ECOSYSTEMS

What are Ecosystems?

A. Ecosystems are the system formed by the interaction of biotic and abiotic factors in a specified area.

1. Understanding the interaction of the biotic and abiotic factors in an ecosystem can help us to see why particular human activities may be a problem for human survival.

2. Example: The loss of ozone in the stratosphere increases the quantity of UV radiation on the surface of the planet. In the same way that humans experience sunburn from too much sun exposure, so do plants. Excessive UV may damage or destroy plant protein and DNA, killing the plant.

B. Plants and animals interact with their abiotic environment. Attempts are made by the plant or animal to reduce or increase the quantity of an abiotic factor.

1. Aspens have a waxy coating on their bark to reduce the quantity of sunlight absorbed.

2. Desert plants have hair-like structures to reduce the quantity of sunlight reaching the leaf surface.

3. Pine trees have needle-like leaves that reduce the quantity of heat lost during the winter.

II. The Structure of Ecosystems.

An ecosystem may be described in various ways. Structurally it is broadly divided into two components:

1. Abiotic or non-living components and
2. Biotic or living components

Abiotic components of an Ecosystem some of the abiotic components of an ecosystem are

1. Light Intensity: south-facing versus north-facing hillside.

2. Soil Type

a. pH

b. Salinity

c. Sand, clay, silt

3. Topography

4. Microclimate and Other Abiotic Factors

Abiotic components of an ecosystem are either inorganic substances or organic substances. Inorganic substances like carbon, oxygen, nitrogen etc. are present in the physical environment of the ecosystem. Organic substances are formed by the decomposition of the plant and animals.

Biotic Components of an Ecosystem are of three types

a. Producers are autotrophic in nature, they create organic molecules proteins, lipids and carbohydrates- by capturing light energy and combining the captured energy with inorganic molecules. Eg. Green plants.

b. Consumers are also known as heterotrophs as they feed on producers and would not exist without producers.

·Primary consumers (herbivores)

·Secondary consumers (carnivores)

·Omnivores are both herbivorous and carnivorous.

c. Detritus feeders and decomposers

· Detritus feeders can be primary (feed directly on detritus) or secondary (feed on those who eat detritus). Generally detritus feeders can be described as those who consume dead plants and animals, feces, etc.

·Decomposers are primary detritus feeders.

2. Trophic Relationships:

a. Food chains: feeding pathways

·Food chains are a description of who eats whom.

·Predator-prey and host-parasite describe specific feeding relationships.

b. Food webs: complexes of feeding relationships.

c. Trophic Levels or Feeding Levels

·All producers belong to the first trophic level.

·All herbivores (primary consumers) are on the second trophic level.

·All primary carnivores (secondary consumers) are on the third trophic level.

Ecological Pyramid graphical representation of various feeding relationship of any ecosystem are known as ecological pyramid.

When we represent the number, biomass and energy of any food chain graphically, they take shape of a pyramid which is known as ecological pyramid

a. All organic matter can be defined as **biomass.**

b. All biomass can be arranged into a feeding relationship with the producers on the first trophic level.

FUNCTIONS OF AN ECOSYSTEM

A. First Law of Thermodynamics: "Energy is neither created nor destroyed; it only changes form." It can be related to: "You can't get something for nothing" or "There is no such thing as a free lunch".

B. Second Law of Thermodynamics: "Systems will go spontaneously in one direction only toward increasing entropy." It can be described as:" It takes energy to get energy" or "In any energy conversion, you will end up with less usable energy than you started with" or "If you think things are confused now, just wait" or"Everything moves in the direction of increasing disorder".

On average, **10%** of the energy from one trophic level moves to the next trophic level. (This is due partly to the First and Second Laws of thermodynamics.) At each trophic level most of the organisms are not consumed, portions of

organisms consumed pass through the consumer undigested, and energy is released to the environment as high potential energy is converted to low potential energy.

d. Because so little energy can be transferred between trophic levels, it is necessary that the first trophic level contain the greatest number of organisms, and the subsequent trophic levels contain fewer and fewer organisms. Limitations on the transfer of energy between trophic levels creates the biomass pyramid.

e. If organisms (humans) eat high on the biomass pyramid (trophic levels 3, 4, 5, etc.), then fewer organisms can be supported than if organisms eat lower on the biomass pyramid.

B. Nonfeeding Relationships

1. Mutually Supportive Relationships: mutualism.

2. Competitive Relationships

a. How are competitive relationships reduced?

·Habitat

·Niche: resource partitioning

b. What happens when competition is not reduced?

Competitive exclusion principle

c. Abiotic factors.

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D. Law of Limiting Factors - Quantities of any single factor above or below optimum levels necessary for organism growth, reproduction, or survival will limit growth, reproduction, or survival.

1. Synergistic effects: The interaction of two or more factors cause an effect greater than the sum of effects produced when each factor acts alone.

