POLLUTION AND ENVIRONMENTAL PROTECTION

Lecture 1.Concepts and components of environment.

BOT 346

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WE HAVE ONLY ONE EARTH

One Earth - Environmental Short Film

By Romain Pennes,2020

OBJECTIVES

- **At the end of this lecture the student should be able to gain knowledge in:**
  1. **Definition of Environment,**
  2. **Ecosystems,**
  3. **Environmental Components,**
  4. **Energy flow**
  5. **Nutrient transfer**

DEFINITION OF ENVIRONMENT

- '**The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature behaviour and the growth, development and maturity of living organisms**' (**Douglas and Holland**).
- 'Environment refers to the sum total of all conditions which surround man at a given point in space and time' (**C.C.Park**)
- The entire range of external influence acting on an organism, both the physical and biological, and other organisms, i.e. forces of nature surrounding an individual. (**Encyclopedia Britannica**)
- Total environmental system including not only the biosphere, but also his interactions with his natural and man-made surroundings (**US Council on Environmental quality**).

Environmental knowledge is a multidisciplinary knowledge whose fundamental aspects have a direct significance to every segment of the planet. Its main characteristics include:

- Conservation and natural resources.
- Maintenance and management of biological diversity.
- Controlling and managing environmental pollution to permissible limit
- Stabilisation of human population and environment.
- Development of alternate sources of renewable energy systems
- Providing new dimension to nation’s security through conservation, protection, management and maintenance of environment

TYPES OF ENVIRONMENT:

- On the basis of basic structure, the environment may be divided into:
  - Physical/abiotic environment
  - Biotic environment
  - Cultural environment

PHYSICAL/ABIOTIC ENVIRONMENT

On the basis of physical characteristics and state, abiotic or physical environment is subdivided into:

- Solid i.e. lithosphere (solid earth)
- Liquid i.e. hydrosphere (water component)
- Gas i.e. atmosphere (gaseous component)

These environments can be termed as lithospheric, hydrosspheic, atmospheric environment which can be further broken into smaller units based on different spatial scales like mountain environment, plateau, plain, lake, river maritime, glacier, desert environment etc. The physical environment may also be viewed in terms of climatic conditions providing certain suits of habitat for biological communities like tropical, temperate and polar environment etc.

BIOTIC ENVIRONMENT

Biotic environment consists of flora and fauna including man as an important factor. Thus the biotic environment may be divided into:

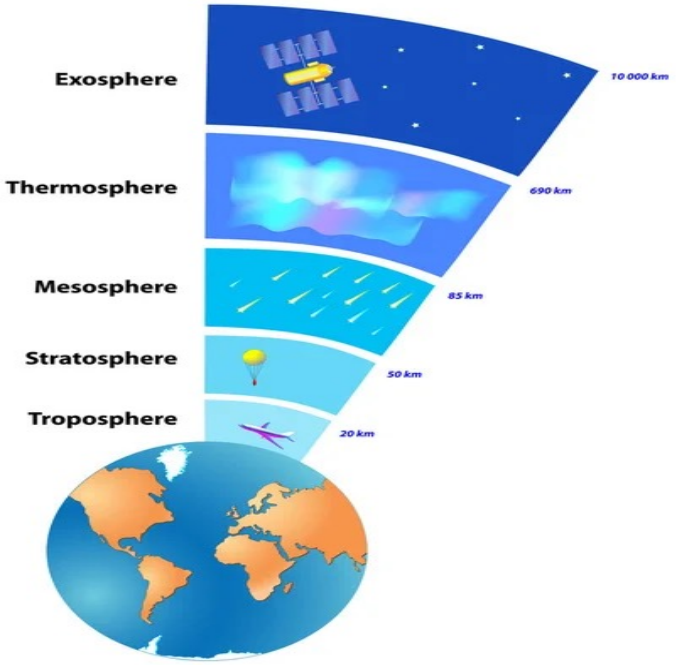
- **Floral environment**
- **Faunal environment**

- Further all the organisms work to form their social groups and organizations at several levels and thus is formed **Social environment**, where in, the organisms work to derive matter from the physical environment for their sustenance and development.

