ADAPTIVE RESPONSES:

- **Mimicry –** structural adaptation that allows one species to resemble another species; may provide protection from predators
- **Camouflage –** structural adaptation that enables species to blend with their surroundings; allows a species to avoid detection
- **Migration –** instinctive seasonal movements of animals from place to place
  - **Emigration –** movement of individuals from a population; leaving the population
  - **Immigration –** movement of individuals into a population
- **Hibernation –** state of reduced metabolism occurring in animals that sleep during parts of cold winter months; an animal's temperature drops, oxygen consumption decreases, and breathing rate declines
- **Estivation** – state of reduced metabolism that occurs in animals living in conditions of intense heat
- **Mating / Reproduction –** production of offspring for the survival of the species; can be seasonally scheduled

PLANT TROPISM:

Growth responses that result in curvature of plant organs towards or away from stimuli due to different rates of elongation

Geotropism – response to gravity; roots have positive geotropism; stems have negative geotropism

Phototropism – response to light (leaves)

Hydrotropism – response to water (roots)

Thigmotropism – response to touch (venus flytrap)

Chemotropism – response to chemicals

GOAL 5: Develop an understanding of ecological relationships among organisms.

- Interrelationships among Organisms / Populations / Communities / Ecosystems, Techniques of Field Ecology, Abiotic / Biotic Factors, Carrying Capacity
- Flow of Energy and Cycling of Matter in the Ecosystem, Relationship of Carbon Cycle to Photosynthesis and Respiration, Trophic Levels, Direction and Efficiency of Energy Transfer
- Human Population and its Impact on Local Ecosystems and Global Environments, Historic and Potential Changes in Population, Factors associated with Population Change, Climate Change, Resource Use, Sustainable Practices / Stewardship

ENERGY FLOW IN AN ECOSYSTEM

SUN >>>>> GRASS >>>>> MICE >>>>> HAWK

Sunlight is the main energy source for living things. Energy flows through an ecosystem from the sun to organisms within the ecosystem in one direction. Two main groups of organisms in the ecosystem are the producers and consumers.

Producers – autotrophs, use sun's energy to make their own food, plants (grass)

Consumers – heterotrophs, cannot make their own food, eat other living things to get their energy (mice- primary consumers; and hawk- secondary consumer)

STRUCTURE OF AN ECOSYSTEM

Organism >>>>> Species >>>>> Population >>>>> Community >>>>> Ecosystem >>>>> Environment

Species – group of organisms that can interbreed

Population – units of single species

Community – groups of interacting populations

Ecosystem – groups of interacting communities

Habitat – place where an organism lives

Niche – organism's role within its habitat

GROUPS OF ORGANISMS		
Consumer	**Energy Source**	**Example**
Herbivore	Eat plants	Deer
Carnivore	Eat other animals	Lion
Omnivore	Eat plants and animals	Human
Decomposer	Break down dead organisms	Bacteria & Fungi

SYMBIOTIC RELATIONSHIPS:

Symbiosis – permanent, close association between one or more organisms of different species

Mutualism – a symbiotic relationship in which both species benefit (ex: in subtropical regions, ants protect acacia trees by fighting invaders, acacia tree provides nectar to ants)

Commensalism – symbiotic relationship in which one species benefits and the other species is neither harmed nor benefited (ex: Spanish moss grows on and hangs from limbs of trees, but does not obtain any nutrients from tree, nor harm the tree)

Parasitism – symbiotic relationship in which one organism benefits at the expense of another, usually another species (ex: parasites such as bacteria, roundworms, tapeworms live in the intestines of organisms to obtain nutrients and reproduce, but cause disease in the organisms)

FOOD CHAIN:
- Path of energy from producer to consumer
- Each level is called a trophic level (trophic = energy)
- Approximately 10% energy is transferred to next level
- 90% used for personal metabolism and development

FOOD WEB:
- Interconnected food chains
- Shows all possible feeding relationships at each trophic level in a community

ECOLOGICAL PYRAMID:
- Representation of energy transfer
- Pyramid of Energy – each level represents energy available at that level, 90% decline
- Pyramid of Biomass – each level represents amount level above needs to consume
- Pyramid of Numbers – each level represents number of organisms consumed by level above it

