UNIT 5: ECOLOGY

Chapter 13: The Principles of Ecology

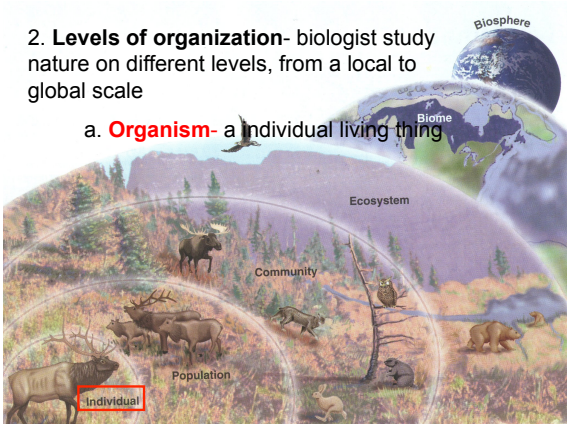
I. Ecologists Study Relationships (13.1)

A. Ecologists study environments at different levels of organization

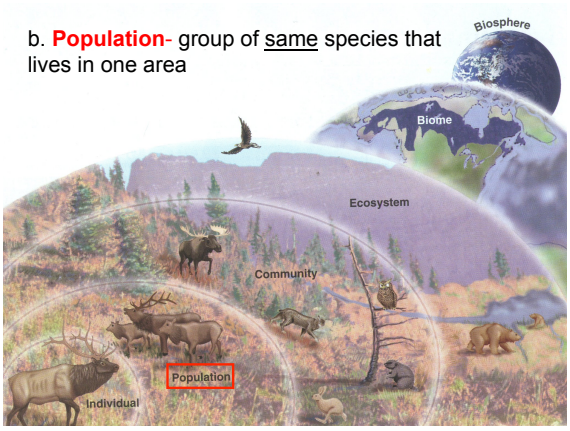
1. **Ecology**- study of the interactions among living things and their surrounding. Name comes from Greek work "*oikos*"- meaning "*house*".

2. **Levels of organization**- biologist study nature on different levels, from a local to global scale

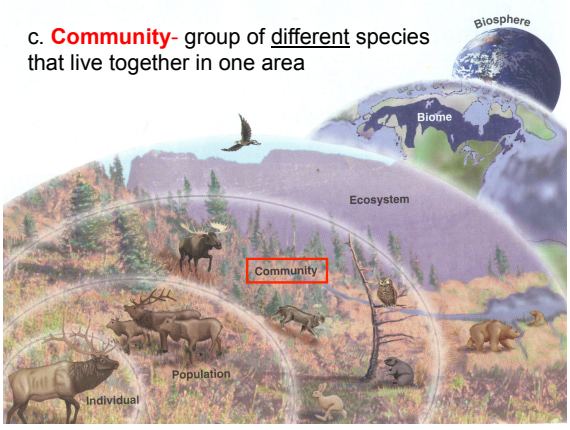
a. **Organism**- a individual living thing



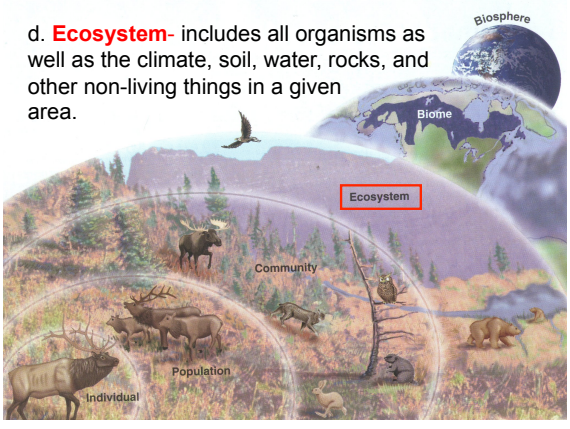
b. **Population**- group of <u>same</u> species that lives in one area