- It is significant to note that the aspects of man, physical, social and economic have different characteristics and functions in the biotic environment. As 'physical man' is one of the organismic populations or biological community and thus requires basic elements of physical environment (habitat, air, water, food etc.) like other biological populations and releases wastes into the ecosystem; 'social man' establishes social institutions forms social organisations, formulates laws and policies to safeguard his existence, interest and social welfare and 'economic man' derives and utilises resource from the physical and biotic environments with his skills and technologies. These may be termed as physical, social and economic functions of man. It is the third function which makes the man and environmental process because he transports matter and energy from one component of the ecosystem to the other.

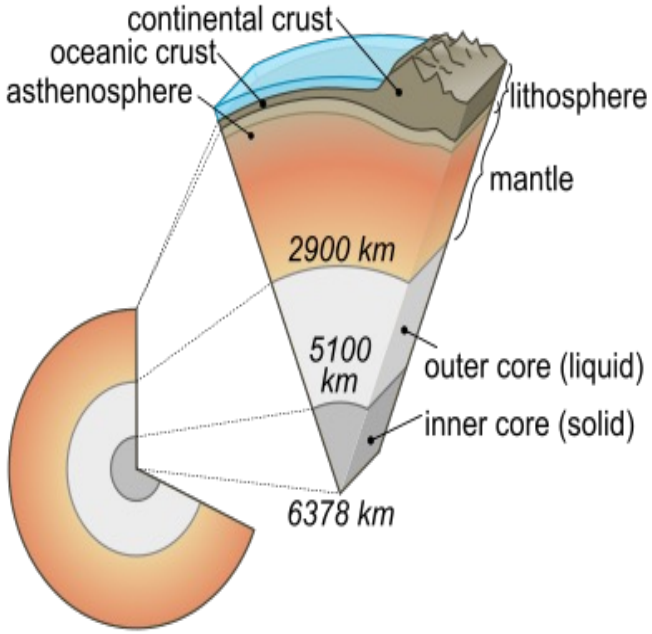
COMPONENTS OF ENVIRONMENT

- The basic components of the environment are:
  - Atmosphere or the air.
  - lithosphere or the rocks and soil.
  - hydrosphere or the water.
  - The living component of the environment or the biosphere.



ATMOSPHERE

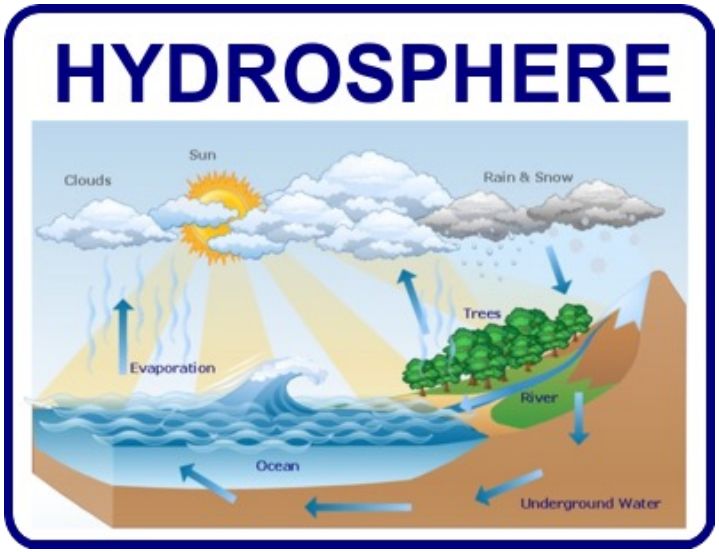
- The thick gaseous layer surrounding the earth.
- It spreads up to 300 km. above the earth's surface.
- Apart from gases there are water vapor, industrial gases, dust and smoke particles in suspended state, microorganism etc.