SOME EXAMPLES OF ENVIRONMENTAL LIMITING FACTORS

Biotic (living)	Abiotic (nonliving)
Plants	Climate
Animals	Light
Bacteria	Soil
Prey	Water
Food Sources (Nutrients)	Shelter
	Pollution

SPECIES / POPULATION SURVIVAL:
- **Natural Selection –** mechanism for change in populations; occurs when organisms with favorable variations survive, reproduce, and pass their variations to the next generation; "survival of the fittest"
- **Adaptation (Behavioral or Physiological) –** evolution of a structure, behavior, or internal process that enables an organism to respond to environmental factors and live to produce offspring
- **Limiting Factors (Environmental) –** any biotic or abiotic factor that restricts the existence, numbers, reproduction, or distribution of organisms
- **Genetic Mutations –** any change or random error in a DNA sequence (one gene or many; somatic cells or gametes)
- **Biodiversity –** variety of life in an area; usually measured as the number of species that live in an area
- **Evolution (Macroevolution vs. Microevolution) –** gradual change in a species through adaptations over time
- **Endangered Species** – number of individuals in the species falls so low that extinction is possible
- **Extinction** – disappearance of a species when the last of its members die

CHARACTERISTICS OF LIVING THINGS:
- require food for energy to carry out life processes
- use energy to maintain homeostasis
- respond to stimuli in the environment
- grow and develop
- reproduce similar offspring
- pass genetic information to their offspring
- composed of cells
- composed of organic based compounds

ALTERNATION OF GENERATIONS:
- type of life cycle found in some algae, fungi, and all plants where an organism alternates between a haploid (n) gametophyte generation and a diploid (2n) sporophyte generation

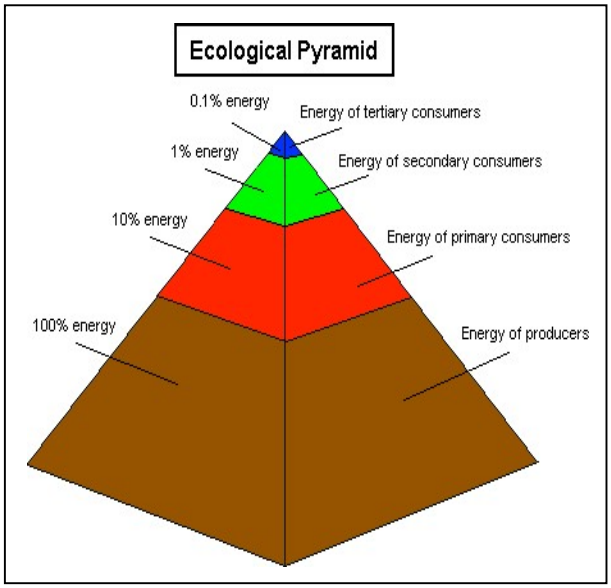
CYCLES:
(Matter cannot be created nor destroyed, but can be converted/recycled to other forms)

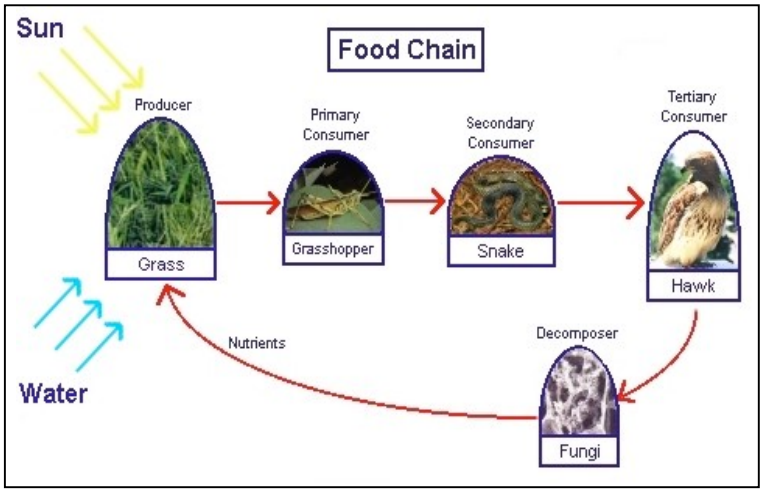
Water Cycle – water is recycled through evaporation, condensation, precipitation, runoff, groundwater, aquifers, respiration, transpiration, excretion, decomposition