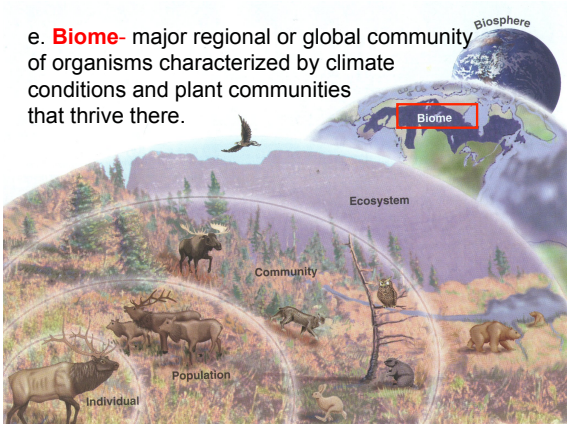
c. **Community**- group of <u>different</u> species that live together in one area



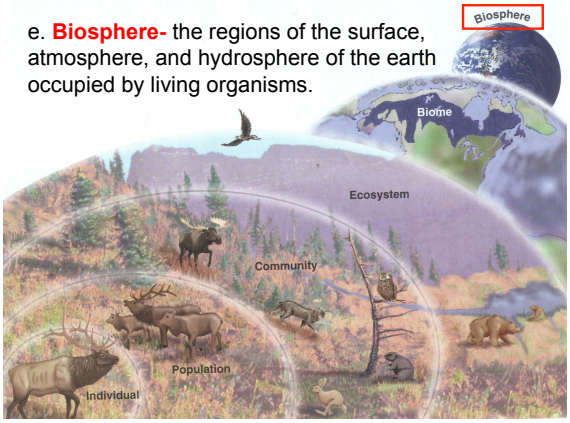
d. **Ecosystem**- includes all organisms as well as the climate, soil, water, rocks, and other non-living things in a given area.



e. **Biome**- major regional or global community of organisms characterized by climate conditions and plant communities that thrive there.



e. **Biosphere-** the regions of the surface, atmosphere, and hydrosphere of the earth occupied by living organisms.



B. Ecological research methods include observations, experimentation, and modeling

1. **Observation**- the act of carefully watching something over time.

a. May be <u>long</u> term or <u>short</u> term studies

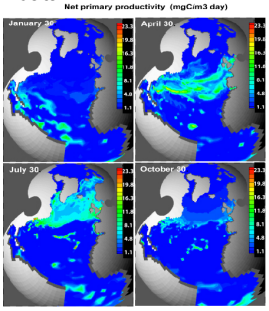
b. **Surveys** are used to monitor and observe populations

2. **Experimentation**- may perform experiments in the lab or in the field

a. **lab experiments** give researcher more control, but artificial setting does not reflect complex interactions that occur in nature.

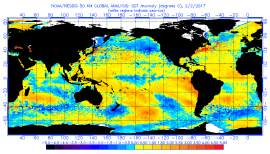
b. **field experiments** gives more accurate picture but is more difficult because of numerous factors at work in nature.

c. **Modeling**- use of computer or mathematical models to describe and model nature based on real data.



1). Can see how one variable affects another

2). Can create **virtual ecosystem**



II. Biotic and Abiotic Factors (13.2)

A. An ecosystem includes both biotic and abiotic factors

1. **Biotic**- includes living things

2. **Abiotic**- includes nonliving things such as moisture, temperature, wind, sunlight, and soil



B. Changing one factor in an ecosystem can affect many other factors

1. **Biodiversity**- the assortment, or variety, of living things in an ecosystem

a. amount depends on many factors

b. **tropical rainforests** have large biodiversity

2. **Keystone species**- a species that has an unusually large effect on its ecosystem

a. loss of this species may cause **ripple effect** felt across entire ecosystem

b. Example- **beaver** changes habitat for many other species by creating ponds

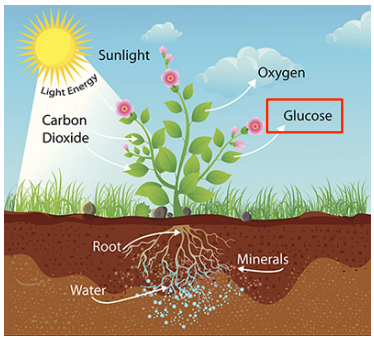
III. Energy in Ecosystems (13.3)

