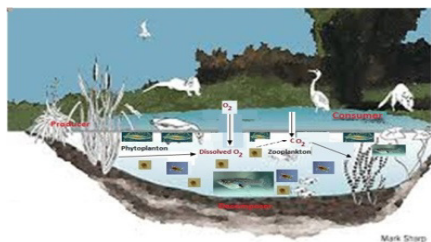


## 5. ECOSYSTEM

- Ecosystem word was coined by A.G. Tansley in 1935.
- Biosphere as well as biomes are very huge and cannot be studied as a single entity.
- Ecosystem– is a functional unit of nature encompassing complex interaction between biotic (living) and abiotic (non-living) component. Ex –pond ecosystem



### • Component of an ecosystem

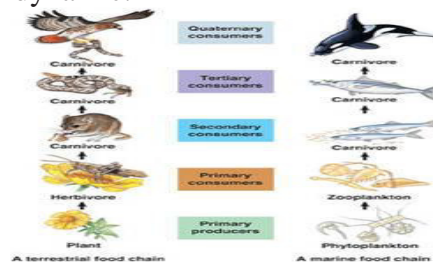
Abiotic components	Biotic components
<b>Physical factors</b> Sunlight, temperature, rainfall, humidity and pressure <b>Inorganic substance:</b> CO <sub>2</sub> , N <sub>2</sub> , O <sub>2</sub> , P, S, water, rock, soil etc. <b>Organic compound:</b> Carbohydrates, proteins, lipids and humic substances.	Producers (Green plants), Consumers (Animals) Decomposers (Microorganisms)

- Ecosystem perform function as
  - Energy flow through food chain
  - Nutrient cycling (biogeochemical cycles)
  - Ecological succession or ecosystem development
  - Homeostasis (or cybernetic) or feedback control mechanisms
- Ecosystems are classified as natural ecosystem (Forest, grasslands, oceans, lakes, river and human modified ecosystem (agricultural fields, aquaculture ponds, urban, industrial. To understand an ecosystem, pond is the best example.

- **Components of pond ecosystem**  
Abiotic and biotic component includes

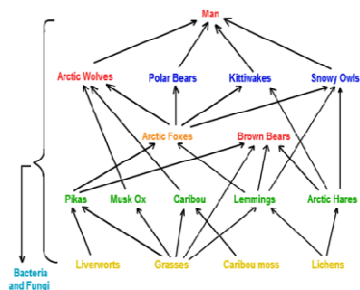
Abiotic components	Biotic components
<b>Light</b> - Euphotic (true light); - Mesophotic (plenty of light); - Aphotic (no light) <b>Inorganic substance:</b> Water, C, N.P etc. <b>Organic compound:</b> Amino acid and humic acid.	<b>Producer/autotrophs:</b> Floating plants and microorganisms, rooted plants <b>Consumers:</b> Zooplanktons, nektons and benthic organisms. <b>Decomposers:</b> Rhizopus, Penicillium, Cladosporium etc

- Food chain and energy flow are the functions of an ecosystem which make them dynamic.

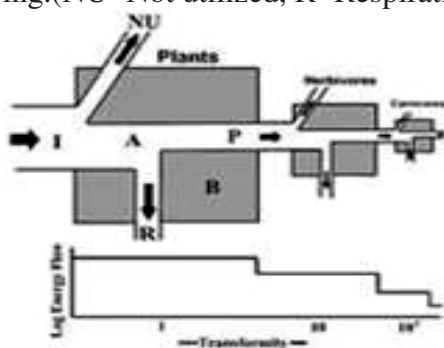


- Transfer of food energy from green plants (producers) through a series of organisms with repeated eating and being eaten is called a food chain. e.g.
- Grasses → Grasshopper → Frog → Snake → Hawk/Eagle. Each step in the food chain is called trophic level.
- During this process of transfer of energy some energy is lost into the system as heat energy and is not available to the next trophic level.
- The total rate at which the radiant energy is stored by the process of photosynthesis in the green plants is called Gross Primary Production (GPP).
- Food web is a network interconnected food chains existing in an ecosystem. Food webs are more realistic models of energy flow through an ecosystem.

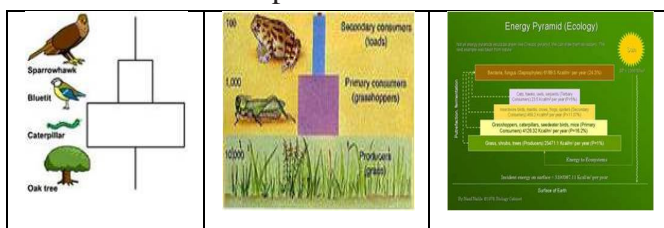
## Senior Secondary Course Learner's Guide – Environmental Science (333)



- The flow of energy in an ecosystem is always linear or one way
- This is a Model of energy flow through an ecosystem. Boxes indicate the standing crop biomass and pipes indicate the energy flowing. (NU=Not utilized, R=Respiration)



- Ecological pyramids are the graphic representations of trophic levels in an ecosystem.
- They are pyramidal in shape and they are of three types: The producers make the base of the pyramid and the subsequent tiers of the pyramid represent herbivore, carnivore and top carnivore levels.



