants

Food Chains are models used to show the direction matter and energy flow through an ecosystem

Arrows indicate the direction in which the energy is transferred. Arrows point to where the energy goes

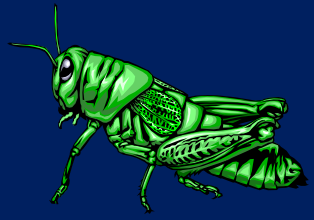
Trophic Levels refer to each step in the transfer of energy

Tertiary Consumer



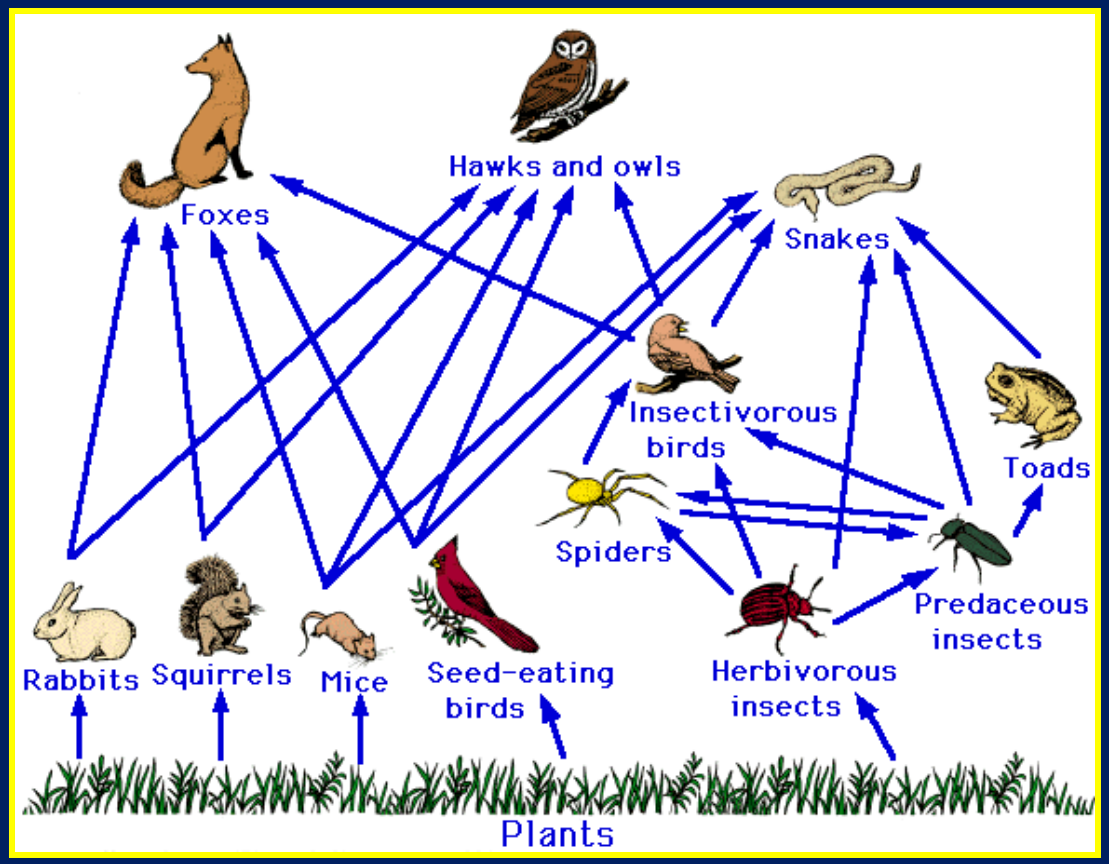
Secondary Consumer

Primary Consumer



Producer

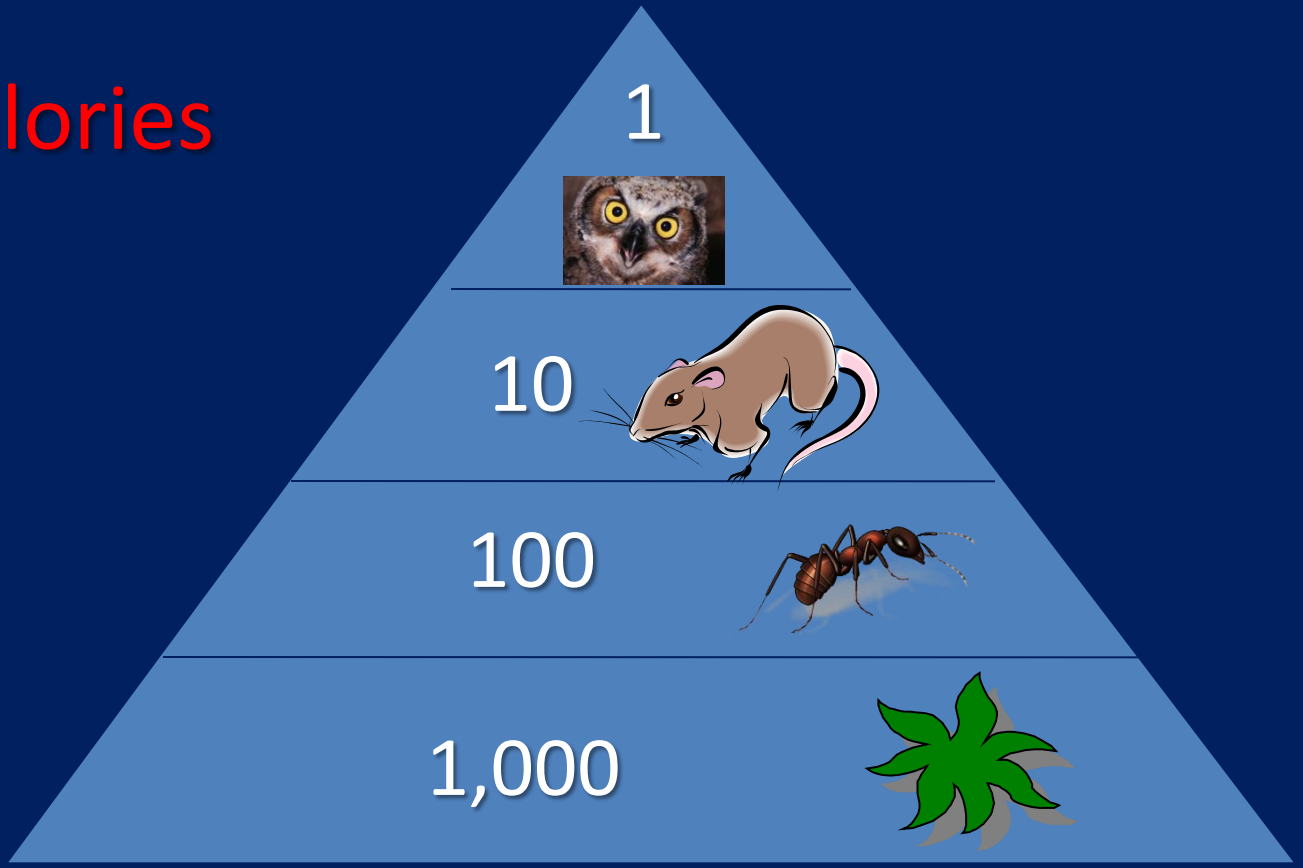
Food Webs are used to show interrelated food chains



Any change to a trophic level will affect all the other trophic levels

Ten Percent Law states that energy decreases by 10% as it travels up the trophic levels

Calories



Population Growth

Sharks

Fish

Objective 5.01: Investigate and analyze the interrelationships among organisms, populations, communities and ecosystems

A Population is a group of organisms that belong to the same species and live in a particular place at the same time

Population size refers to the number of individuals in the population.

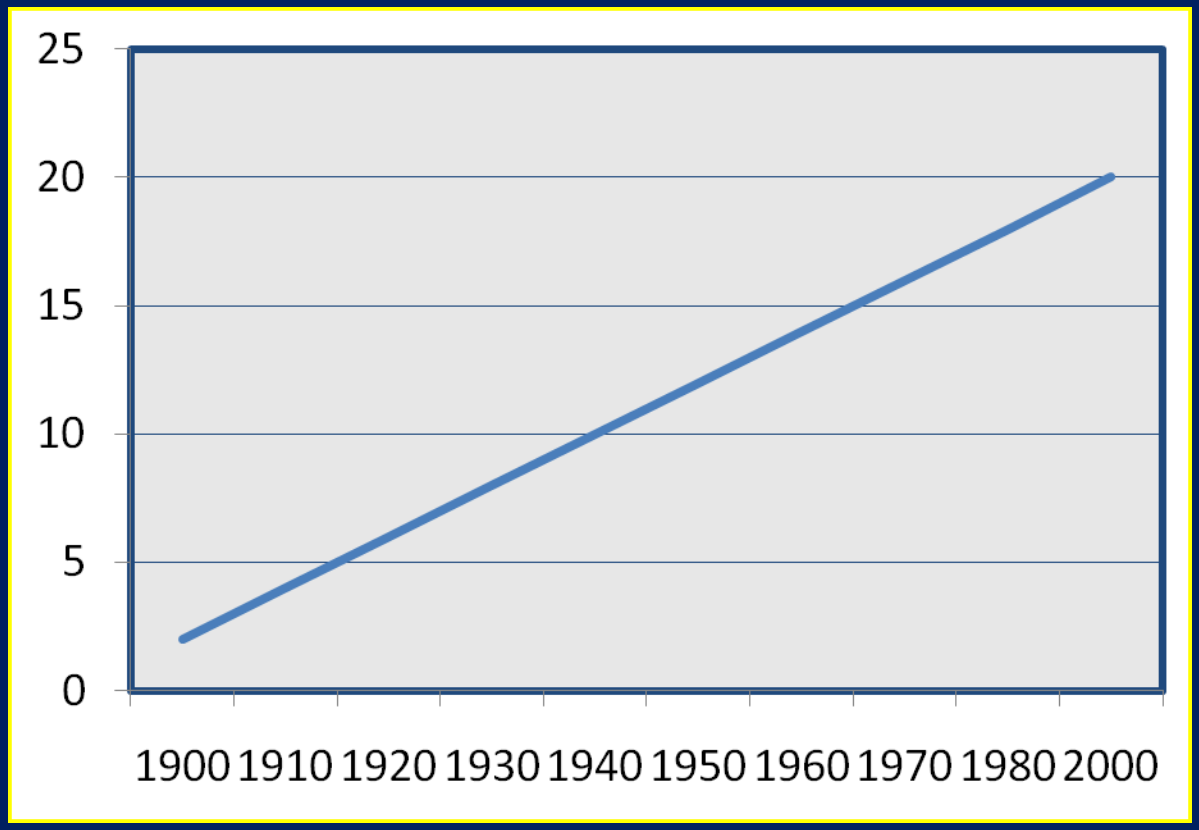
Population growth refers to an increase in the size of a population over time