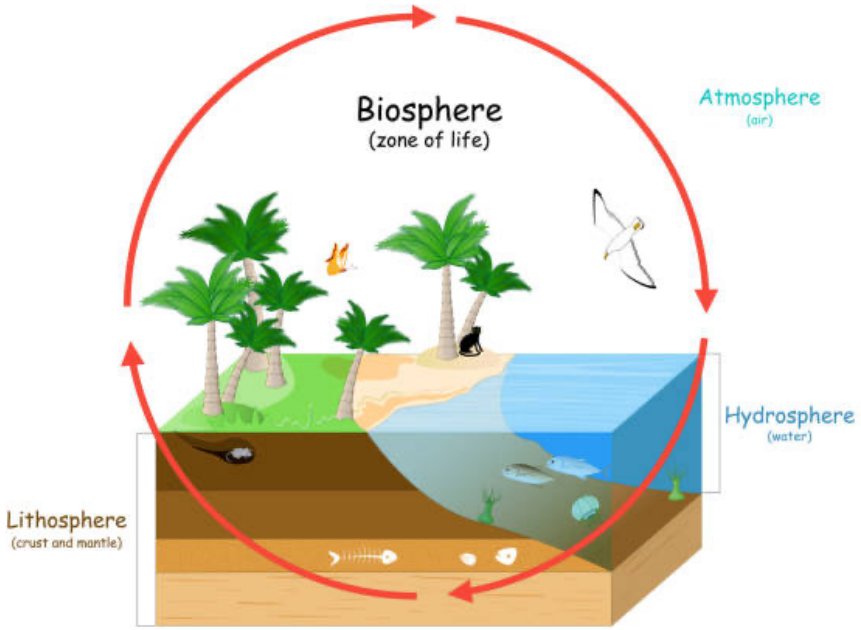
The word lithosphere originated from a Greek word mean "rocky" + "sphere" i.e. the solid outmost shield of the rocky planet. The Earth is an oblate spheroid. It is composed of a number of different layers. These layers are:

- The Core which is around 7000 kilometers in diameter (3500 kilometers in radius) and is situated at the Earth's center.
- The Mantle which environs the core and has a thickness of 2900 kilometers.
- The Crust floats on top of the mantle and is composed of basalt rich oceanic crust and granitic rich continental crust.