A. Producers provide energy for other organisms in an ecosystem

1. **Producer** (**autotroph**)- get their energy from nonliving resources (make their own food)

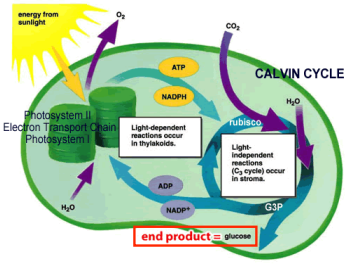
2. **Consumer** (**heterotroph**)- get their energy by eating other living things such as plants and animals

B. Almost all producers obtain **energy** from **sunlight**

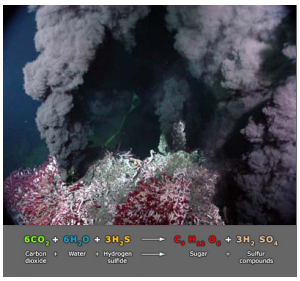


1. Most producers on Earth use **sunlight** as energy source using **photosynthesis**.

2. photosynthesis converts light energy (**sunlight**) into chemical energy (**carbohydrates**)



C. **Chemosynthesis**- organisms make carbohydrates using **chemicals** instead of sunlight



1. Found in **deep-sea thermal vents** and sulfur-rich marsh flats and hydrothermal pools

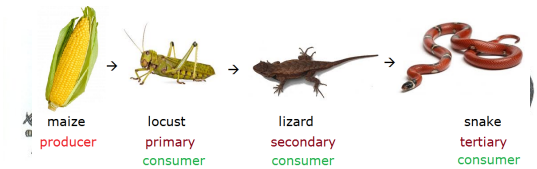
2. can be basis for thriving ecosystems

IV. Food Chains and Food Webs (13.4)

A. **Food chain**- sequence that links species by their feeding relationships.

1. only follows connections between one producer and single chain of consumers

2. simplest way to look at energy flow in an ecosystem



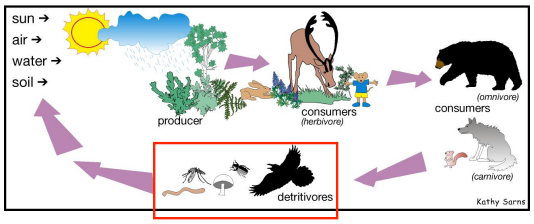
B. Types of consumers

1. **Herbivores**- eat only plants

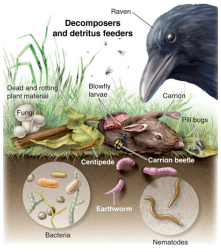
2. **Carnivores**- eat only animals

3. **Omnivores**- eat both plant and animals

4. **Detritivores**- organisms that eat detritus (dead organic matter)



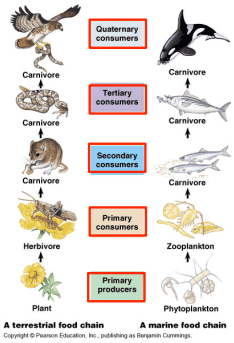
5. **Decomposers**- break down organic matter into simpler compounds



a. Fungi and **bacteria**
b. Important to stability of ecosystem by returning nutrients back into the environment

6. Organism may focus on single organism to feed (**specialist**), or have varying diet (**generalist**)

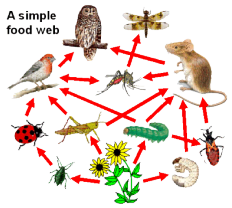
C. **Trophic levels**- level in a food chain (arrows show flow of energy)

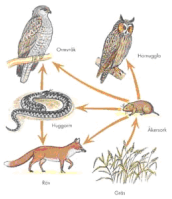


1. **Producers** always first level
2. **Primary consumers** next level (**herbivore**)
3. **Secondary consumer** eat herbivores (**carnivore**)
4. **Tertiary consumer** carnivores that eat secondary consumers.