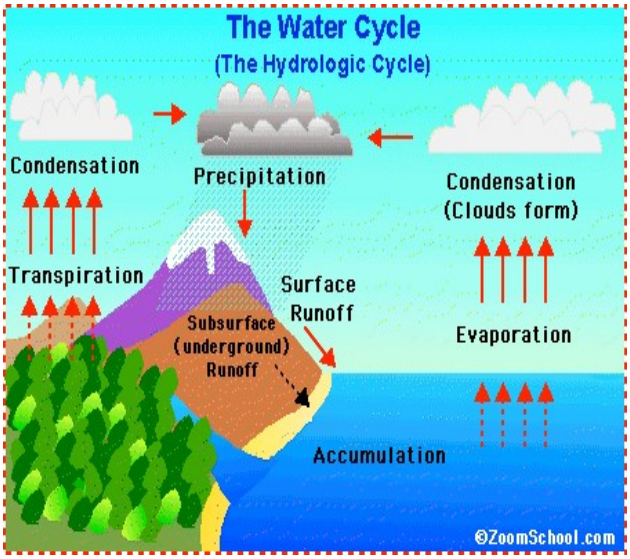
Nitrogen Cycle – producers take in nitrogen compounds in soil and pass to consumers that consume the producers; decomposers (bacteria) break down nitrogen compounds and release nitrogen gas to air or usable nitrogen so the soil

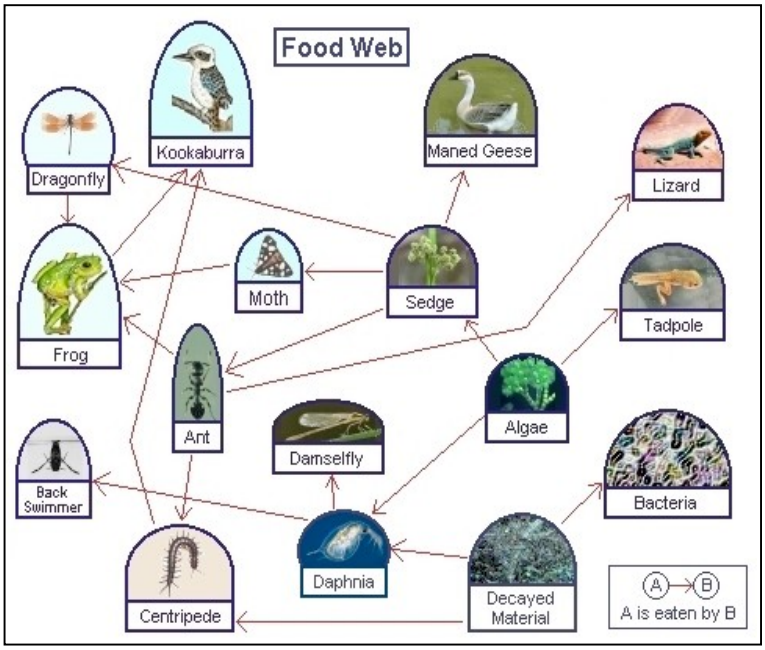
Carbon Cycle – carbon is recycled through respiration, photosynthesis, fuel combustion, decomposition; carbon can be atmospheric or dissolved, or can be found in organic compounds within the body