Population Growth = Birth Rate - Death Rate

An increase in birth rate or a decrease in mortality rate will cause an increase in population growth

Graphs are used to analyze population growth

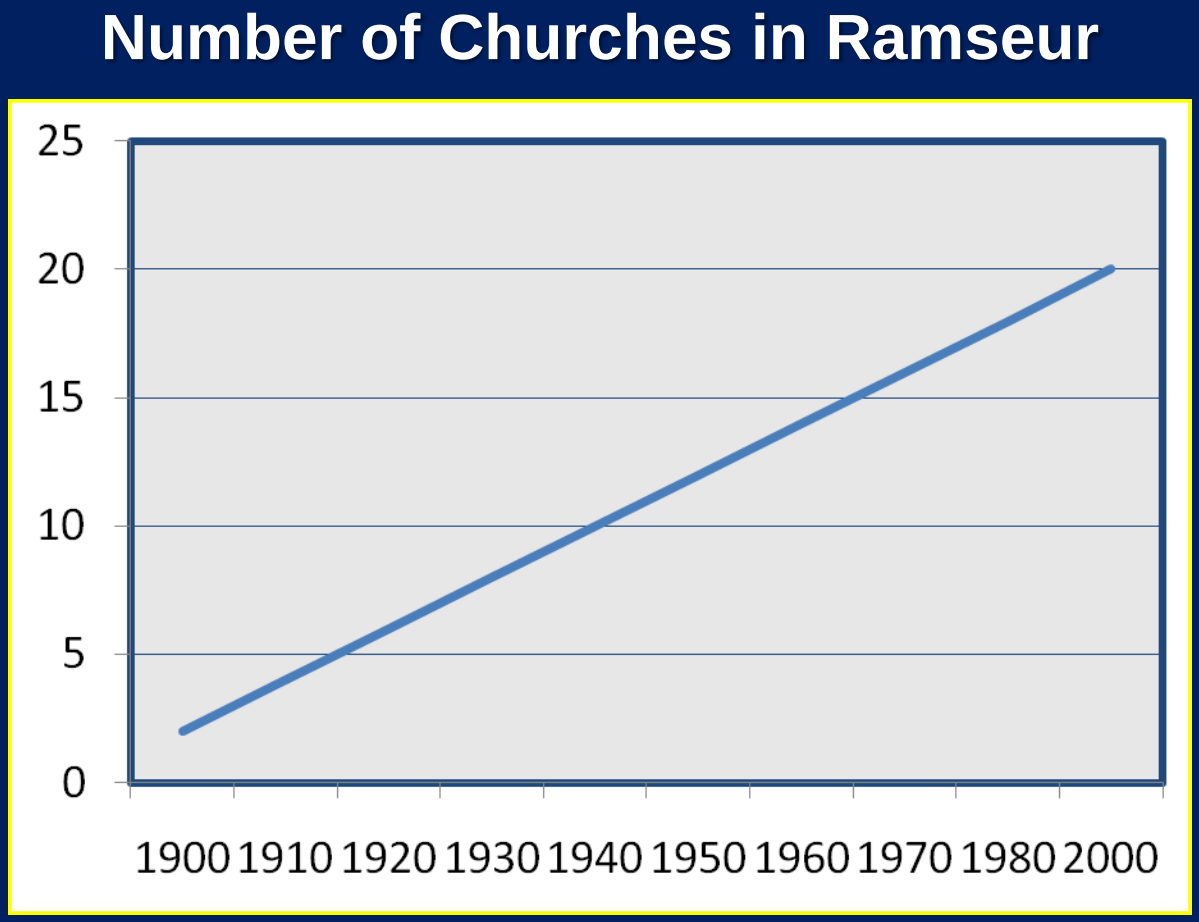
Y axis
Number
of
Churches



X axis - Years

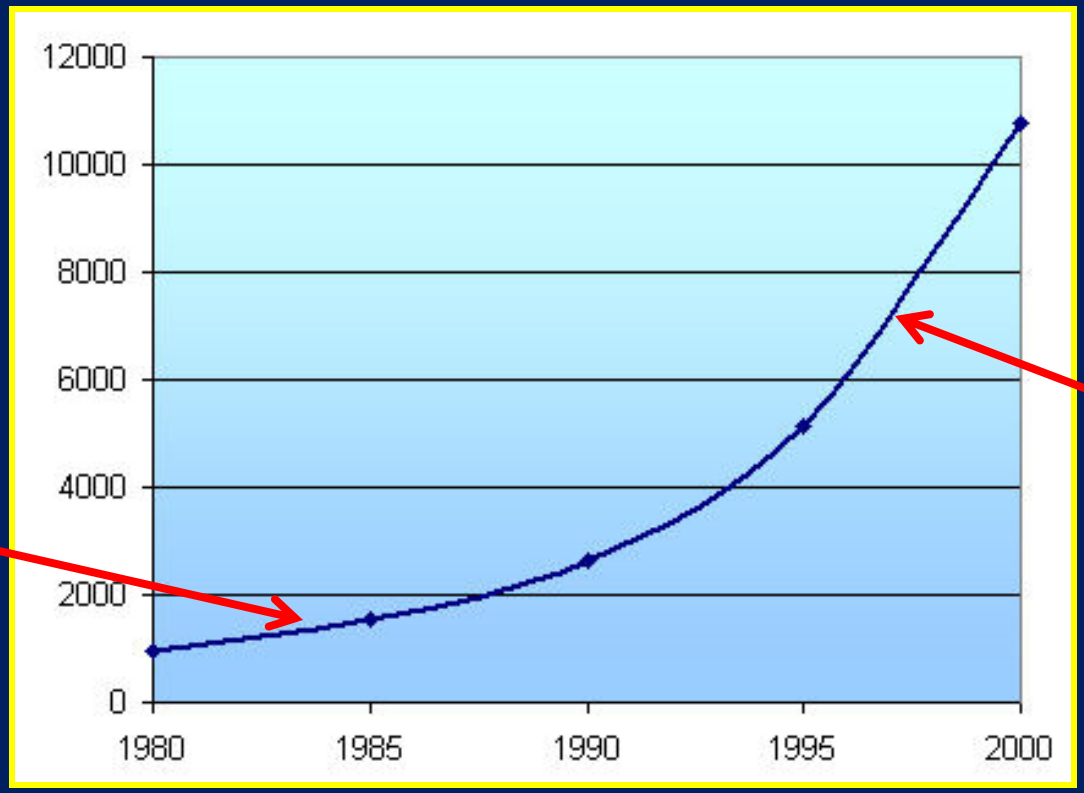
Linear Growth is when the numbers increase steadily by the same amount (2, 4, 6…)

Y axis Number of Churches



X axis - Years

Populations tend to increase exponentially in that as they grow larger they begin increasing faster



Slow Increase

Rapid Increase

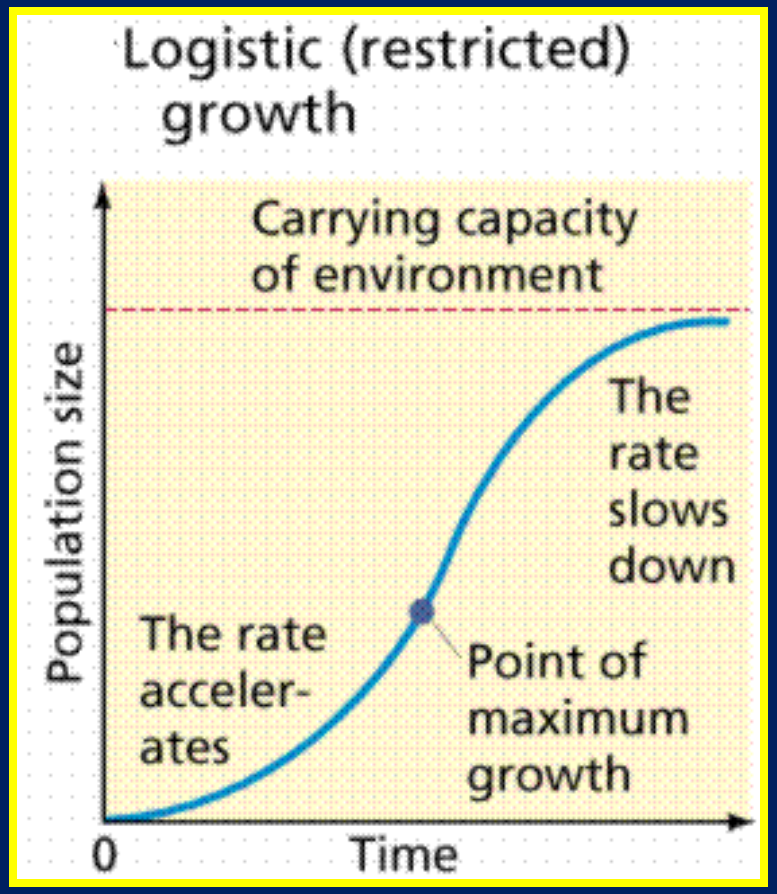
All ecosystems have a limited amount of resources to support populations