D. A **food web** shows a complex network of feeding relationships

1. **Food web**- organism may have multiple feeding relationships.
2. Stability of food web depends on presence of **producers** (forms base of food web)

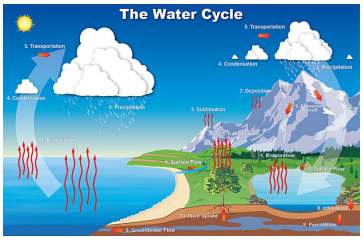




V. Cycling of Matter (13.5)

A. Water cycles through the environment

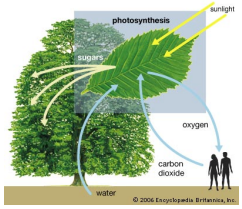
1. **Hydrologic cycle** (**water cycle**)- circular pathway of water on Earth



2. Flows from atmosphere to the surface, below ground and back and involves humans and other organisms.

B. Elements essential for life also cycle through ecosystems

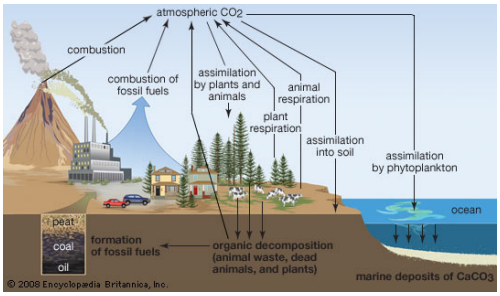
1. **biogeochemical cycles**- movement of a particular chemical through biological and geological parts of an ecosystem



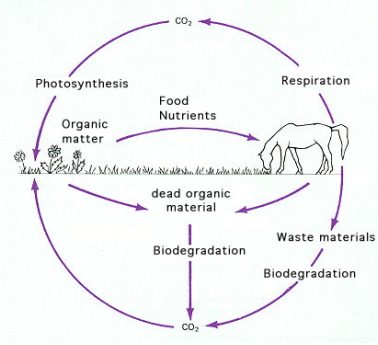
a. **Oxygen cycle**- cycle of photosynthesis and cellular respiration

b. **Carbon cycle**-flow of carbon through environment

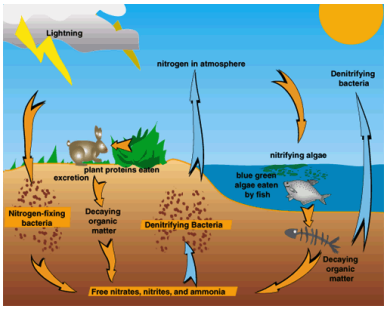
1). **Carbon** essential for organic compounds (carbohydrates, proteins, fats, etc.)



2). Simplest transfer occurs between plants and animals (**photosynthesis** and **cellular respiration**)

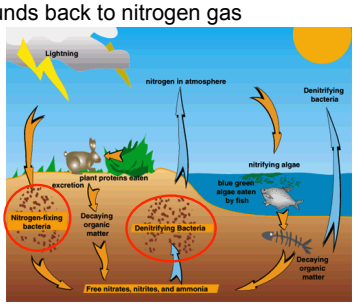


c. **Nitrogen cycle**- conversion of nitrogen gas in atmosphere into compounds that living things can utilize