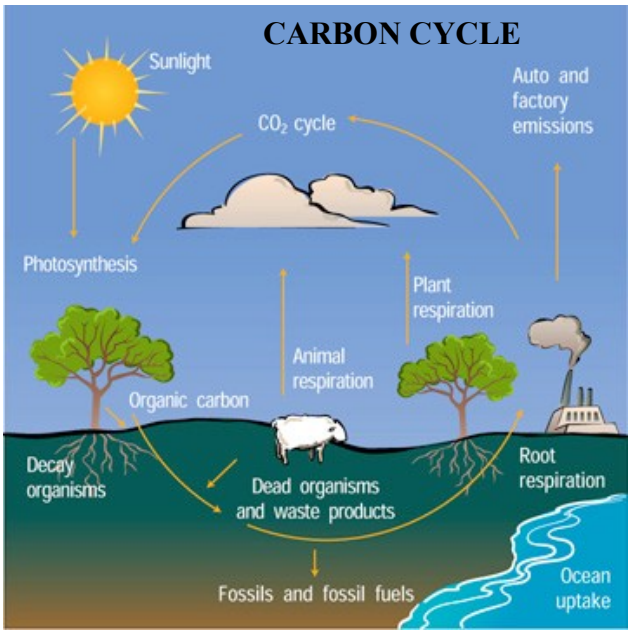
ECOLOGY FIELD STUDY:
- using specific methods and procedures to study plants and animals in their natural setting, and to observe interrelationships of living and non-living factors in a specific habitat
- observations might include: temperature recordings, location, soil description, number and kinds of plants and animals, food source(s), rainfall amount, change in growth, interactions between organisms, identification of organisms into genus and species, temperature variations from morning to afternoon to night, light levels (at different times of day), sound levels (at different times of day), photographs, diagrams of levels (ground level, canopy level, etc.) and the animals and plants at each level, water sampling, quadrant studies, graphs of growth
- field study requires the collection of data and the analysis of data through graphs, charts, diagrams, etc.
- field study also requires the recording of all observations, data, etc. into a legitimate field notebook that would include personal interpretations, photographs, newspaper clippings, etc.

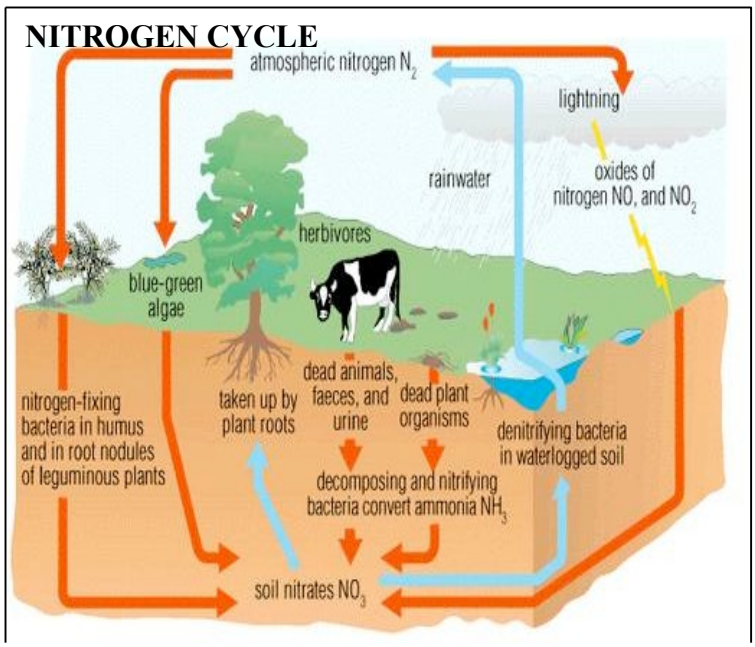

Ecological Pyramid
0.1% energy
Energy of tertiary consumers
1% energy
Energy of secondary consumers
10% energy
Energy of primary consumers
100% energy
Energy of producers


Sun
Food Chain
Producer
Primary Consumer
Secondary Consumer
Tertiary Consumer
Grass
Grasshopper
Snake
Hawk
Nutrients
Decomposer
Fungi
Water


The Water Cycle
(The Hydrologic Cycle)
Condensation
Precipitation
Condensation
(Clouds form)
Transpiration
Surface
Runoff
Subsurface
(underground)
Runoff
Evaporation
Accumulation
©ZoomSchool.com

