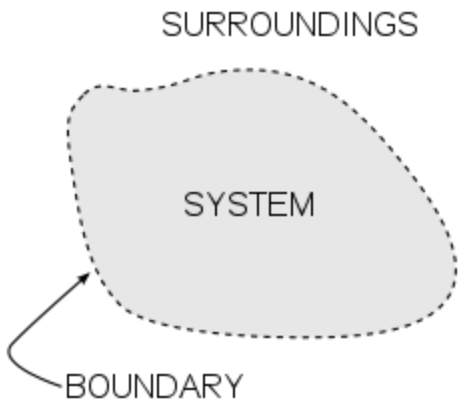
CONCEPT OF SYSTEM:

System is group or sum assemblage of elements (can be called subsystem), interacting or independent with each other and separated from space around it (can be called surrounding or its environment) by a boundary (has to be defined by the observer).

The concept came into existence for explaining or studying the behavior of a complex element in a scientific and rational manner, however it as good for the simple elements.



Therefore in simple words a system could be defined as:

- A set of inter-related components (What it is)
- Operates collectively (How it operates)
- To accomplish common goals (Its purpose)

And SYSTEMS ENVIRONMENT can be defined as:

- Elements surrounding the system
- That are outside the system and interact with the system

And based upon the interaction between the system and its environment, a system can be classified into:

- Closed System, i.e. No interaction of any nature
- Open System, i.e. Interaction exits between environment and the system

Note: In environmental studies most of the systems are of open nature and are thus complex.

UNDERSTANDING THE ECOSYSTEM:

- The **living community** of plants and animals in any area together with the **non-living components** of the environment such as soil, air, climate, landform and water, constitute the ecosystem. The ecosystem is the unit and way of study of Ecology (i.e. Study of home of living species).
- In other words, any system which constitutes of living community and non-living community functioning through various cycles can be called an ecosystem.
- Therefore an **'Ecosystem' is a region with a specific and recognizable landscape form such as forest, grassland, desert, wetland or coastal area.**
- The nature of the ecosystem is based on its geographical features such as hills, mountains, plains, rivers, lakes, coastal areas or islands.
- It is also controlled by climatic conditions such as the amount of sunlight, the temperature and the rainfall in the region. The geographical, climatic and soil characteristics form its non-living **(abiotic)** component.
- These features create conditions that support a community of plants and animals that evolution has produced to live in these specific conditions. The living part of the ecosystem is referred to as its **biotic component**.

Structural aspects of an ecosystem: Components that make up the structural aspects of an ecosystem include:

1. Inorganic aspects – C, N, CO_2, H_2O
2. Organic compounds – Protein, Carbohydrates, Lipids (link abiotic to biotic aspects)
3. Climatic regimes – Temperature, Moisture, Light & Topography
4. Producers – Plants
5. Macro consumers – Phagotrophs – Large animals
6. Micro consumers – Saprotrophs, absorbers – fungi

Functional aspects of an ecosystem (what an ecosystem actually does):-

1. Energy cycles
2. Food chains
3. Diversity - interlinkages between organisms
4. Nutrient cycles - biogeochemical cycles, e.g. Water cycle, Carbon cycle, Nitrogen cycle, Oxygen cycle
5. Evolution

- Therefore an ecosystem can be as small as the hole of ants and can be as large as the thin skin of the earth on the land, the sea and the air, called the **biosphere** (**global level**), which is realm of earth and its atmosphere where life can be found, so it depends upon the area of interest of the observer and hence classified thus.
- But on a broad scale or division, ecosystems are divided into **terrestrial or land-based ecosystems**, and **aquatic ecosystems** in water.
- These form **the two major habitat** conditions for the Earth's living organisms.
- At a **sub-global level**, this is divided into bio-geographical realms, e.g. Eurasia called the palaeartic realm; South and South-East Asia (of which India forms a major part) is the Oriental realm; North America is the Nearctic realm; South America forms the Neotropical realm; Africa the Ethiopian realm; and Australia the Australian realm.
- At a national or state level, this forms bio-geographic regions.
- There are **several distinctive geographical regions** in India - the **Himalayas,** the **Gangetic Plains**, the **Highlands of Central India**, the **Western and Eastern Ghats**, the **semi-arid desert in the West**, the **Deccan Plateau**, the **Coastal Belts**, and the **Andaman and Nicobar Islands**.
- These geographically distinctive areas have plants and animals that have been adapted to live in each of these regions.
- At an even more local level, each area has several structurally and functionally identifiable eco-systems systems such as different types of forests, grass-lands, river catchments, mangrove swamps in deltas, seashores, islands, etc. to give only a few examples. Here too each of these forms a habitat for specific plants and animals.