Alanoud Alfagham,2022

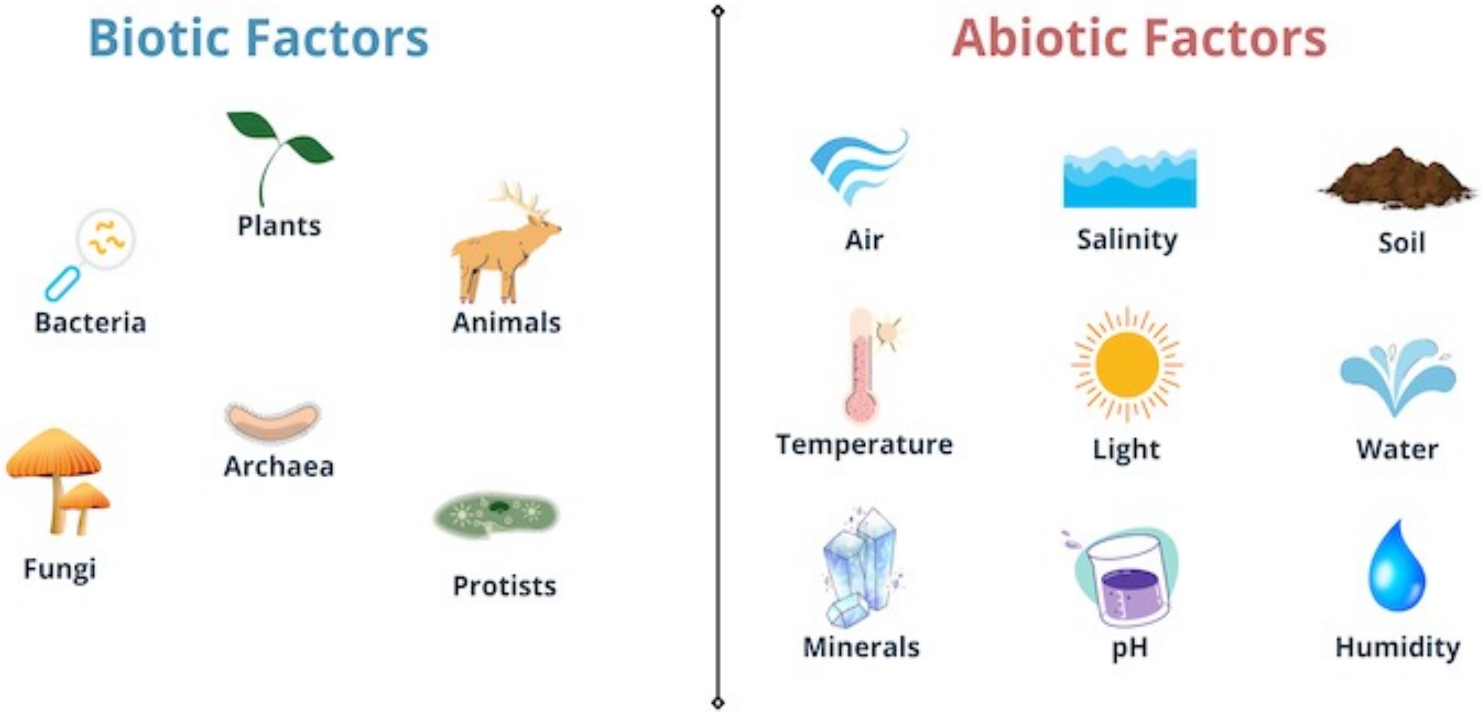


The hydrosphere includes all water on or near earth surface and includes oceans, lakes, rivers, wetlands, icecaps, clouds, soils, rock layers beneath surface etc.



The entire part of earth's land, soil, water & atmosphere in which living organism are found is called biosphere orThe combined area lithosphere, hydrosphere of & atmosphere is known as biosphere.

- Since the environment includes both physical and biological concept, it embraces both the abiotic (non-living) and biotic (living) components of planet earth



DIFFERENCE BETWEEN ENVIROMENT AND ECOLOGY

- Environment is everything that surrounds us, whereas, ecology is how all those work. It refers to the study of the interaction of organisms with their environment. Ecology seeks to understand life processes, adaptation and biodiversity. Environment, on the other hand, aims to identify the internal and external factors that affect the population.