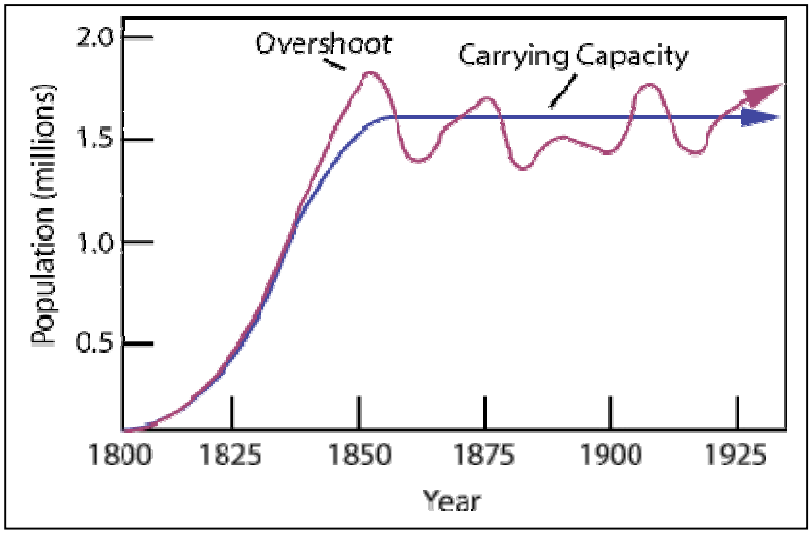

Food Web
Kookaburra
Maned Geese
Dragonfly
Lizard
Moth
Sedge
Frog
Tadpole
Ant
Algae
Damselfly
Back Swimmer
Bacteria
Daphnia
Centripede
Decayed Material
A is eaten by B

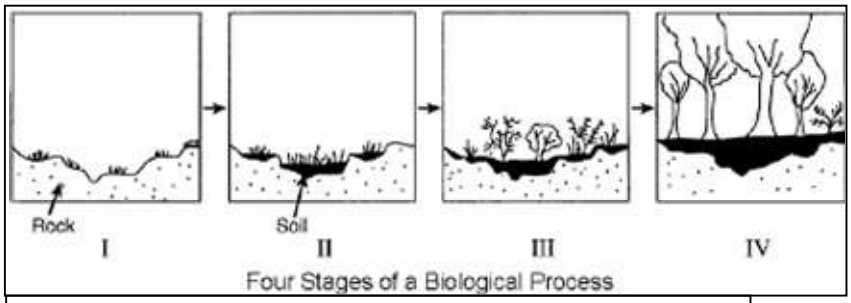

CARBON CYCLE
Sunlight
Auto and factory emissions
CO_2 cycle
Photosynthesis
Plant respiration
Animal respiration
Organic carbon
Decay organisms
Dead organisms and waste products
Root respiration
Fossils and fossil fuels
Ocean uptake


NITROGEN CYCLE
atmospheric nitrogen N_2
lightning
rainwater
oxides of nitrogen NO, and NO_2
herbivores
blue-green algae
nitrogen-fixing bacteria in humus and in root nodules of leguminous plants
taken up by plant roots
dead animals, faeces, and urine
dead plant organisms
denitrifying bacteria in waterlogged soil
decomposing and nitrifying bacteria convert ammonia NH_3
soil nitrates NO_3

FLUCTUATIONS IN CARRYING CAPACITY

TYPES OF ECOSYSTEMS (BIOMES):
AQUATIC: based on flow, depth, temperature, chemistry
TERRESTRIAL: based on geography, rainfall, temperature
Tropical Rain Forest – significant diversity, warm, moist
Savanna – grassland with isolated trees, warm year-round, consistent rainfall, borders deserts
Desert – hot, dry, minimal rainfall, middle latitudes
Temperate Grassland – variety of grasses, cold winters, warm summers, seasonal rainfall, borders savannas
Temperate Forest – deciduous, seasonal growth and weather patterns
Taiga – coniferous, borders tundra
Tundra – cold, frozen
Marine – oceans, saltwater, large diversity
Freshwater – lakes, streams, lower diversity