All organisms need water, food, space for habitats, and sanitary conditions

As populations increase, there is more competition for the same resources

Populations begin to die out due to disease, starvation, or thirst

Therefore, any ecosystem can only support a certain amount of individuals

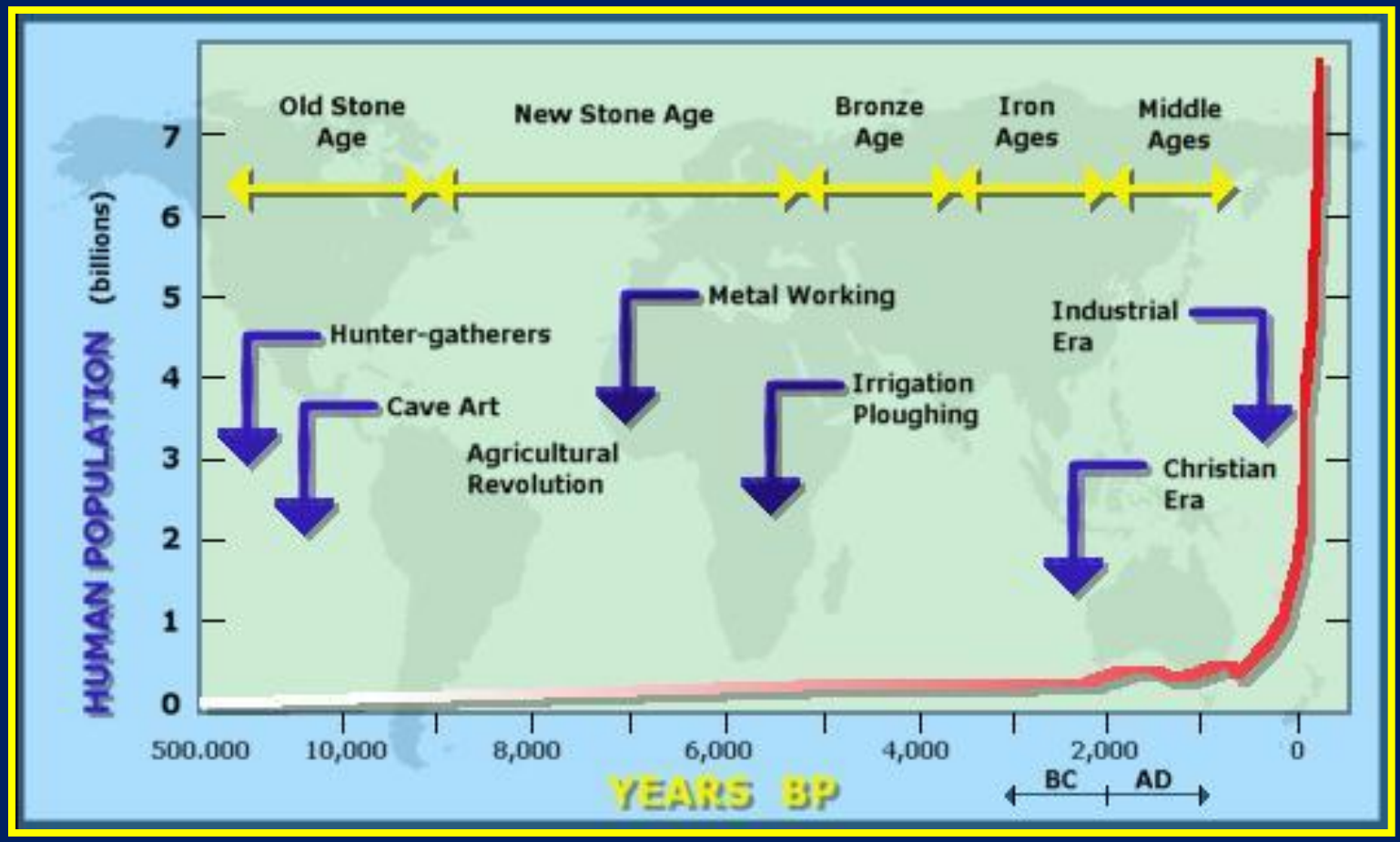


Carrying Capacity refers to the maximum number of individuals an ecosystem can support

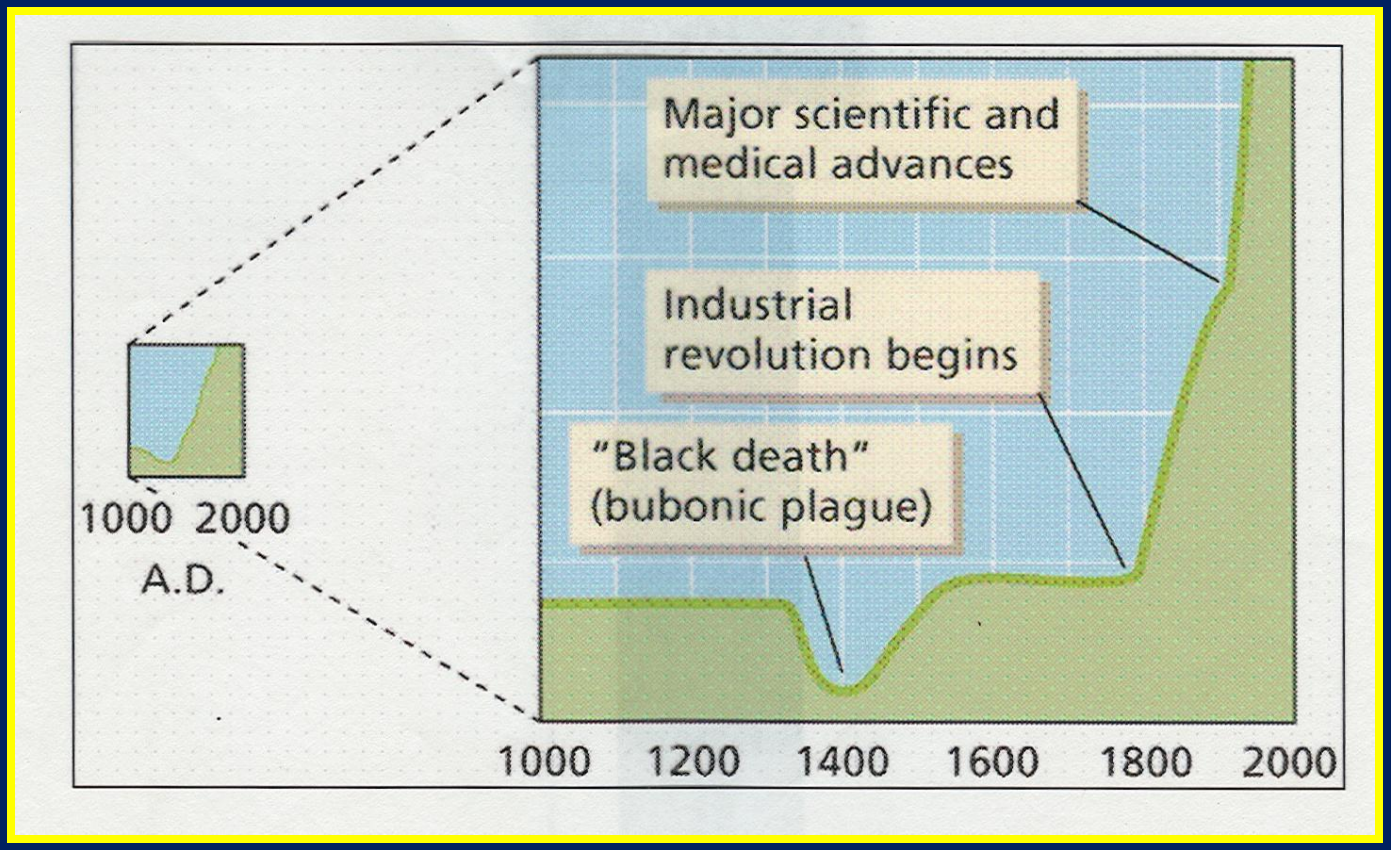
Impact of Human Population on the Environment

Objective 5.03: Assess human population and its impact on local ecosystems and global environments

The current trend of human population growth is that of exponential growth. In other words, as the population gets larger, it is increasing faster.



Industrial revolution, that began in the 1800's, made obtaining resources even easier.



The discovery of antibiotics, vaccines, and other medical improvements lowered the mortality rate