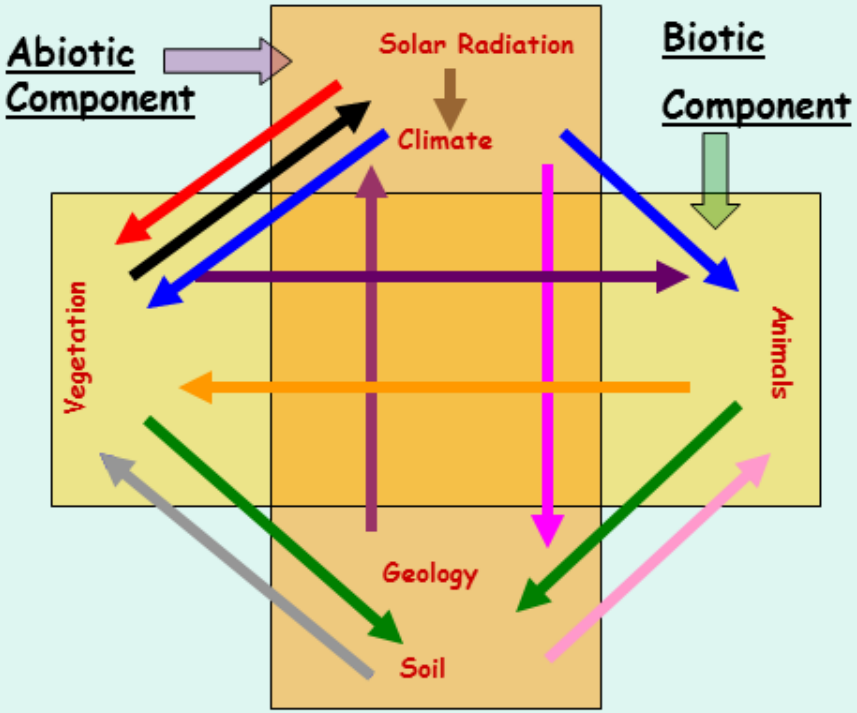
ENVIRONMENT VS ECOLOGY

FOLLOWING ARE THE IMPORTANT DIFFERENCE BETWEEN ENVIRONMENT AND ECOLOGY

Environment	**Ecology**
Environment refers to the interaction between the physical, chemical and biological components.	Ecology is the study of the relationship between organisms and their environment.
The environmental issues include pollution, deforestation, global warming, and other broader issues.	The ecological issues include population size, diversity, distribution of organisms, and also competition between them.
Studies the internal and external factors affecting the environment.	Aims to understand life processes, distribution, adaptation and biodiversity.

ECOSYSTEM

- Ecosystems are structured to be viewed as a series of biotic components that are linked together and thus interact with one another. The fact that ecosystem components are linked has an important ramification: disturbances to one component impact on all other components of the ecosystem to varying degrees.
- The interactions between ecosystem components involve two general processes:
    1. Energy flow.
    2. Nutrient cycling.
- Ecosystems are structured according to how different populations acquire energy, species obtaining energy in a similar way are grouped into trophic levels which are three primary trophic levels:
    1. Primary producers
    2. Consumers
    3. Decomposers



Sun provides energy for plant photosynthesis

Amount of solar radiation varies with latitude & hence effects climate. solar radiation also power weather systems

Volcanic activity ,mountain, ranges etc. can also affect climate

Climate interacts with geology in soil formation provides water for solar climate.

Soil provides water & nutrients for plants together with a physical base in which plants can root themselves.

Plants provides food for animals

Animals alter vegetation by browsing & grazing. Human have significantly altered vegetation patterns through modification for agriculture.

Vegetation gives off water vapour who helps to stabilize the climate of the earth.

