Unit 1
Life Science: Sustainablility of Ecosystems

Paradigm

- an example or pattern
- a model, ideal or standard
- a philosophical framework or school of thought

e.g. Flat Earth paradigm

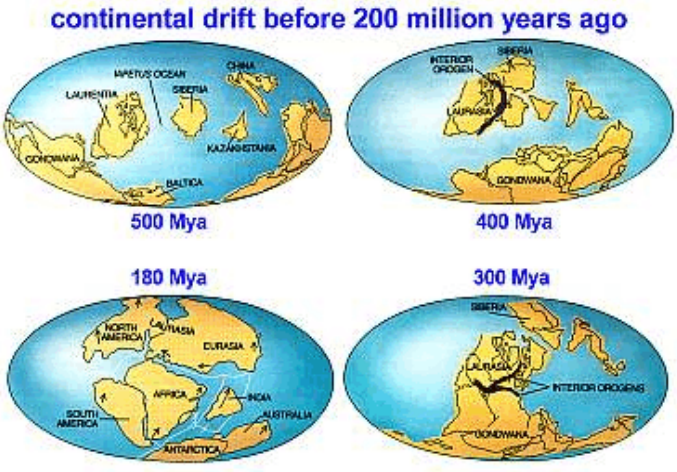
Paradigm shift

- rare and significant changes in the way humans view the world

Paradigm shifts are major changes in the way people view an issue

- usually controversial when first proposed
- gradually comes to be accepted as a major advancement in scientific knowledge and understanding (e.g., continental drift)

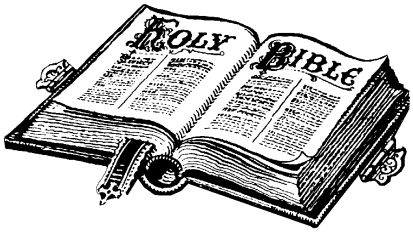
Continental Drift



Some Paradigms

concerning the Environment:

1. **Man has Dominion** – the environment is there for man's use



Genesis 1:28 "And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth."

2. **Unlimited Resource** – the resources of the environment are unlimited: they will never run out

3. **One with Nature** – Man is a part of the environment; the creatures are our brothers. (Native American view)

4. **Extreme environmentalism** – The environment must be protected at all cost

5. **Sustainable Development** – the environment must be developed to meet our present needs, ensuring that the needs of future generations can also be met.

Sustainable System

- a sustainable system is one that survives and functions over time. (Pg.87)

Examples of Sustainable development (see ppt on Forestry/Fisheries)

Understanding Sustainability:

Terms:

ecology - the study of the relationship between organisms and their environment

ecosystem

- a unit of the biosphere in which matter nd energy are transferred as organisms interact with their environment

An ecosystem is made up of two features:

Biotic

- living, or recently living part of the environment
- includes predators, plants, microorganisms, decaying material, etc.

Abiotic

- non-living components of the ecosystem
- include rocks, soil (partly), heat, light, water, rain, weather, etc.

Types of Biotic Interactions:

1. Feeding relationships - All organisms are either:

A. **Autotrophs** – Producers: can produce their own food. (plants, algae)

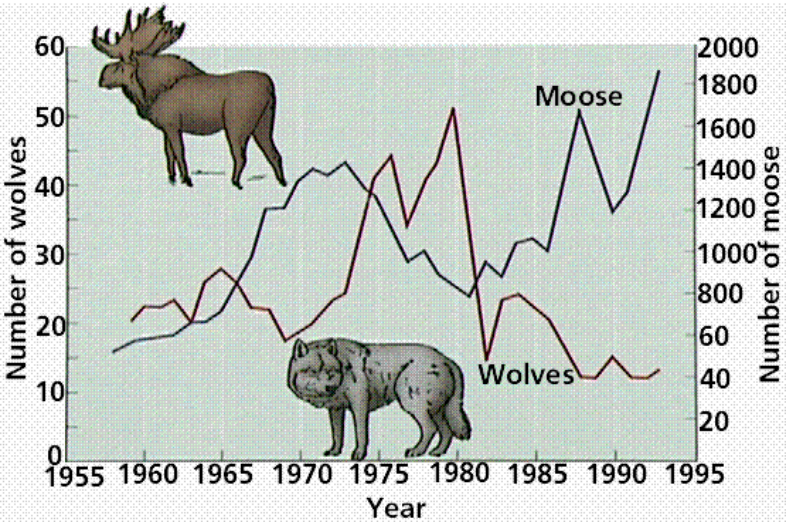
or: B. **Heterotrophs** – Consumers: obtain food from other organisms. Include
- herbivores (plant eaters)
- carnivores (meat eaters)
- omnivores (eat both plants and animals)

Consumers can be also be classified as **predators** (hunt or trap their prey for food), **scavengers** (feed on dead plants/animals), **parasites** (live in or on a host organism), **saprobes** – bacteria and fungi

decomposers - consume dead organisms or the wastes of organisms
- release nutrients that were tied up in living tissue; becomes available again to producers