III.. Global Biomes

A. The Role of Climate

1. Climate versus Weather

a. Climate the average temperature over time

b. Weather the daily variations in temperature and precipitation

2. Temperature and precipitation combine to create the world's biomes.

3. Describe how ecosystems change as temperature and precipitation change.

a. Vary temperature while precipitation is held constant (Moderate rainfall:

cold = **cool desert**, warmer = **grassland**)

b. Vary precipitation while temperature is held constant (Cold temperature: little

rain = **tundra**, more rain = **cool desert**, more rain = **spruce/fir forest**).

C. Biotic Factors

1. Shading of One Plant by Another

2. Chemical Produced by One Plant May Limit Growth of Another Plant

3. Presence of Herbivores tasty plants are consumed first.

D. Physical Barriers

IV. Implications for Humans

A. Three Revolutions

1. Neolithic Revolution

a. Development of agriculture

b. Required permanent or long term settlements and specialized skills

c. Allowed for the initial increase in human population reliable food.

2. Industrial Revolution

a. Created the modern world

b. Energized by fossil fuels (initially timber)

c. Resulted in the concentration of waste products

d. Created even greater increase in human population size because of the specialization of the workforce and the replacement of animal/human power with fossil fuels.

3. Environmental Revolution

a. Need to create sustainable human systems

b. Need to create systems in which waste products are not concentrated (pollution), and wastes are resources.

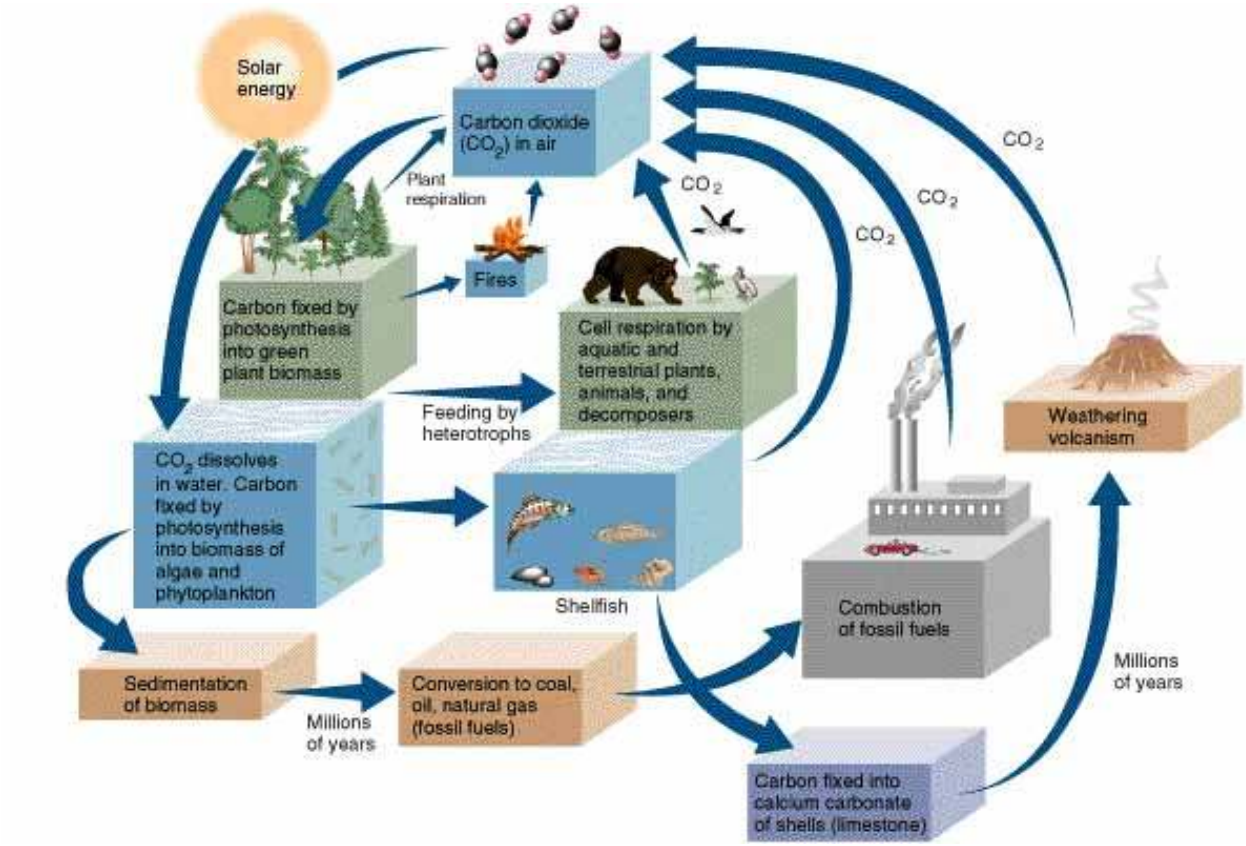

Figure 1 Carbon Cycle