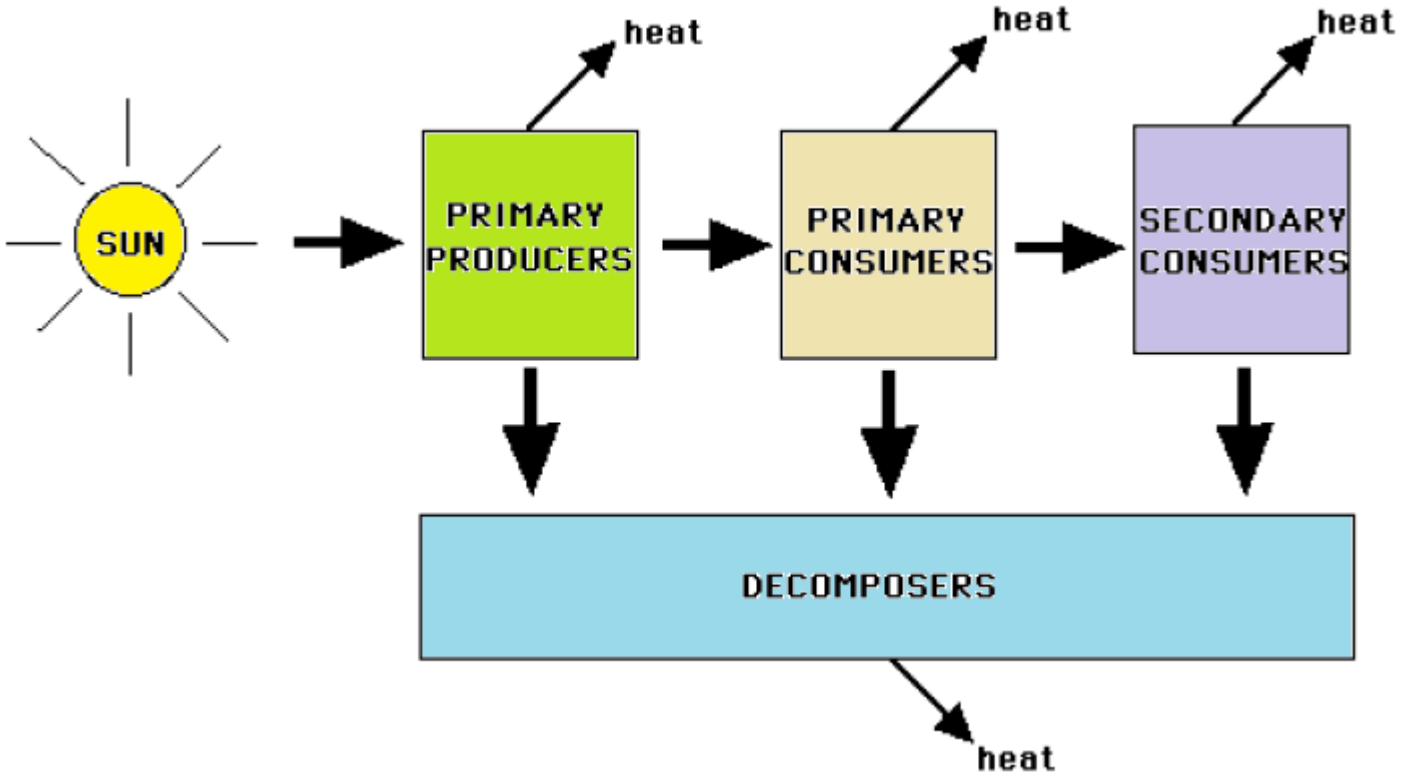
Climate restricts the type of plants & animals that can survive in a particular ecosystem. Water & temperature are two main climate controls.

Dead plants & animals decomposes & return nutrients to the soil. Nutrients are also returned to the soil through animal excrement.

Soil [provides habitat including water & air for many invertebrates addition many animals have evolved specialist cope with different soils for example the feet of camel.

Ecosystem Model

ENERGY FLOW MODEL IN A NATURAL SYSTEM



ENERGY FLOW

- It is a one-way process in ecosystems, in order to persist, ecosystems require a constant input of energy.

  1. The sun is the ultimate source of energy for most ecosystems.

  2. Primary producers capture a fraction of energy in sunlight striking the earth and convert it into chemical energy (carbohydrate) that is stored in tissues of the primary.

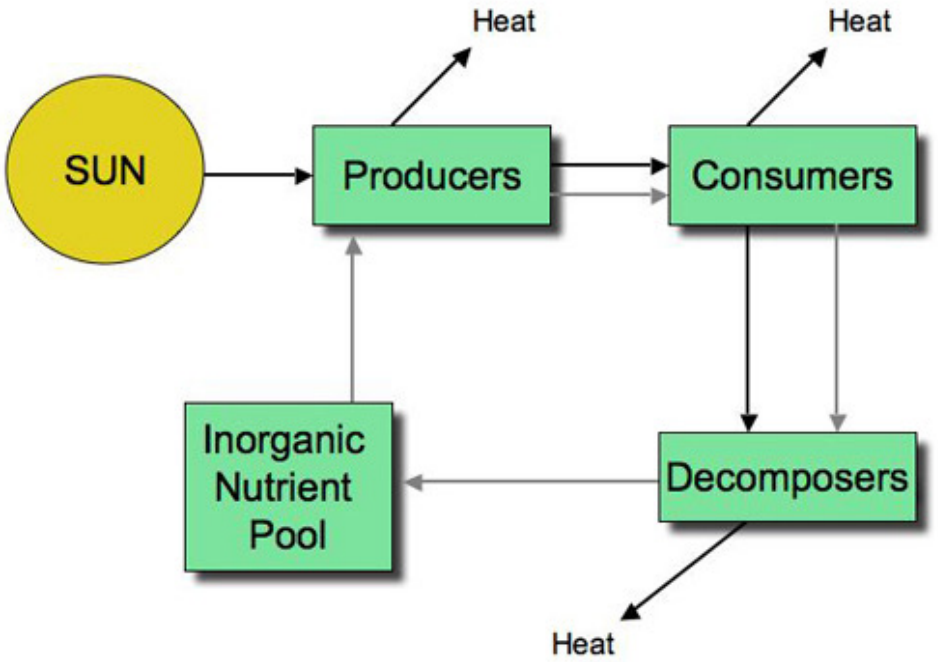
  3. Energy in tissues of primary producers transferred to consumers as each consumes tissue of other organisms -- about 90% - 95% of energy present in one component is lost as heat at each transfer -- very inefficient process -- very little energy left when decomposers get to it.