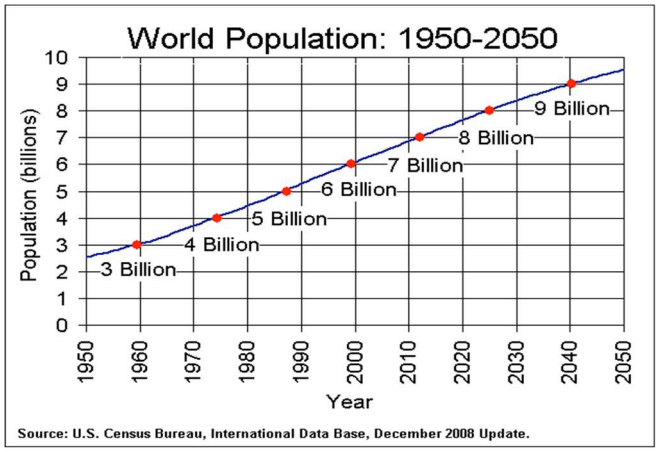
Four Stages of a Biological Process

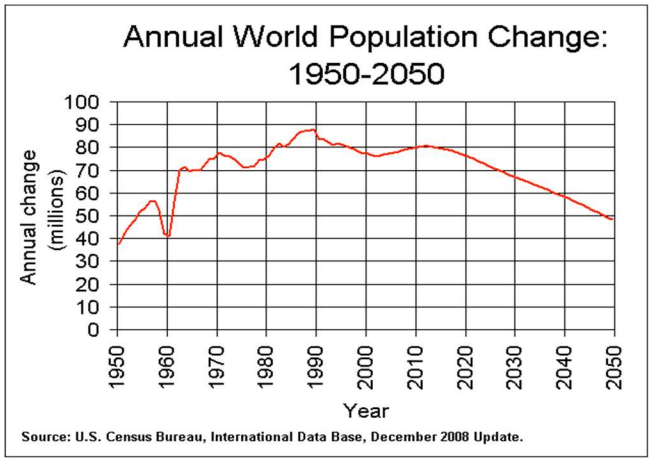
SUCCESSION:
- orderly, natural changes, and species replacements that take place in communities of an ecosystem over time
Primary Succession – colonization of barren land by pioneer organisms (soil must be developed)
Secondary Succession – sequence of changes that take place after a community is disrupted by natural disasters or human actions (soil already present)

IMPACT OF HUMANS ON THE ENVIRONMENT:
- caused extinction of species through hunting, fishing, agriculture, industry, urban development
- growing population = greater demands on environment
- affected quality and quantity of land, air, water resources
- Pollution = pollutants
- Air Pollution = smog, acid rain, dust, smoke, gases, fog, carbon dioxide
- Water Pollution = sewers, industry, farms, homes, chemical waste, fertilizer, dirty dish water
- Land Pollution = landfills, dumpsites, runoff, negligence, urban wastes

CONSERVATION EFFORTS:
- conserve energy resources
- protect and conserve material resources
- control pollution (recapture wastes, carpooling, solid waste neutralization)
- wildlife conservation protect animals from habitat loss, over-hunting, pollution
- reduce, reuse, recycle programs
- sanitation and waste disposal programs

CRITICAL ISSUES:
- Global Warming, Pesticides, Population Growth





FACTORS THAT AFFECT POPULATION CHANGE:
- natural increase of a population depends on the number of births and deaths
- if births outnumber deaths, there will be an increase in population
- growth rate of a population measured in terms of birth rate (number of births per 1000 people per year) and death rate (number of deaths per 1000 people per year)
- fertility rates (number of babies), life expectancy, migration / immigration also contribute to population change
- study of population is called demography; a census is a measure of the population at a particular time

FACTORS THAT AFFECT CLIMATE CHANGE:

- distance from the sea
- ocean currents
- Direction of prevailing winds
- relief (altitude / mountains)
- proximity to the equator
- El Nino phenomenon
- human population growth
- pollution
- industry

FACTORS THAT AFFECT RESOURCE USE AND SUSTAINABILITY:

- population count
- number of producers and consumers
- percapita consumption
- rate of industrial, urban, and infrastructure development
- wealth of country / municipality
- amount of precipitation
- renewable or nonrenewable status
- pollution / degradation of land
- industry, manufacturing, commercialism
- recycling programs
- conservation programs
- substitution programs
-