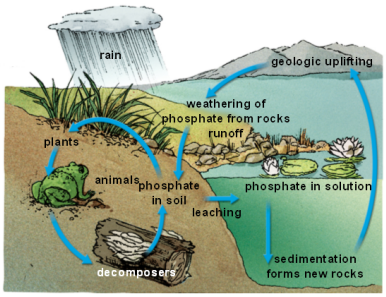


1). **Nitrogen fixation**- converting gaseous nitrogen into ammonia (NH3) (used by certain bacteria)

2). **Denitrifying bacteria**- convert nitrogen compounds back to nitrogen gas

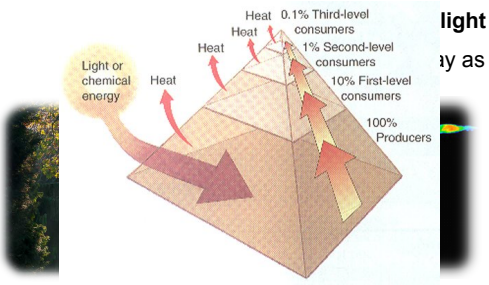


d. **Phosphorus cycle**- returns phosphorus to environment (phosphorus is **limiting factor** for plant growth)



VI. Pyramid Models (13.6)

A. An **energy pyramid** shows the distribution of energy among trophic levels



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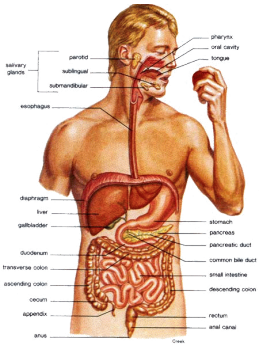
B. Loss of available energy



1. energy used for many purposes such as **movement** and **growth**.

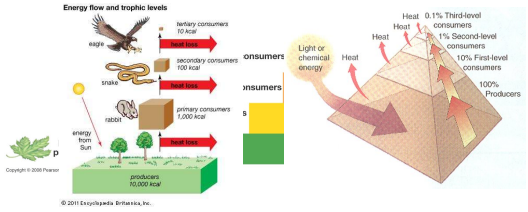
2. Your body very **inefficient** at converting food into useful energy

3. Unused material excreted as **waste**

4. **Biomass**- measure of total dry mass of organisms in given area

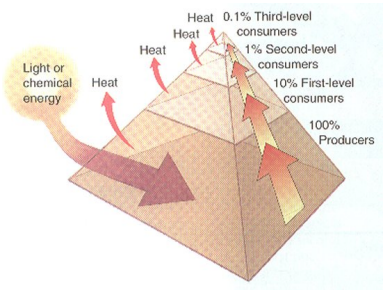
a. When consumer eats producer a great deal of energy lost in process as **heat** and **waste**

b. **Only 10% of energy is transferred at each trophic level**



C. **Energy Pyramid-** diagram that compares energy used by each trophic level

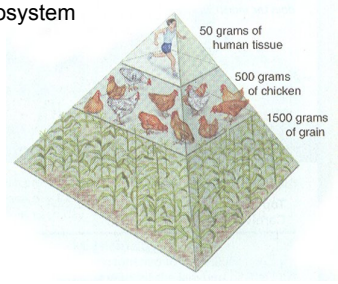
1. Base made up of **producers**



2. Energy lost to each succeeding trophic level

D. Other pyramid models illustrate an ecosystem's biomass and distribution of organisms

1. **Biomass pyramid**- diagram comparing biomass of different trophic levels within an ecosystem



2. **Pyramid of Numbers**- shows the <u>numbers</u> of individual organisms

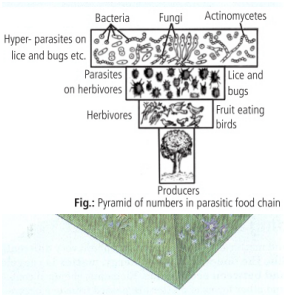


Fig.: Pyramid of numbers in parasitic food chain

3. Both types of pyramids may occur in an **inverted**, or upside down, formation (E.g. pyramid of numbers based on single tree