  4. Important point is that energy does not cycle through ecosystems -- ecosystems require constant energy input from sun or some other source.

NUTRIENT TRANSFER

- **Producers**: autotrophic organisms capable of photosynthesis, they make food for themselves and indirectly for other components; these are primarily green plants. Plants convert inorganic substances; for example: Carbon dioxide CO2, water and minerals into simple organic substances (carbohydrates and proteins) using solar energy; hence the plants grow in size.
- CO2 + H2O + organic substance (Biomass).
- **Consumers:** heterotrophic organisms dependent on other organisms for food, consumers can be subdivided into more specific trophic levels --those feeding directly on producers are called primary consumers (herbivores), secondary and tertiary consumers (carnivores) eat other consumers.
- **Decomposers** are organisms that obtain energy and nutrients from remains of dead producers and consumers; they are primarily bacteria and fungi and they are extremely important to the process of nutrient cycling (see natural cycles of phosphorous, nitrogen and carbon).

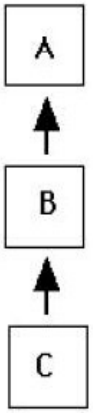
ENERGY AND NUTRIENT FLOW THROUGH THE SYSTEM



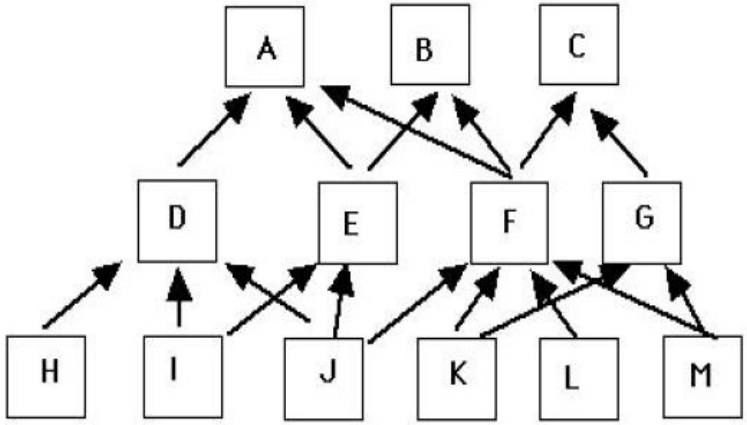
Nutrients (shown by light arrows) cycle through ecosystems in a closed loop, while energy (shown by dark arrows) is released at each stage.

Trophic relationships -- we can sometimes describe "who-eats-whom" in an ecosystem as a food chain -- more often, however, food chains are "cross-linked" into more complicated structures called food webs.

FOOD CHAIN



FOOD WEB



Notice that as the ecosystem diversity (e.g. number of species) increases, the complexity of these food webs also increases -- as complexity increases so does stability -- e.g. disturbance or extinction of one or two species can be compensated for -- in simple food webs or chains, extinction of one species may lead to the collapse of the entire system. Examples: Eskimos living mainly on fish and hunting of few polar animals are less stable than humans living around the equator living on more diverse ecosystems.

Thanks for yoyr attention