

Learning Objective of the Class:

Understanding the overview of fundamental of Environment and ecosystems with different aspect with respect to different ecosystems.

MODULE 3**Environment & Ecosystem****ENVIRONMENT:**

Definition: it is defined as “the sum total of water, air and land and the inter-relationships that exist among them and with the human beings, other living organisms and materials”

Multidisciplinary nature of Environment Studies:

What does it mean?

When we consider environment as whole, everything is interconnected, people, animals, microbes, plants, soil etc

The concept of environment can be clearly understood from below Fig 1.

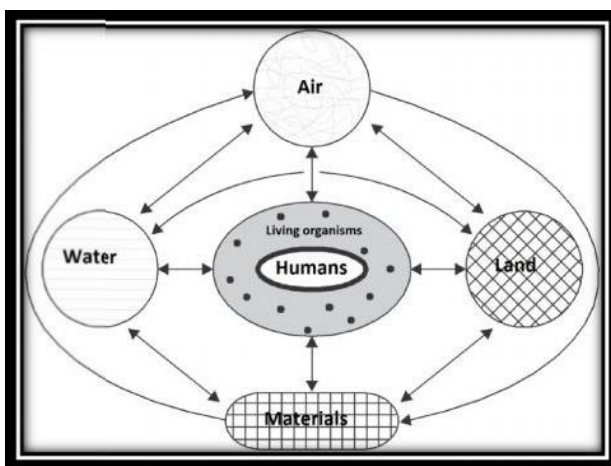


FIG 1

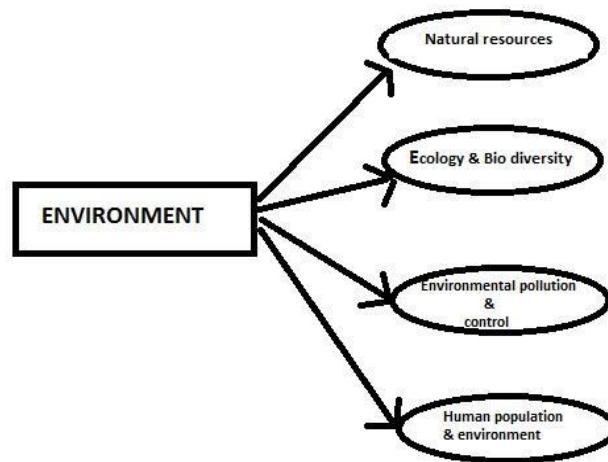
The above Figure explains the environment of human beings. Air, water and land surrounding us constitute our environment, and influence us directly. At the same time we too have an influence on our environment due to overuse or over-exploitation of resources or due to discharge of pollutants in the air, water and land.

By consider different aspects of Environment we can classify into Urban and rural areas, as we know urban environment is somewhat different from rural environment. In urban environment we can see profound influence of human beings.

Most of the natural landscapes in cities have been changed and modified by man-made artificial structures like multi-storied buildings, commercial complexes, factories, transportation networks and so on. Urban air, water and soil are loaded with various types of chemicals and wastes.

Scope:

Environmental studies as a subject has a wide scope. It encompasses a large number of areas and aspects, which may be explained as follows:



Environmental studies can also be highly specialized concentrating on more technical aspects like environmental science, environmental engineering or environmental management.



In the recent years, the scope of environmental studies has expanded dramatically the world over. Several career options have emerged in these fields that are broadly categorized as shown above

1. **Research & Development (R & D) in environment:** Skilled environmental scientists have an important role to play in examining various environmental problems in a scientific manner and carry out R & D activities for developing cleaner technologies and promoting sustainable development.
There is a need for trained manpower at every level to deal with environmental issues. Environmental management and environmental engineering are emerging as new career opportunities for environmental protection and management.
2. **Green advocacy:** With increasing emphasis on implementing various Acts and Laws related to environment, need for environmental lawyers has emerged, who should be able to plead the cases related to water and air pollution, forest, etc.
3. **Green marketing:** While ensuring the quality of products with ISO mark, now there is an increasing emphasis on marketing goods that are environment friendly. Such products have ecomark or ISO 14000 certification.
Environmental auditors and environmental managers would be in great demand in the coming years.
4. **Green media:** Environmental awareness can be spread amongst masses through mass media like television, radio, newspaper, magazines, hoardings, advertisements etc. for which environmentally educated persons are required.
5. **Environment consultancy:** Many non-government organisations (NGOs), industries and government bodies are engaging environmental consultants for systematically studying and tackling environment related problems.

Importance of Environment:

Environment belongs to all and is important to all. Whatever be the occupation or age of a person, he will be affected by environment and also he will affect the environment by his deeds. That is why we find an internationally observed environment calendar to mark some important aspect or issue of environment.

a) Global vs. Local Importance of Environment

Global importance: Environment is one subject that is actually global as well as local in nature. Issues like global warming, depletion of ozone layer, dwindling forests and energy resources, loss of global biodiversity etc. which are going to affect the mankind as a whole are global in nature and for that we have to think and plan globally.

