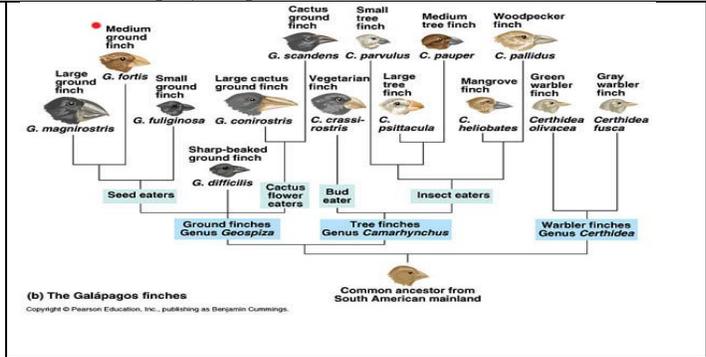


5.2 Describe species as reproductively distinct groups of organisms. Recognize that species are further classified into a hierarchical taxonomic system (kingdom, phylum, class, order, family, genus, species) based on morphological, behavioral, and molecular similarities. Describe the role that geographic isolation can play in speciation.

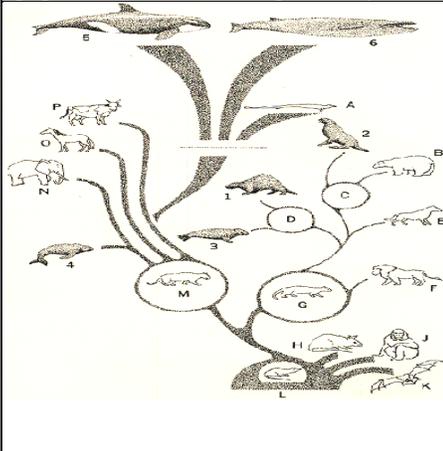
**Species**-interbreeding populations of organisms that can produce fertile, healthy offspring

**Speciation**-the evolution of one or more species from a single ancestor species

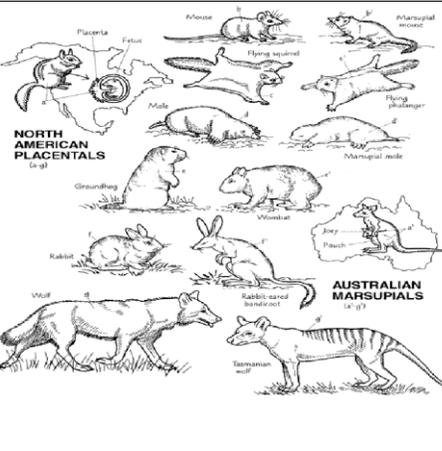
**CoEvolution**-when organisms interact closely adapt with one another



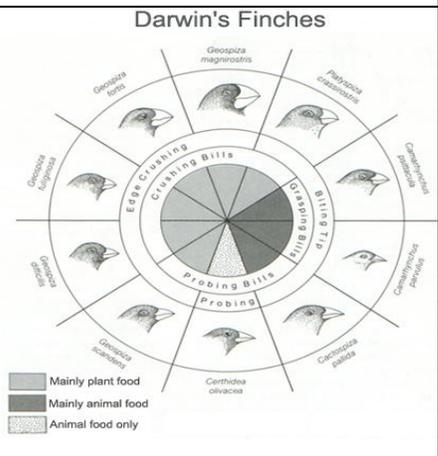
**Divergent Evolution**-when geographic barriers separate members of a population and isolated populations evolve independently



**Convergent Evolution**-when natural selection produces analogous adaptations in response to similar environmental conditions

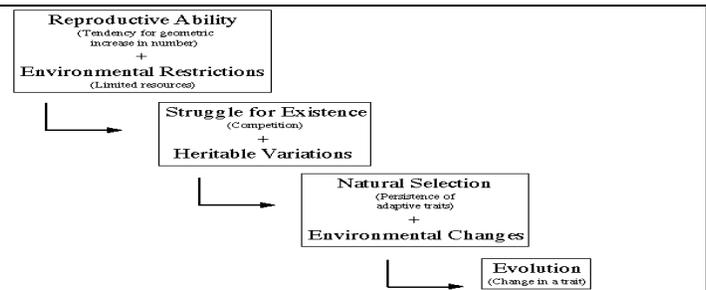


**Adaptive Radiation**-the evolution of many diversely adapted species from a common ancestor.



5.3 Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity from a population.