Current World Population

6,815,052,967

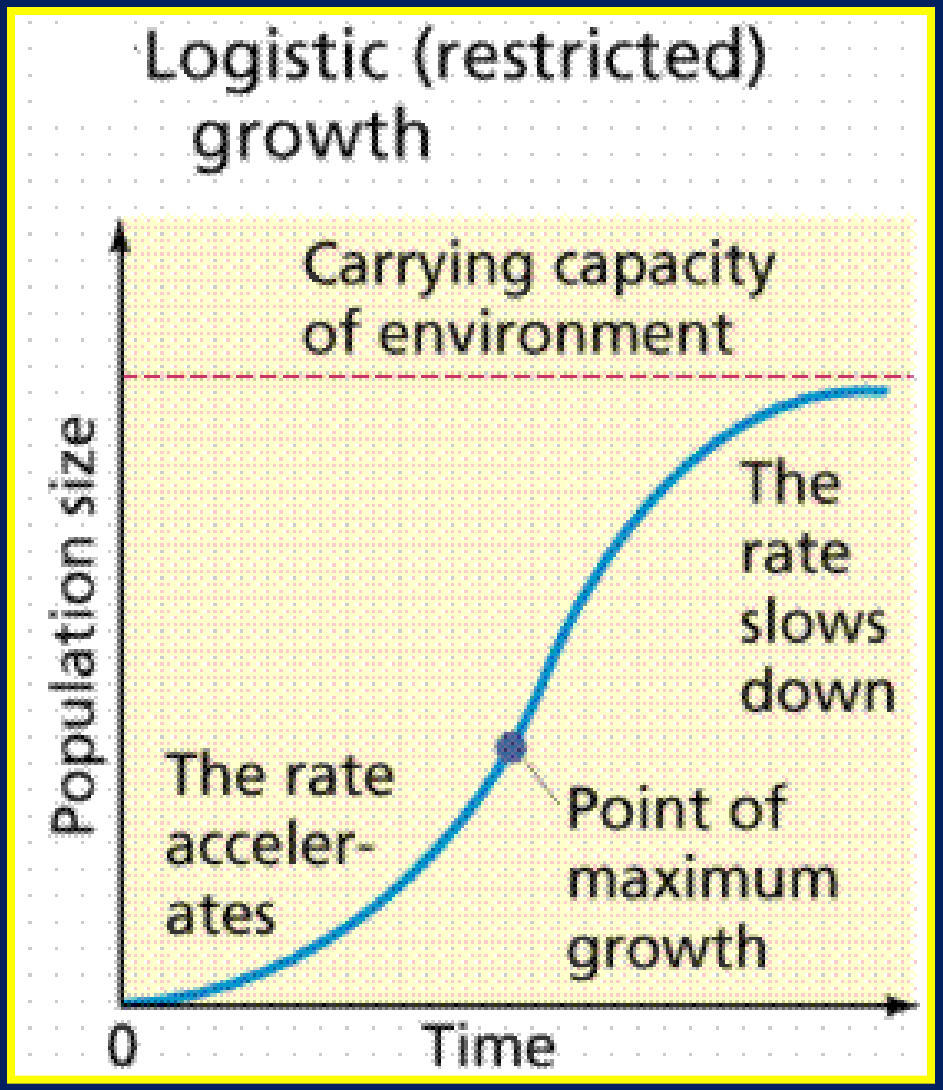
World Population 1970

3,912,211,699

World Population 2050

10,299,634,568

Carrying Capacity

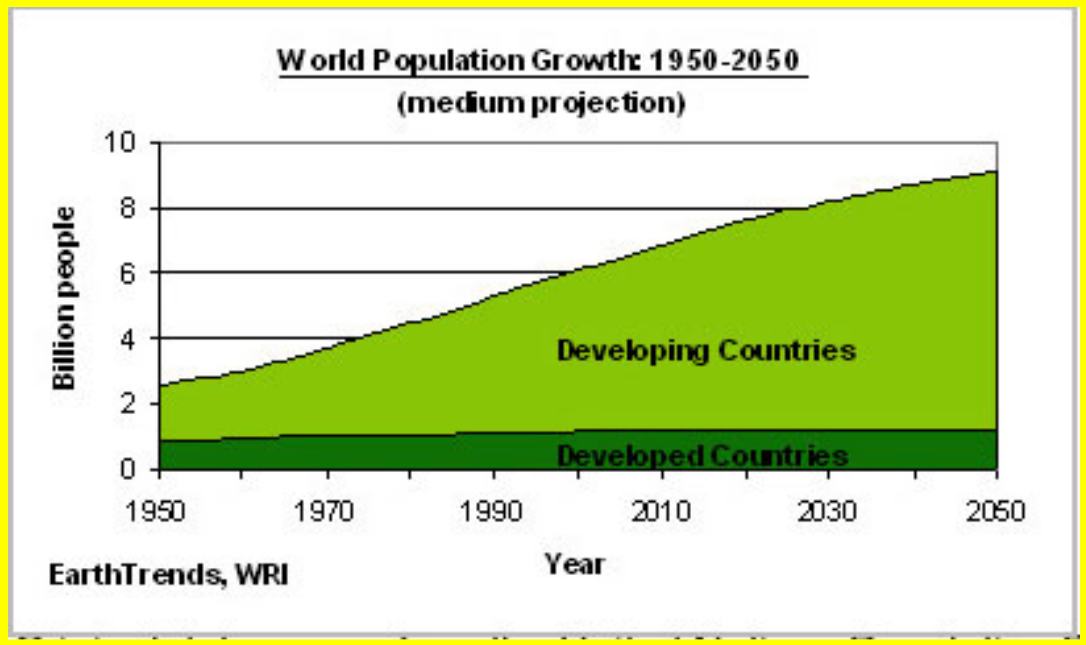


When ?

How ?

Who ?

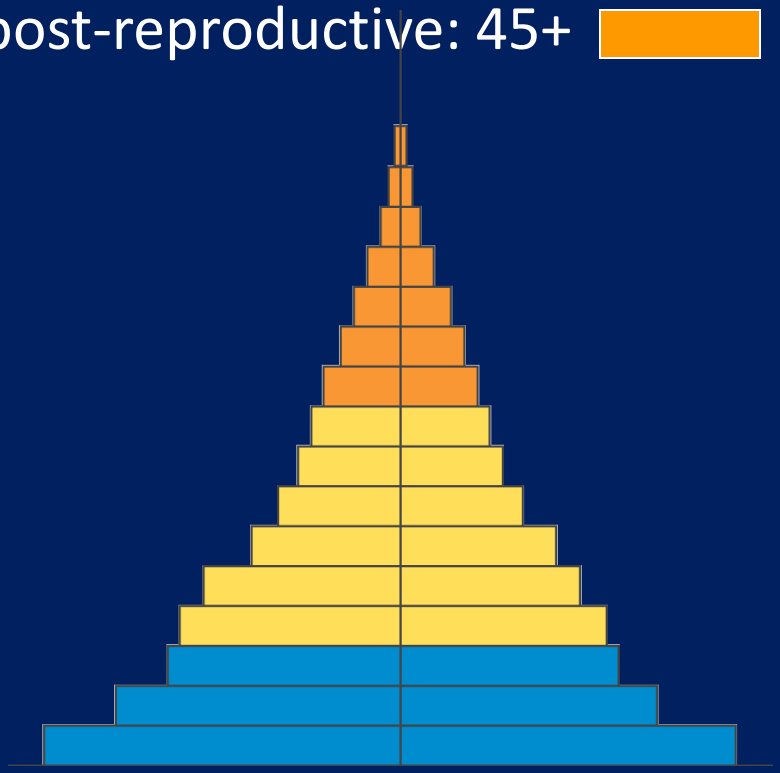
Developing nations are those nations that are not fully industrialized and still use primitive means to farm and live. The average income is far below poverty level.

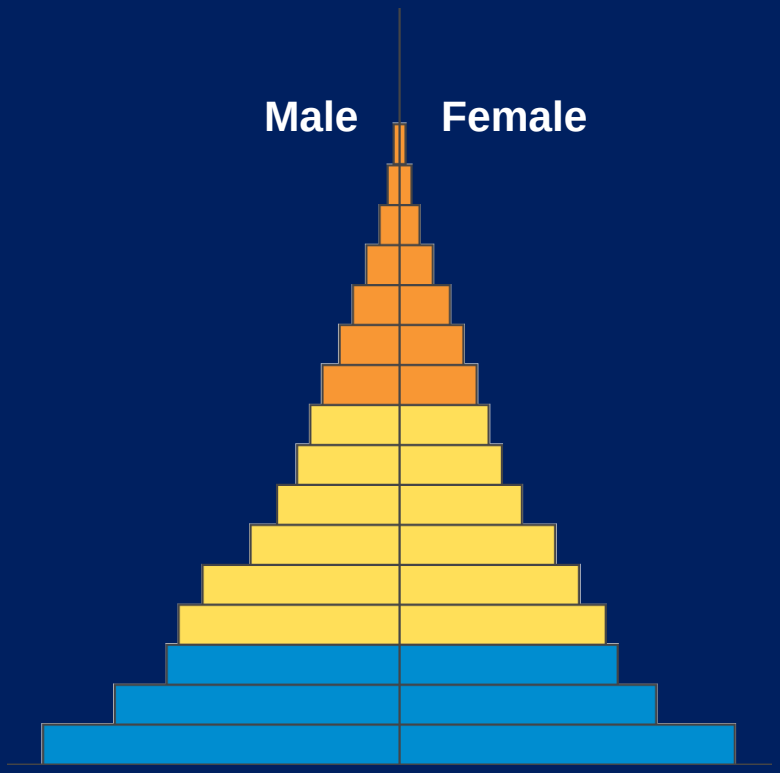


Developing nations include India, those in the Mid-East, Africa, South America, and Asia

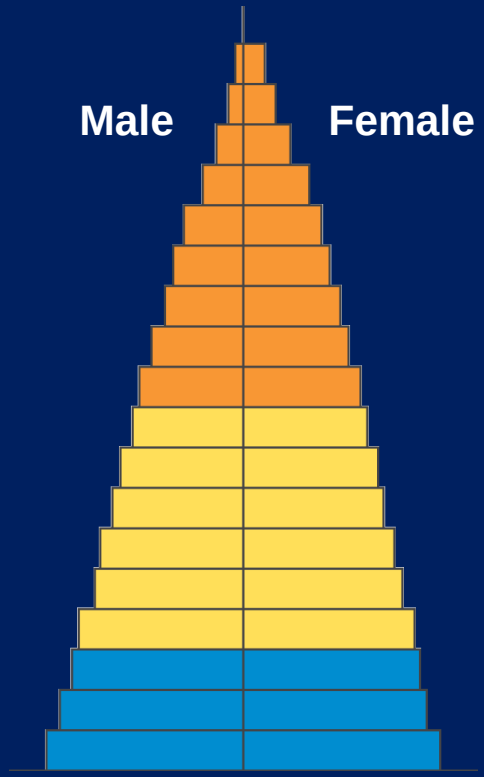
Population Age Structure

- Age structure diagram: shows the proportion of the population at each age level
  - » prereproductive: 0-14
  - » reproductive: 15-44
  - » post-reproductive: 45+