- Trophic relationships of the organisms in an ecosystem can be represented graphically in the form of ecological pyramids the base of the pyramid represents the producers and successive tiers represent subsequent higher levels.
- It is the ratio between the amount of energy acquired from the lower trophic level and the amount of energy transferred

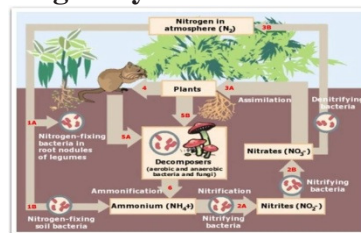
from higher trophic level is called ecological efficiency.

- Lindman in 1942 defined these ecological efficiencies for the 1<sup>st</sup> time and proposed 10% rule of ecological efficiency (also called Lindman's efficiency) can be represented as

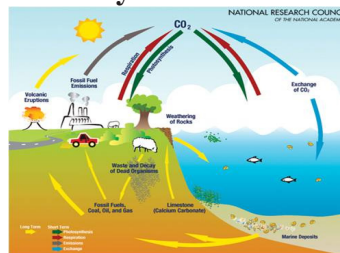
$$\frac{I_t \times 100}{I_{t-1}} = \frac{\text{Ingestion at trophic level}_t \times 100}{\text{Ingestion at previous trophic level} - 1}$$

- Significance of studying food chains
  1. It helps in understanding the feeding relations and interactions among different organisms of an ecosystem.
  2. It explains the flow of energy and circulation of materials in ecosystems.
  3. It helps in understanding the concept of biomagnifications in ecosystems.
- The nutrients move from the nonliving to the living and back to the nonliving component of the ecosystem in a more or less circular manner. These nutrient cycles are known as biogeochemical cycles.
- The main components of all the biogeochemical cycles are:-
  - a) The reservoir pool that contains the major bulk of the nutrients soil or atmosphere.
  - b) Cycling pool which are the living organisms (producers, consumers and decomposers), soil, water and air in which it stays temporarily.

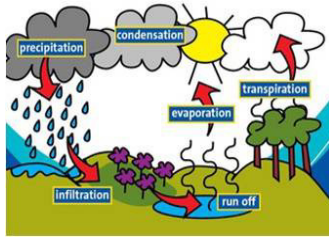
### Nitrogen Cycle



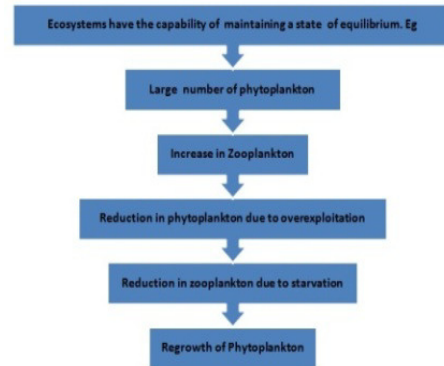
### Carbon Cycle



## Water Cycle



Ecosystems are capable of maintaining their state of equilibrium. They can regulate their own species structure and functional processes. This capacity of ecosystem of self regulation is known as homeostasis.



Negative feedback mechanism is responsible for maintaining stability in an ecosystem.



### Check Yourself

1. A pond can be divided on the basis of presence of light into:
  - a. Aphotic
  - b. Mesophotic
  - c. Euphotic
  - d. All the above
2. Cyclops and Cypris are belong under the category of :
  - a. Benthic
  - b. Nektons
  - c. Zooplankton
  - d. Lotic animal
3. Grass→Grasshopper→Frog→Snake→Eagle  
Which trophic level belongs to frog and eagle in the above food chain?
  - a. I, V
  - b. II, IV
  - c. III, V
  - d. II, V
4. Flow of energy of any ecosystem is always:
  - a. Rectangular
  - b. Circular
  - c. Triangular
  - d. Linear
5. The amount of the living matter at any time is known as:
  - a. Standing of biomass
  - b. Pyramid of energy
  - c. Food web
  - d. Pyramid of number

Ans: 1. a.    2.b    3.c    4.d    5. a



### Stretch Yourself

1. Define ecological efficiency.
2. What is meant by trophic level?
3. What are nektons?
4. What does standing crop mean?
5. Which factor is responsible for maintaining stability of ecosystem?



### Test Yourself

1. Prepare a food chain upto four trophic level.
2. Mention significance of food chain.
3. Why do we consider forests as a reservoir?
4. Draw nitrogen cycle showing all five steps with brief explanation.
5. Enumerate abiotic and biotic component of pond ecosystem.
6. Discuss homeostasis process in any ecosystem.