**Natural Selection**-the process by which populations change in response to their environments. This change happens through inherited traits that increase a population's chances of survival and reproduction called adaptations (anatomical structure, physiological process, or behavioral trait).



**6. Ecology**

**Broad Concept:** Ecology is the interaction among organisms and between organisms and their environment.

6.1 Explain how birth, death, immigration, and emigration influence population size.

**Population Size**- the total number of individuals in a population. The population size can affect a population's ability to survive. The smaller the population the more prone it is to extinction.

**Population Density**- the number of individuals in a given area. Population densities can impact reproduction, spread of disease, availability of resources, etc.

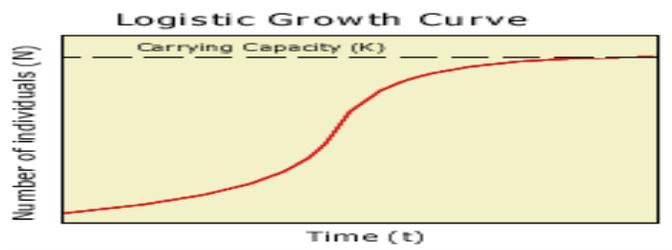
**Dispersion**-the way that a population is arranged in a space. Dispersion is determined by the interactions of a population and its environment

**Population Models**-In general populations grow when birth rates exceed death rates, populations decline when death rates exceed birth rates, and remain stable when birth and death rates are even.

**Exponential Growth Curve**-population growth curve in which the rate of population growth stays the same. Exponential growth curves are J-shaped and occur when there are no **Limiting Factors**.

**Logistic Growth Model**-population growth curve in which the rate of exponential population growth is limited by **Density-Dependent Limiting Factors**. In this model birth and death rates will vary with population size and stabilize at an ecosystem's **Carrying Capacity** (the population size that an environment can sustain).

Figure 35.3A Exponential growth of bacteria



Copyright © The Benjamin Cummings Publishing Co., Inc., from Campbell, Mitchell, Reece *Biology: Concepts and Connections*.

6.2 Analyze changes in population size and biodiversity (speciation and extinction) that result from the following: natural causes, changes in climate, human activity, and the introduction of invasive, non-native species.

**Factors that affect population size**

**Density Dependent Limiting Factors**-limited resources whose rates of depletion depend upon the density of the population using them. ie: resources such as food & water, diseases, or predator-prey relationships.

**Density Independent Limiting Factors**-non-density dependent factors that affect the growth of populations. ie: weather, seasonal cycles, natural disasters, human activity “Bad Luck”

**Reproductive Strategies**

**r-Strategists**-species characterized by rapid growth, high fertility, short lifespan, and exponential population growth. R-strategists typically live in unstable environments.

**K-Strategists**-species characterized by slow maturation, few young, slow population growth, and reproduction late in life. K-strategists typically have small population sizes that hover near the carrying capacity. Many endangered species are K-strategists.

6.3 Use a food web to identify and distinguish producers, consumers, and decomposers, and explain the transfer of energy through trophic levels. Describe how relationships among organisms (predation, parasitism, competition, commensalism, and mutualism) add to the complexity of biological communities.

**Ecosystem**-the combination of all of the communities (biotic features) and all of the abiotic factors in an environment.

**Biotic Factors**-the living organisms in a habitat (ie: plants, animals, fungi, protists, and bacteria (think of the 6 Kingdoms of life).