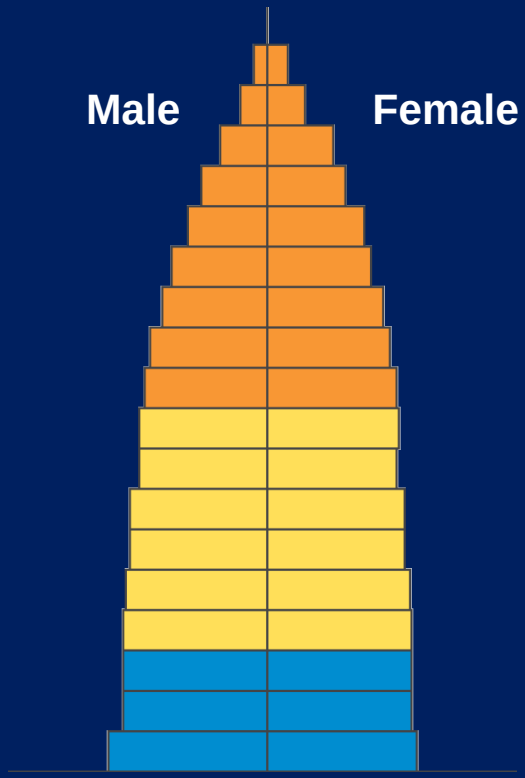
Rapid Growth
Guatemala
Nigeria
Saudi Arabia



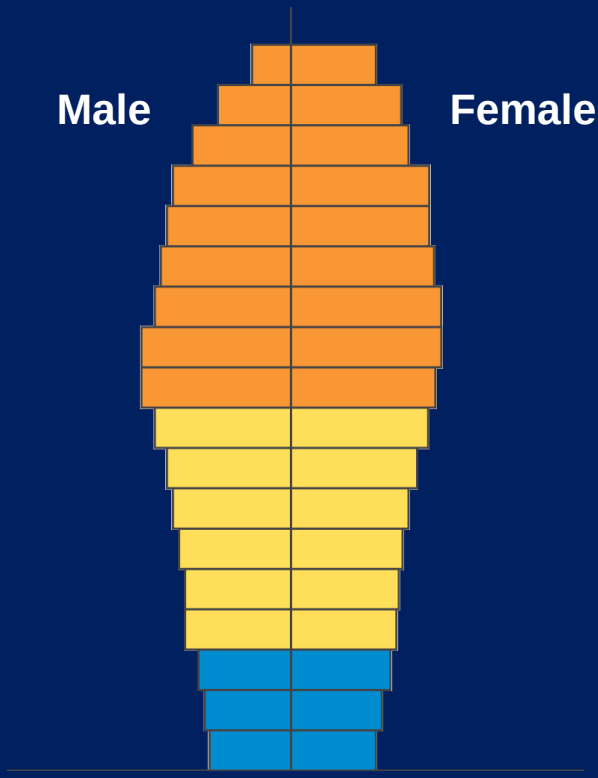
Slow Growth
United States
Australia
Canada

Ages 0-14 **Ages 15-44** **Ages 45-85+**

Fig. 11.16a, p. 247



Zero Growth
Spain
Austria
Greece



Negative Growth
Germany
Bulgaria
Sweden

Ages 0-14 **Ages 15-44** **Ages 45-85+**

Fig. 11.16b, p. 247

Biodiversity

Biodiversity refers to the variety of organisms in a given area

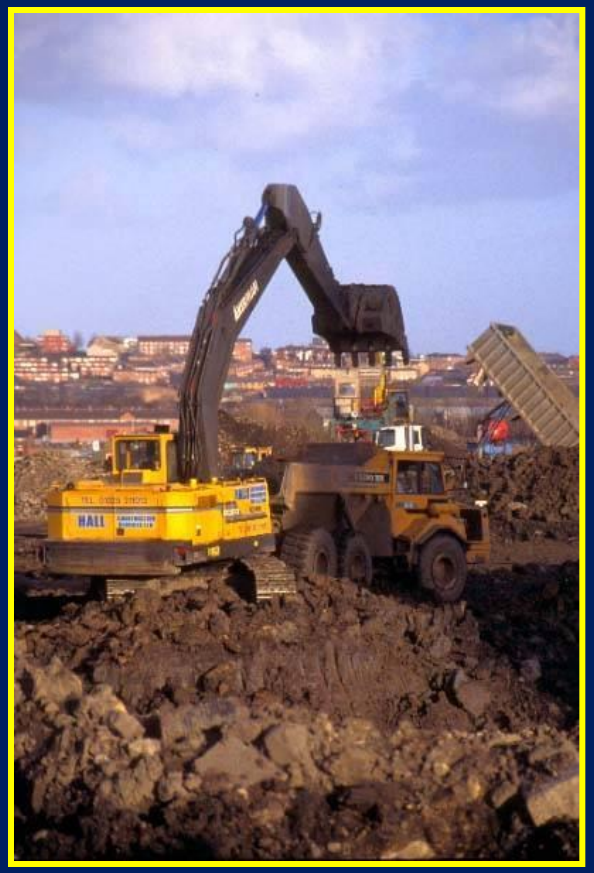
Importance of Biodiversity

Diversity breeds diversity. Different types of vegetation provide different habitats and different sources of food.

The higher the biodiversity the better chances there are for an ecosystem to bounce back after a disturbance.

Reducing Biodiversity

The number one threat to biodiversity is habitat destruction



Acid Rain

Acid rain is created when sulfur oxides and nitrogen oxides from the burning of fossil fuels combine with rain to make it more acidic

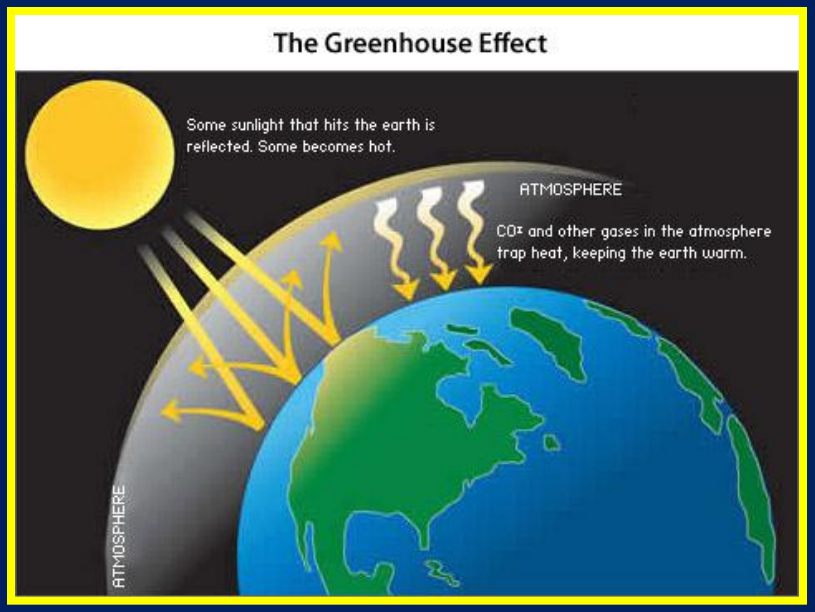
Coal Plants

Acid Rain

Acid rain washes minerals such as calcium and magnesium from the soil that plants need to grow

Greenhouse Effect

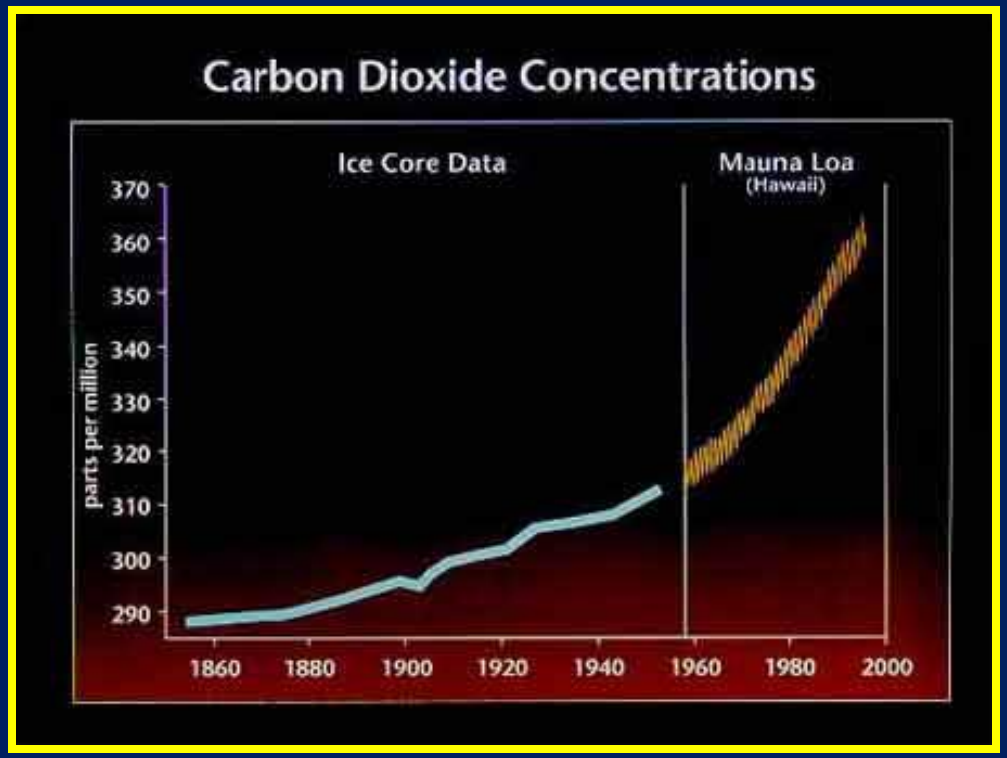
In the atmosphere, CO_2 acts as a greenhouse gasses allowing light radiation to pass through but prevents infrared radiation from escaping, thus keeping the Earth warm.