Amongst the various cycles operating at an ecosystem level, one of the most important cycle is **Energy cycle and concepts associated with it.**

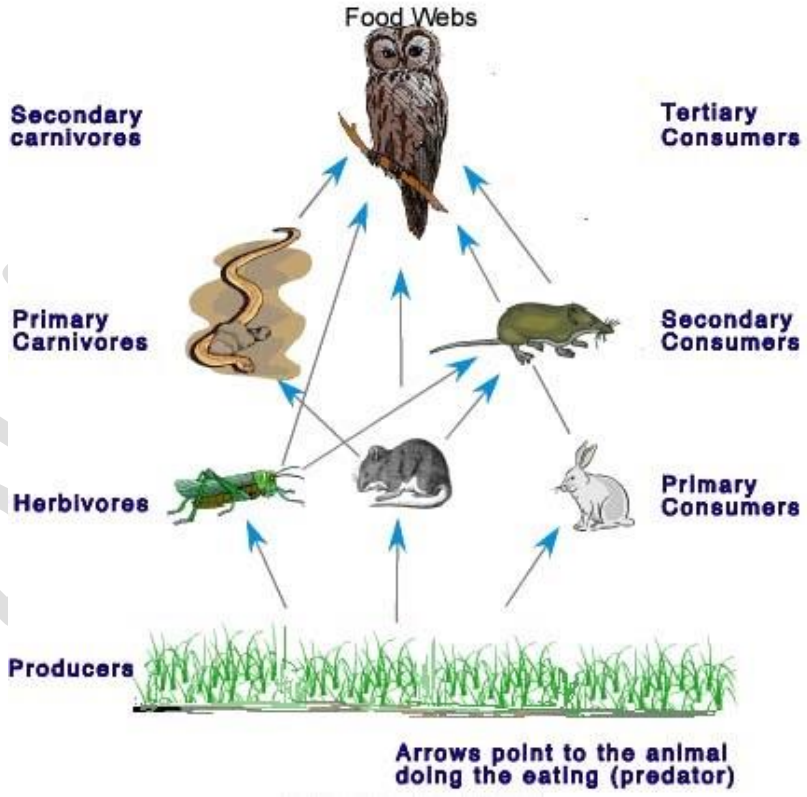
ENERGY CYCLE

- The energy cycle is based on the flow of energy through the ecosystem. The main source of energy to an ecosystem is Sun's energy which is converted into bio-mass energy by Producers i.e. plants.
- The energy in the ecosystem can be depicted in the form of a food pyramid or energy pyramid.
- The food pyramid has a large base of plants called 'producers'. The pyramid has a narrower middle section that depicts the number and bio-mass of herbivorous animals, which are called 'first order consumers first order consumers'.

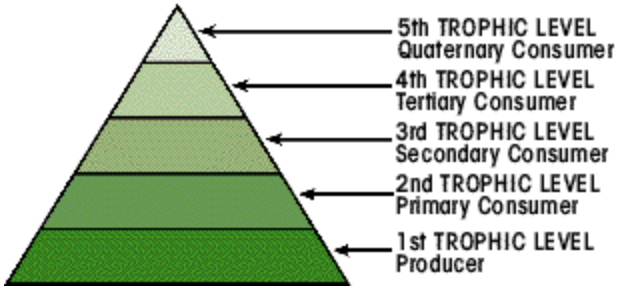
- The apex depicts the small biomass of carnivorous animals called 'second order consumers'.
- Man is one of the animals at the apex of the pyramid. Thus to support mankind, there must be a large base of herbivorous animals and an even greater quantity of plant material.
- When plants and animals die, this material is returned to the soil after being broken down into simpler substances by decomposers such as insects, worms, bacteria and fungi so that plants can absorb the nutrients through their roots.