**Abiotic Factors**-the physical aspects of a habitat: soil, water, air, weather, and fire. Abiotic factors are non-living parameters that impact an ecosystem

**Population**-a group of organisms of the same species living in a specific area.

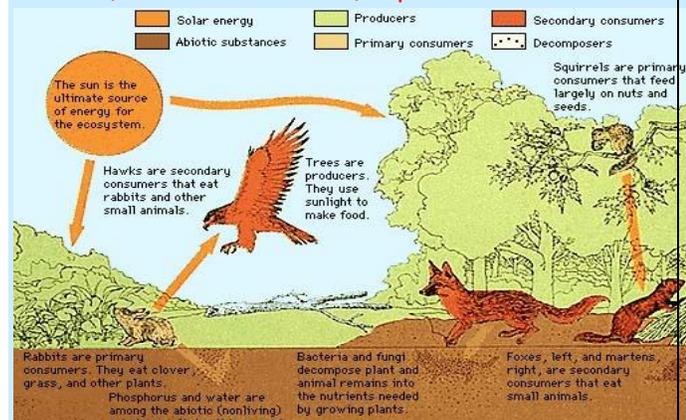
**Community**-a collection of interacting populations within a given ecosystem. Organisms within a community depend upon each other for survival.

**Biodiversity**-the number of species living within an ecosystem. Biodiversity is typically viewed from the perspective of the degree of species variety and balance within an ecosystem.

**Habitat**-the type of environment where a particular population of a species lives.

**Niche**-the functional role of a particular species in an ecosystem. A niche is the pattern of living of an organism; how an organism lives, the “job” it performs in an ecosystem.

**Ecosystem**-a community (biotic features) and all of the abiotic (soil, water, weather) aspects of its habitat.



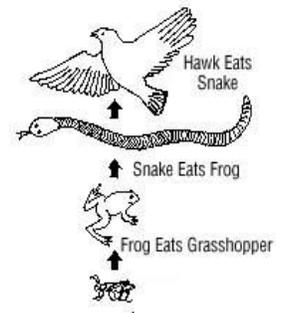
A **Food Chain** models the flow of energy through organisms in a community along a linear pathway. Organisms within a food chain are assigned to different levels within a food chain known as **Trophic Levels**. **Trophic Levels** consist of groups of organisms that have the same source of energy (a step in a food chain). The term trophic comes from the Greek “trophos” meaning food/to feed.

**Symbiosis**-an ecological interaction in which two or more species live together in a close long-term association. The three types of symbiotic relationships are mutualism, commensalism, and parasitism.

**Mutualism**-an ecological interaction in which both partners benefit.

**Commensalism**-an ecological interaction in which one species benefits and the other species is neither harmed nor helped.

**Parasitism**-an ecological interaction in which one species feeds on, but does not kill its host

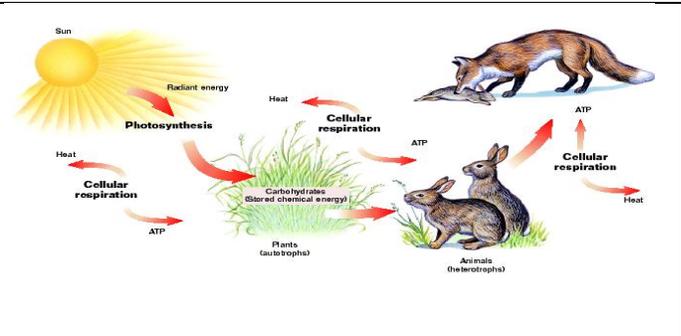


A **Food Web** is a network of interconnected food chains in an ecosystem.

**Autotrophs**-organisms that use energy from sunlight or inorganic substances to make organic compounds via the process of **photosynthesis** or **chemosynthesis**. The foods made are primarily carbohydrates such as glucose.

**Producer**-autotrophs that provide food for a community.

**Heterotrophs/Consumers**-organisms that cannot make their own food and therefore must obtain energy from outside food sources. Heterotrophs use this food to make ATP during **cellular respiration**.