95% of the atmosphere on Venus is 95% CO_2 – Temperatures on Venus reach 900F

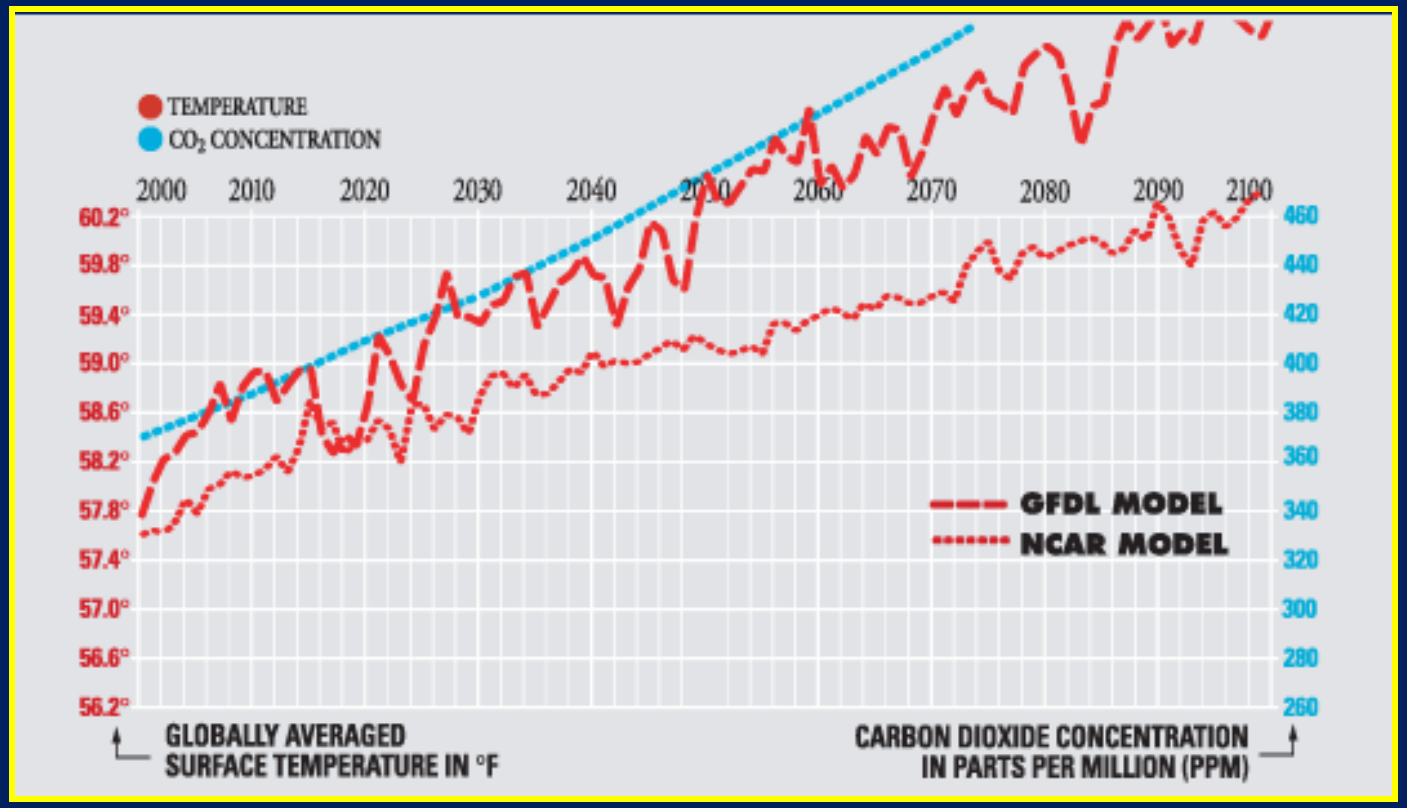
Increased CO_2 Levels

Since the industrial revolution and the burning of fossil fuels, that began in the 1850's, the levels of carbon dioxide in the atmosphere has increased by over 30%



Global Climate Change

If the warming trend continues, it could lead to a change in our global climate where there is a significant change in the "average" temperature



Global Climate Change

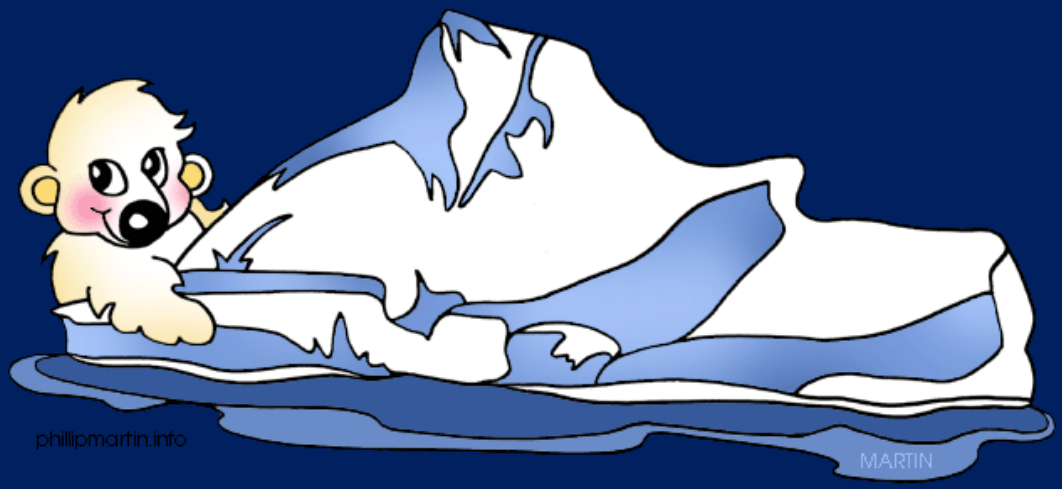
Possible changes if the global climate changes could include:

Melting of Polar Ice Caps

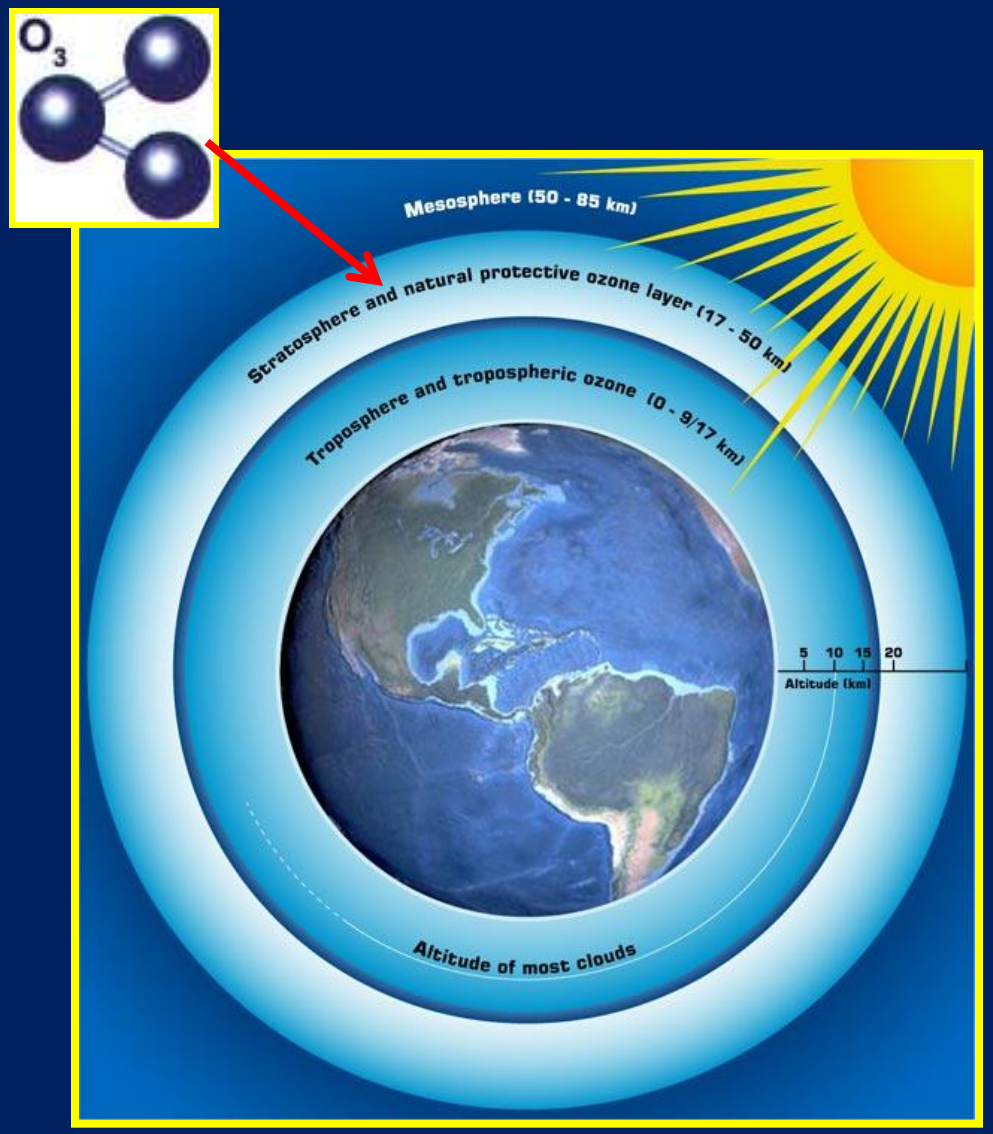
Rise in Sea Level

Disappearance of Many Sea Islands

Flooding of Major Coastal Cities



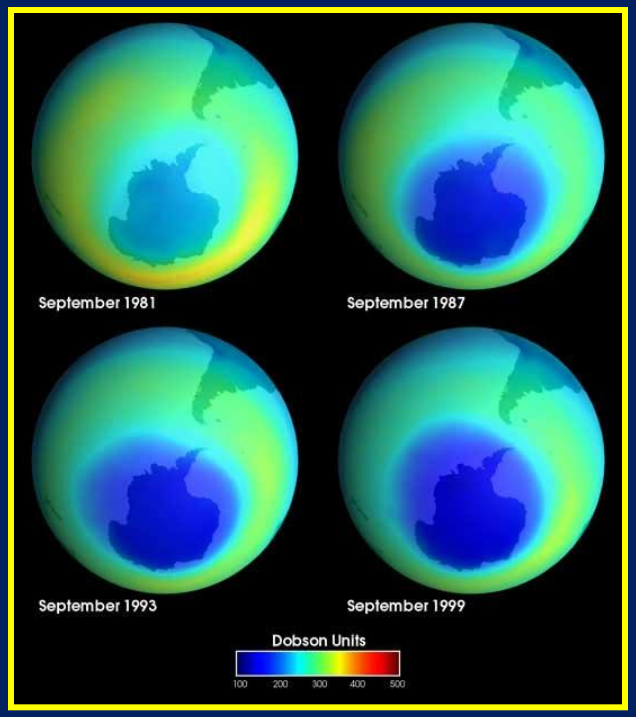
Hole in the Ozone Layer



Ozone, O3, is a naturally occurring gas that collects in the stratosphere and shields the Earth from harmful ultraviolet radiation released from the Sun.