Feeding relationships affect the size of a population. For example

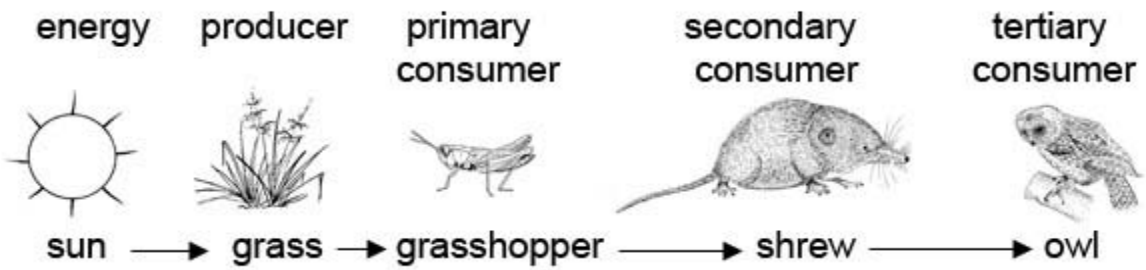
Predator- prey relationships – each helps to keep the population of the other in check.



Feeding Relationships are represented in
food chains and food webs
- show the flow of food energy from organism to organism

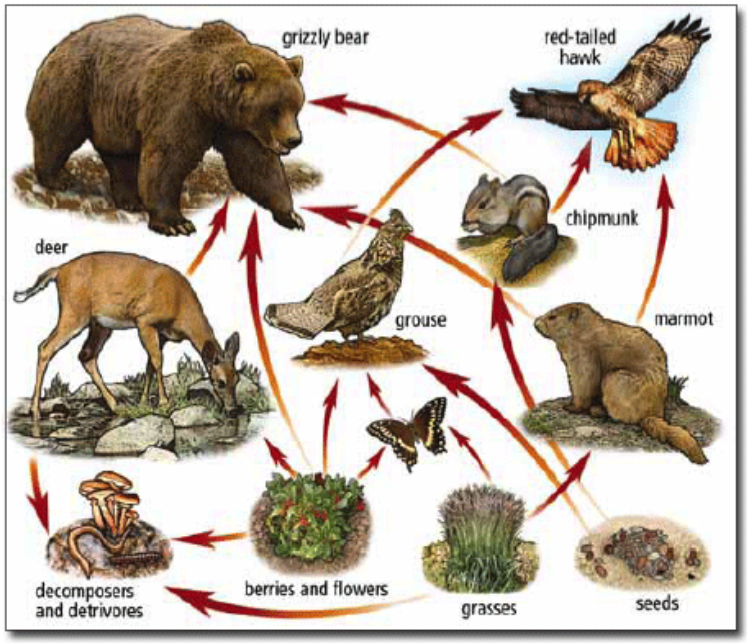
Food Chain:
Each link is called a **trophic level**

1st Trophic Level: Producer
2nd Trophic level: Primary Consumer
3rd Trophic level: Secondary Consumer
4th Trophic level: Tertiary Consumer



***Note: Arrows point in the direction of energy flow

Food web – many interconnected food chains

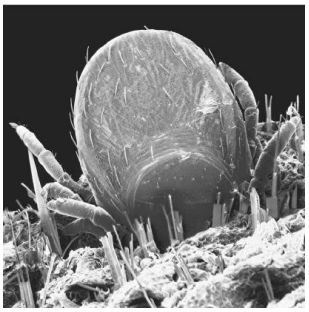


Biotic Interactions: (continued)

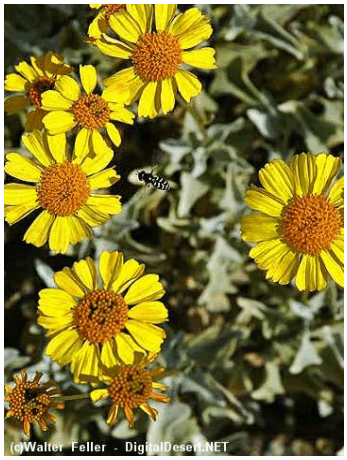
2. Symbiotic Relationships - two different organisms live in close association, to the benefit of one of them:

- **commensalism** - only one organism benefits (e.g. barnacles on whales) but the other does not benefit and is not hurt

- **parasitism** - one benefits, the other is harmed (e.g., tapeworm in a cow)



- **mutualism** - both organisms benefit from the relationship
eg. lichen – made up of an alga and a fungus
legumes with nitrogen- fixing bacteria in their root nodules



Biotic Interactions: (continued)

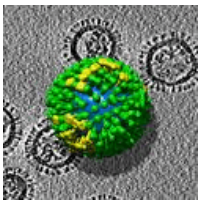
3. Competition - the struggle for resources which occurs among organisms in a particular habitat

a. Interspecific competition
- competition between members of different species

b. Intraspecific competition
- competition between members of the same species

4. Disease - bacterial or viral infection which is to the advantage of the infecting organism, but to the disadvantage of the host

bacteria 

flu virus 

Abiotic Factors – non-living components that affect biotic components. Most organisms are adapted to survive in a narrow range of abiotic conditions.