**Primary Consumers**-organisms that feed directly on producers

**Herbivore**-a primary consumer that eats only plants.

**Secondary/Tertiary/Quaternary Consumers**-organisms that feed on organism below them in a food chain.

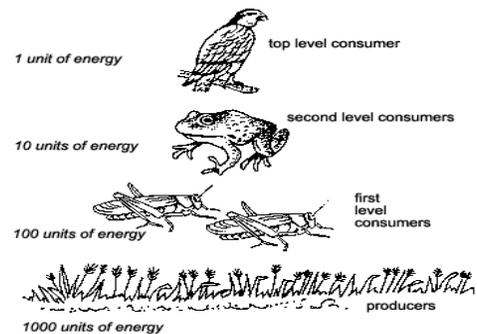
**Carnivore**-organisms that eat only meat

**Omnivore**-organisms that eat both producers and other consumers

**Scavenger**-organisms that feed on the tissue of dead animals

**Detritivore/Decomposer**-organisms that feed on wastes and dead organic matter from all trophic levels

An **Energy/Ecological** pyramid shows the relationship between producers and consumers at the trophic levels in an ecosystem. Each trophic level contains only 10% of energy available in the trophic level below.



6.4 Explain how water, carbon, and nitrogen cycle between abiotic resources and organic matter in an ecosystem and how oxygen cycles through photosynthesis and respiration.

**Water Cycle**-the continual movement of water from Earth’s surface to the atmosphere and back to the surface again. The water cycle is powered by energy from the sun. Major steps include:

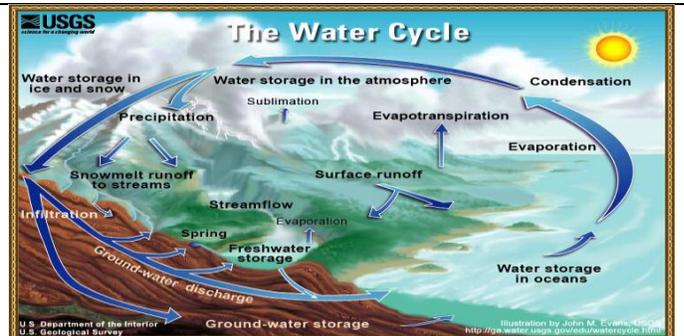
**Evapotranspiration**-the process of transferring moisture from the earth to the atmosphere by evaporation of water and transpiration from plants.

**Condensation**-the process by which atmospheric water vapor liquefies to form fog, clouds, or the like, or solidifies to form snow or hail.

**Precipitation**-falling products of condensation in the atmosphere, as rain, snow, or hail.

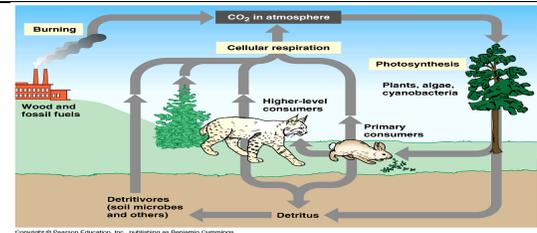
**Runoff**-Rainfall not absorbed by soil

**Infiltration/Percolation**-the slow movement of water through the pores in soil or permeable rock.



**Carbon Cycle**-the movement of carbon through the non-living environment and living organisms. The carbon cycle is driven by photosynthesis and cellular respiration. Carbon is returned to the atmosphere via the processes of respiration, combustion, and erosion. Photosynthesis results in the storage of carbon (carbon sequestration). Consider Sources vs. Sinks in the Carbon Cycle.

**Carbon Sequestration** (the storage of carbon) is accomplished by storing carbon in carbon sinks such as trees or underground geologic formations.



**Nitrogen Cycle**-the atmosphere is 79% nitrogen gas, but most organisms are unable to use it in this form because the two nitrogen atoms in this gas are connected by a strong triple covalent bond that is very difficult to break. Some bacteria that live in soil and plants have enzymes that enable them to break N<sub>2</sub> and bind it with ammonia to form NH<sub>3</sub>. This process is nitrogen fixation. The stages of the nitrogen cycle are:

1. **Assimilation**-absorption and assimilation of N by organisms.
2. **Ammonification**-production of ammonia by bacteria during decay of urea from urine and feces.
3. **Nitrification**-production of nitrate from urea
4. **Denitrification**-conversion of nitrate (NO<sub>3</sub>) to nitrogen gas (N<sub>2</sub>)

**Legumes such as pea plants have the ability to fix nitrogen.**