Hole in the Ozone Layer

Certain synthetic chemicals, especially chlorofluorocarbons, CFCs, rise into the stratosphere and act as catalysts that break down ozone faster than its formed.



Since the 1980's, scientists have observed a hole in the ozone layer, due to CFC's, over Antarctica that is allowing more UV radiation in and increasing the amount of skin cancer

Eutrophication

Eutrophication occurs when too much nutrients, such as nitrogen, from animal wastes become fertilizers for the algae which reproduce rapidly creating an algal bloom.

Once the nutrients are consumed, the algae begins to die off and are decomposed. During decomposition, oxygen is removed from the water by the decomposers as a result of cellular respiration.

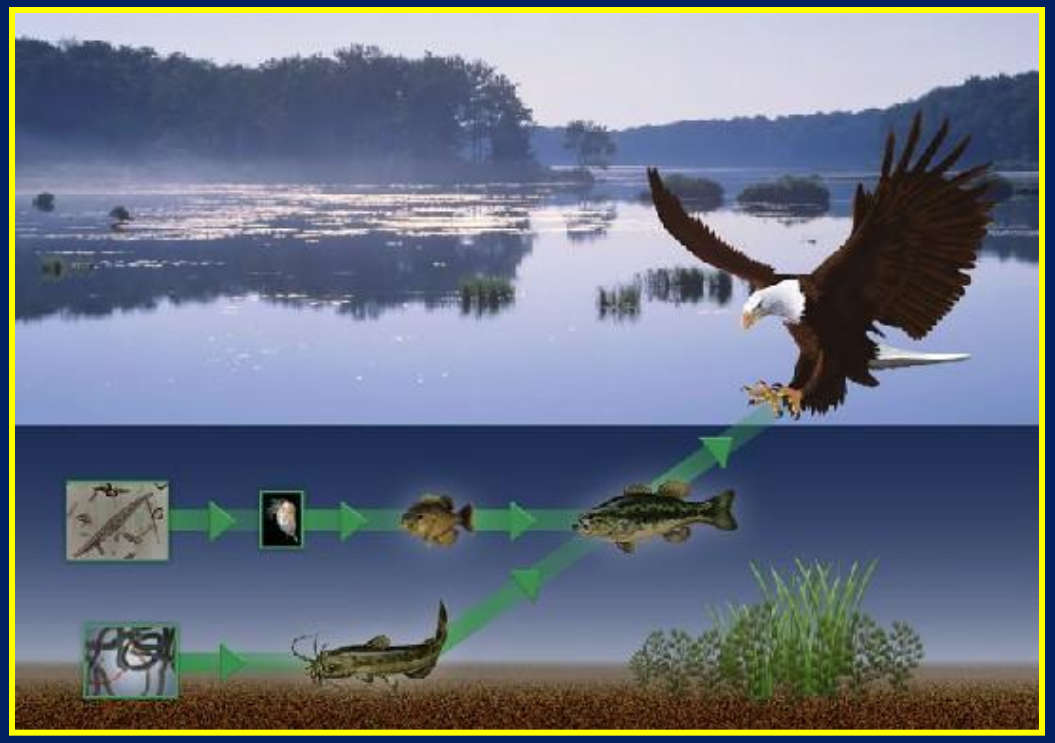
Low levels of dissolved oxygen lead to fish kills

Pesticides

Wide spread use of pesticides or “weed killers” have also led to a loss in biodiversity, especially when rain washes it into the waterways

Effects of Pesticides

Bioaccumulation is the process by which toxins are stored and increase in concentration within the body of an organism



Biomagnification is the process by which toxins build increase in strength and concentration as they travel up the food chain

Metals

Besides pesticides, heavy metals such as mercury can also bioaccumulate in organisms and result in biomagnification.

Mercury usually enters the water as a result of coal burning plants and bioaccumulate in fish. In humans, mercury poisoning results in birth defects and brain damage.

Animal Behavior

http://video.nationalgeographic.com/video/animals/birds-animals/seabirds/boobies_bluefooted/

Behavior is anything an animal does in response to a stimulus in its environment.

A stimulus is anything that directly influences the activity of an organism or one of its sensory organs (ears, eyes, nose, touch sensors).

There two main categories of animal behavior:
Innate and learned

Innate behavior requires no experience

Learned behavior occurs through practice and experience

Innate Behavior

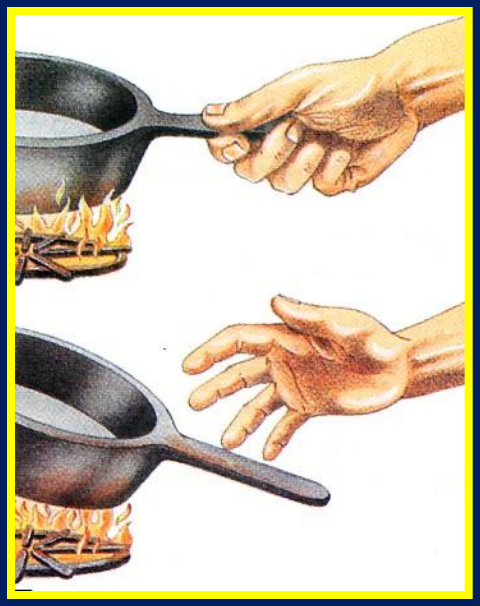
Innate Behavior is genetically inherited with animals being born already knowing how to exhibit a certain behavior.

Natural selection plays a role favoring certain behaviors until nearly all animals of that species exhibit that behavior

Only the baby turtles born with the genetic tendency to head towards the moonlight over the water survive to pass on that genetic trait.

Automatic Responses

Some innate behaviors are automatic responses which are quick, unconscious reactions.



A reflex is a simple, unconscious, automatic response to a stimulus.

Fight or Flight is another automatic response to a sudden fright where the body prepares for action by increasing adrenalin so the body can either flee or fight.

A taxis is a semi-automatic response towards a stimulus (positive) or away from a stimulus (negative).

When moths detect light, they fly towards the light.

Planaria worms have eye spots that can detect light. Planaria prefer darkness, so when the eye spots detect light, they move away from the light.

Instinctive Behavior

Instinctive behavior is still innate but the responses last longer and are more complex.

Courtship behavior is instinctive and is used to help recognize and choose the best mate.

http://www.youtube.com/watch?v=Or9NUEroVcE

Territorial behavior is instinctive and is used to defend physical space against other animals.

Animals can mark territory or can show aggressive behavior to warn others away.

Dominance hierarchy behavior establishes dominant members within a group.

Migration is an instinctive behavior that occurs when seasons change and animals move to warmer climates or back to cooler climates to take advantage of food availability.

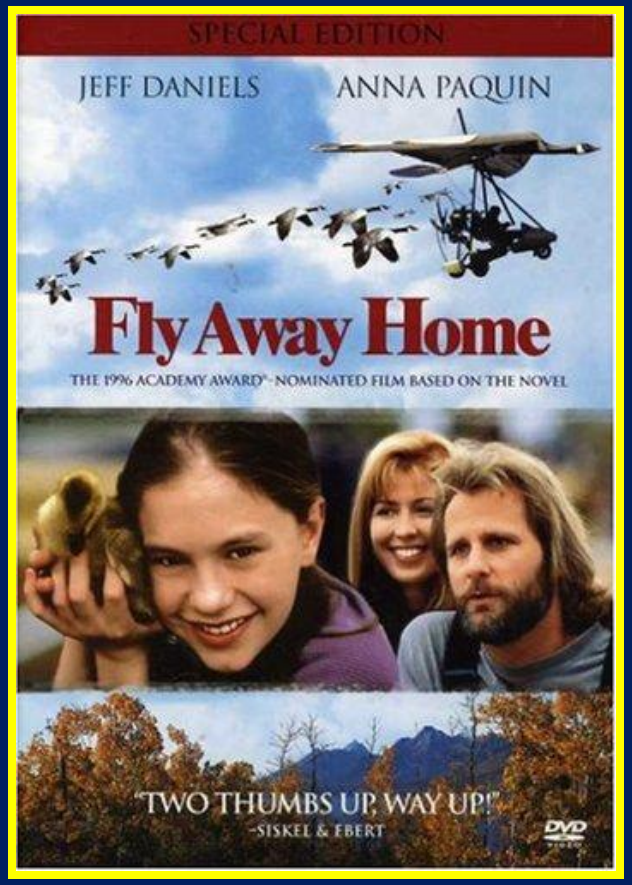
Hibernation occurs when food becomes scarce in the winter. Animals slow down their metabolism and sleep through the winter.

In areas with extended dry periods, some fish and amphibians will burrow in the mud, slow down their metabolism, and sleep until it rains again, in a behavior called estivation.