Meaning of the term 'Food Chains', 'Food Web', 'Trophic Level' and 'Ecological Pyramid'

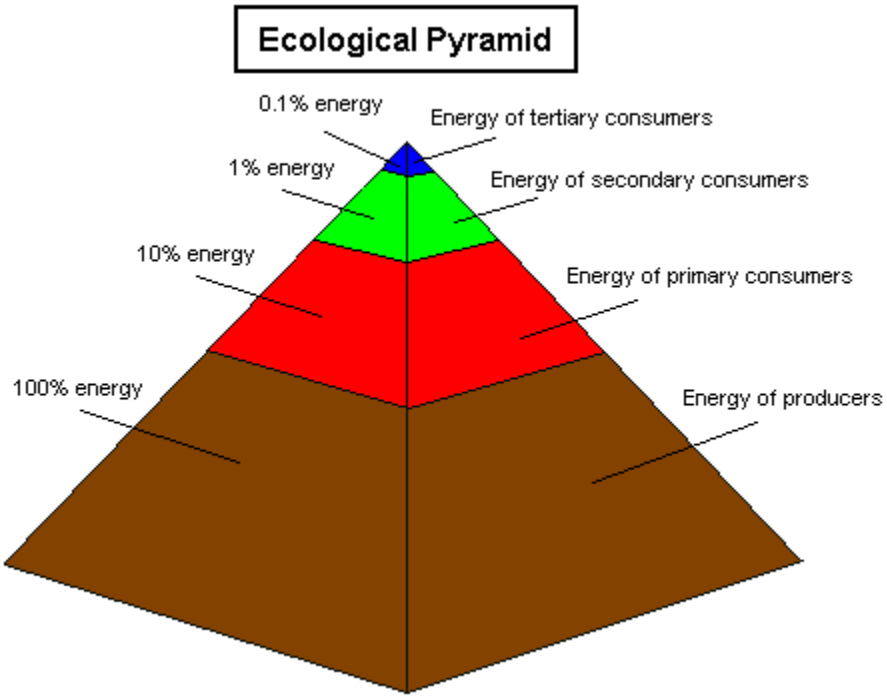
- The most obvious aspect of nature is that energy must pass from one living organism to another. When herbivorous animals feed on plants, energy is transferred from plants to animals.
- In an ecosystem, some of the animals feed on other living organisms, while some feed on dead organic matter.
- At each linkage in the chain, a major part of the energy from the food is lost for daily activities. Each chain usually has only four to five such links. However a single species may be linked to a large number of species.
- This transfer of energy from the source in plants through a series of organisms by eating and being eaten constitutes **food chains**.
- These food chains are not isolated sequences, but are interconnected with each other and this interlocking pattern is known as the **food web**.
- In an ecosystem there are a very large number of interlinked chains. This forms a food web. If the linkages in the chains that make up the web of life are disrupted due to human activities that lead to the loss or extinction of species, the web breaks down.



- Each step of the food web is called a **trophic level.** Hence green plants occupy the first level, herbivores the second level, carnivores the third level and secondary carnivores the fourth level.



- These trophic levels together form the **ecological pyramid**. At each transfer, a large proportion of energy is lost in the form of heat.



ECOLOGICAL SUCCESSION

- Ecological succession is a process through which ecosystems tend to change over a period of time. Succession can be related to seasonal environmental changes, which create changes in the community of plants and animals living in the ecosystem. Other successional events may take much longer periods of time extending to several decades.
- There is a tendency for succession to produce a more or less stable state at the end of the successional stages.
- Developmental stages in the ecosystem thus consist of a pioneer stage, a series of changes known as serel stages, and finally a climax stage.
- The most frequent example of successional changes occur in a pond ecosystem where it fluctuates from a dry terrestrial habitat to the early colonization stage by small aquatic species after the monsoon, which gradually passes through to a mature aquatic ecosystem, and then reverts back to its dry stage in summer where its aquatic life remains dormant.