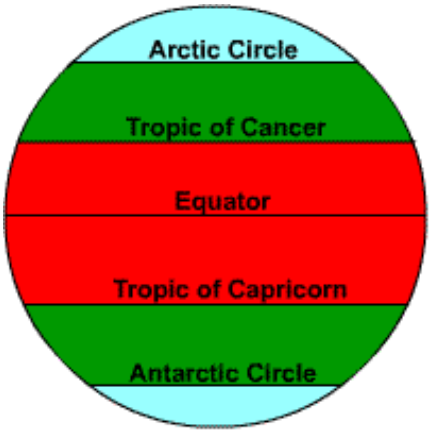
Types of abiotic factors:

1. **availability of water**
- determines the type of vegetation present in a region (eg. desert, tundra, taiga, rain forest)
- needed by plants for photosynthesis
- makes up a large % of cells of plants/animals
  - availability of water in an area is determined by rainfall/climate

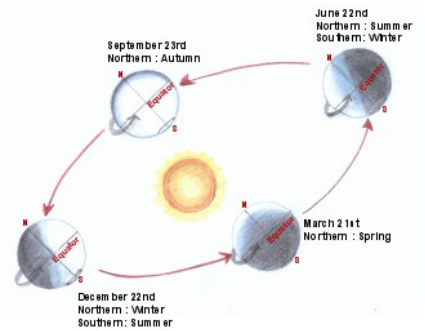
2. **temperature**
- varies with seasons, latitude, altitude, time of day, etc.
- affects the rate of metabolism (chemical reactions) in cells (eg. Warm-blooded vs cold-blooded animals)

Temperature

latitude: north and south of the equator are increasingly cooler regions



seasons: sunlight always hits the equator directly. Other regions receive light at an angle, depending on the time of year. This creates seasons

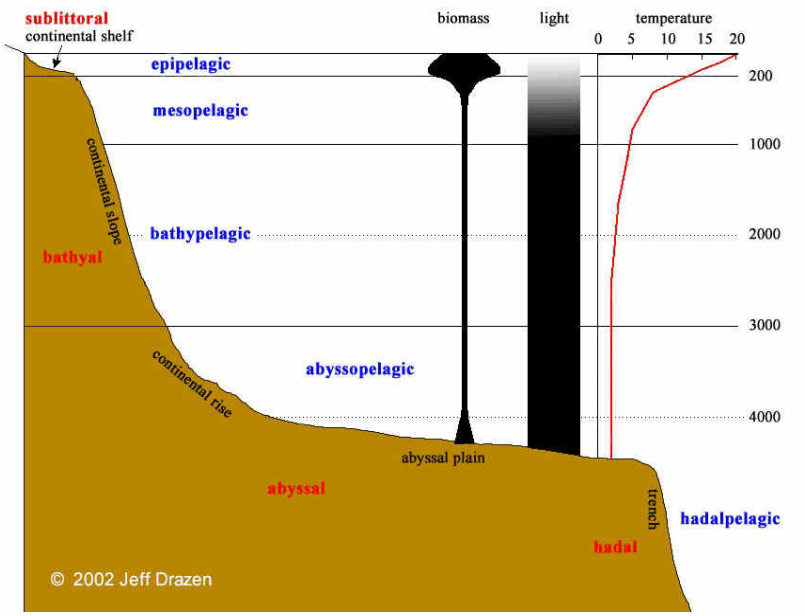


altitude: Temperature decreases as altitude increases

3. <u>amount of light</u>

- varies with height above ground (eg. Forests) or depth below sea level
- also varies seasonally
- needed by plants for photosynthesis
- needed for vision

Ocean underwater zones



4. availability of organic and inorganic nutrients

- erosion and weathering affect the amount of inorganic material available as nutrients to the ecosystem (eg. minerals)
- decomposition of organic materials provides organic nutrients to the ecosystem

5. composition of the soil

- this will affect what types of plant life will grow from that soil.

- soil pH: acidic soil will support certain types of plants (e.g., spruce trees), while basic soil supports other types (e.g., grass).

6. **Levels of O_2 and CO_2**

- Oxygen: needed by all organisms for cell respiration
- Carbon dioxide: needed by plants for photosynthesis

- oxygen makes up approximately 21% of the atmosphere.
- dissolved oxygen in water – affected by water temperature

When oxygen levels are very low, only anaerobic organisms can survive (eg. certain bacteria)

Higher than "normal" carbon dioxide levels can increase the rate of plant growth, but will also contribute to global warming.