Learned Behavior

Learned behavior allows animals to adapt to changes in their environment.

Imprinting occurs when an animal forms an attachment to a stimulus which can be another animal or a scent during a critical period.

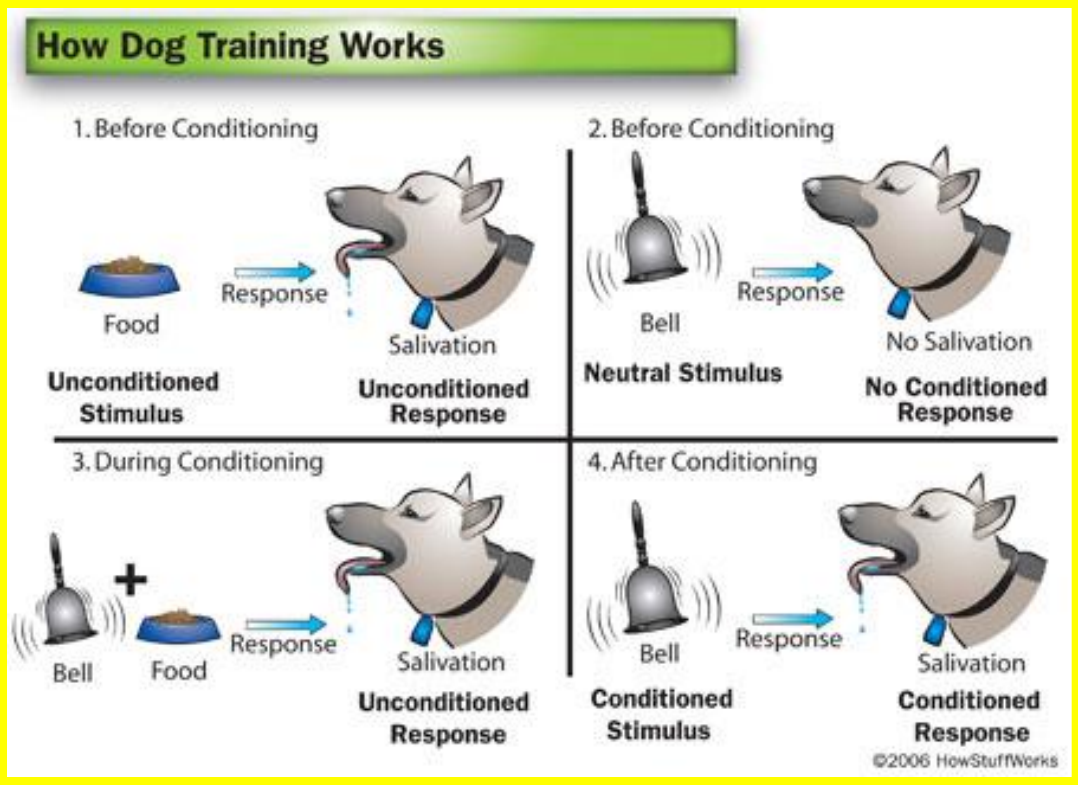


Habituation occurs when a stimulus is repeated without a punishment or reward and the animal learns not to respond.

Classical conditioning is when an animal associates one stimulus with another stimulus and begins to respond to the associated stimulus in a way that would not normally illicit that response.

Pavlov's Dog

Pavlov rang a bell each time before he fed the dog. The dog began to associate the bell with food and would begin to salivate as soon as he heard the bell.



Operant Conditioning uses punishment or reward to modify voluntary behavior

Also known as Trial and Error

Insight or reasoning occurs when an animal uses previous experience to respond to a new situation.

Social Behavior

Many behaviors, both innate and learned, are considered as social behaviors.

Courtship

V Formation

Schools of Fish

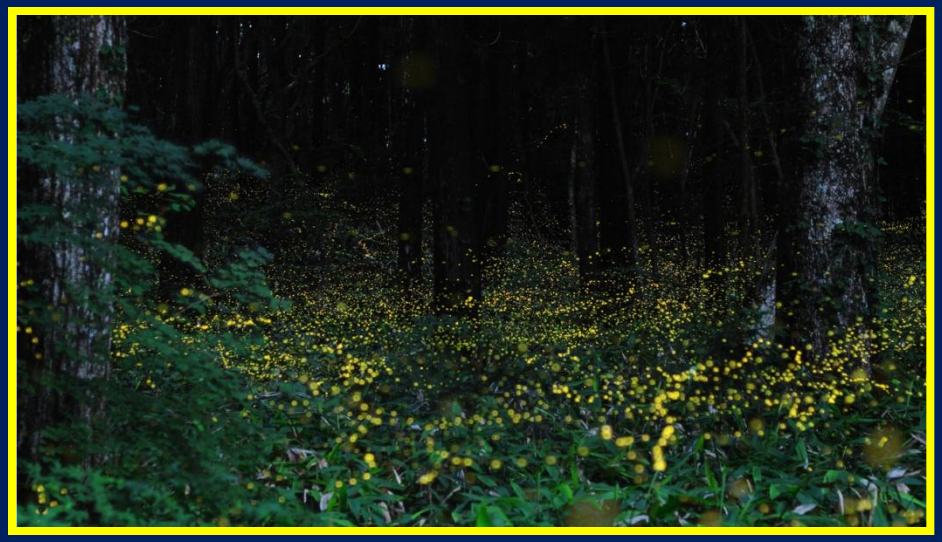
Herding

Social behaviors occur when two or more animals of the same species interact in ways that benefit all involved.

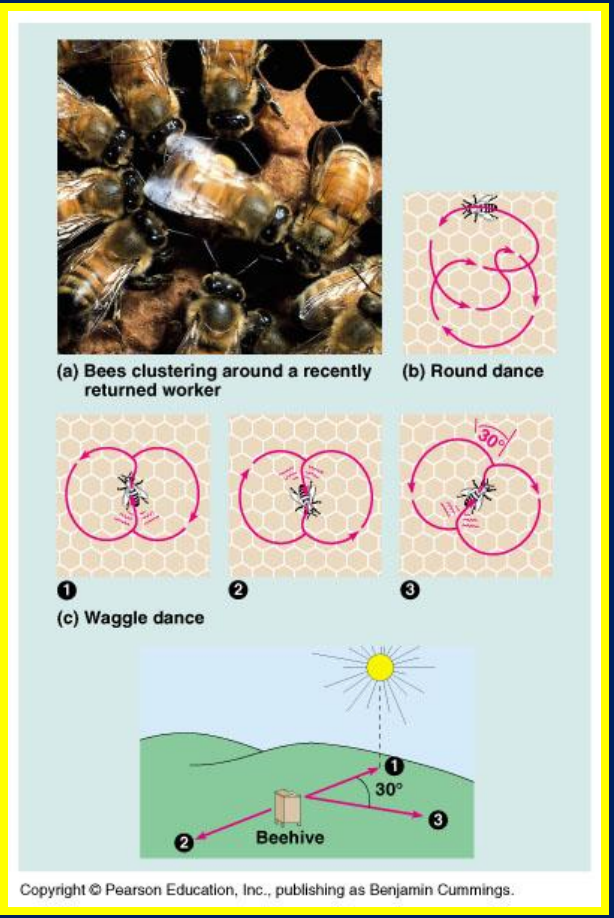
Communication is can be a learned social behavior or an instinctive behavior involving sound, body expressions, or chemicals.

Ants leave trails of chemical, called pheromones, to lead other ants to food or nesting places.

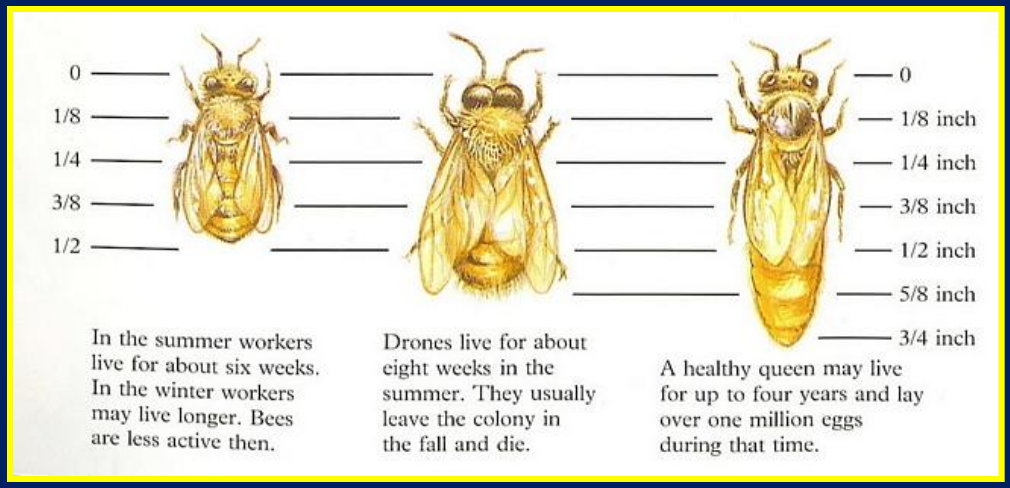
Fireflies use species specific flash patterns to locate and attract mates.

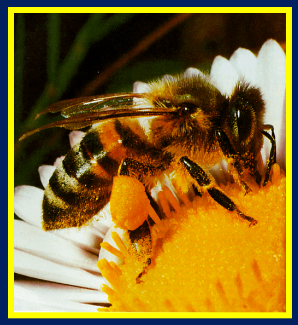


Scout bees perform what is called the <u>waggle dance</u> to show other bees where a source of food is located.



Waggle Dance





Worker Bee (sterile female)

Drone Bee (male)

Queen Bee (Fertile Female)

Many animals use sound to communicate. Sometimes species specific sounds, used for communication, are taught and other times, they are instinctive.

Songbirds will sing instinctively but they must hear their own species sing, at some point, to sing their species characteristic song.

The End