Local importance: some environmental problems which are of localized importance. For dealing with local environmental issues, e.g. impact of mining or hydroelectric project in an area, problems of disposal and management of solid waste, river or lake pollution, soil erosion, water logging and salinization of soil, fluorosis problem in local population, arsenic pollution of groundwater etc., we have to think and act locally.

b) Individualistic Importance of Environment

Environmental studies is very important since it deals with the most regular problems of life where each individual matters, like dealing with safe and clean drinking water, hygienic living conditions, clean and fresh air, fertile land, healthy food and sustainable development.

If we want to live in a clean, healthy, aesthetically beautiful, safe and secure environment for a long time and wish to hand over a clean and safe earth to our children, grandchildren and great grandchildren, it is most essential to understand the basics of environment.

Public Awareness for Environment

1) International Efforts for Environment

Environmental issues received international attention about 35 years back in Stockholm Conference, held on 5th June, 1972. Since then we celebrate **World Environment Day** on **5th June**.

2) Public Awareness for Environment

The goals of sustainable development cannot be achieved by any government at its own level until the public has a participatory role in it. Public participation is possible only when the public is aware about the ecological & environmental issues.

There is a proverb **"If you plan for one year, plant rice, if you plan for 10 years, plant trees and if you plan for 100 years, educate people."** If we want to protect and manage our planet earth on sustainable basis, we have no other option but to make all persons environmentally educated. Prevention of environment degradation in which we must all take part that must become a part of all our lives. So individually we can play a major role in environment management. It can be made possible through mass public awareness. If each of us feels strongly about the environment, the press & media add to our effort, defiantly we can create awareness about to save nature.

3) Role of Contemporary Indian Environmentalists in Environmental Awareness

In our country, efforts to raise environmental awareness have been initiated, and several landmark judgements related to environmental litigations have highlighted the importance of this subject to general public. Two noted personalities

Who need a mention here, are Justice Kuldeep Singh, known popularly as **the green judge** and Sh. M.C. Mehta, **the green advocate**, who have immensely contributed to the cause of environment.

In 1991, the Supreme Court of our country issued directives to make all curricula environment-oriented. This directive was, in fact, in response to a Public Interest Litigation (PIL) filed by *M.C. Mehta vs. Union of India (1988)* that prompted the apex court to give a mandate for creating environmental awareness among all citizens of India. Based on the judgment, **Environmental Studies is being taught as a compulsory course to all students.**

4) Role of Government

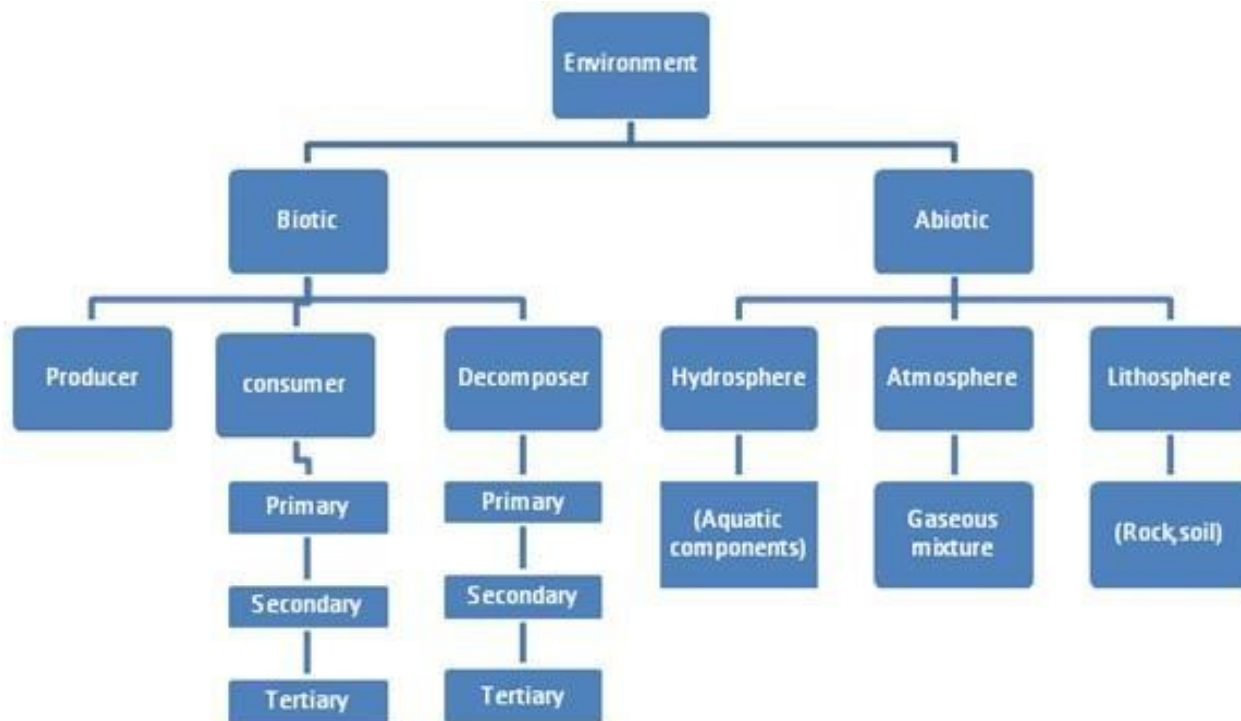
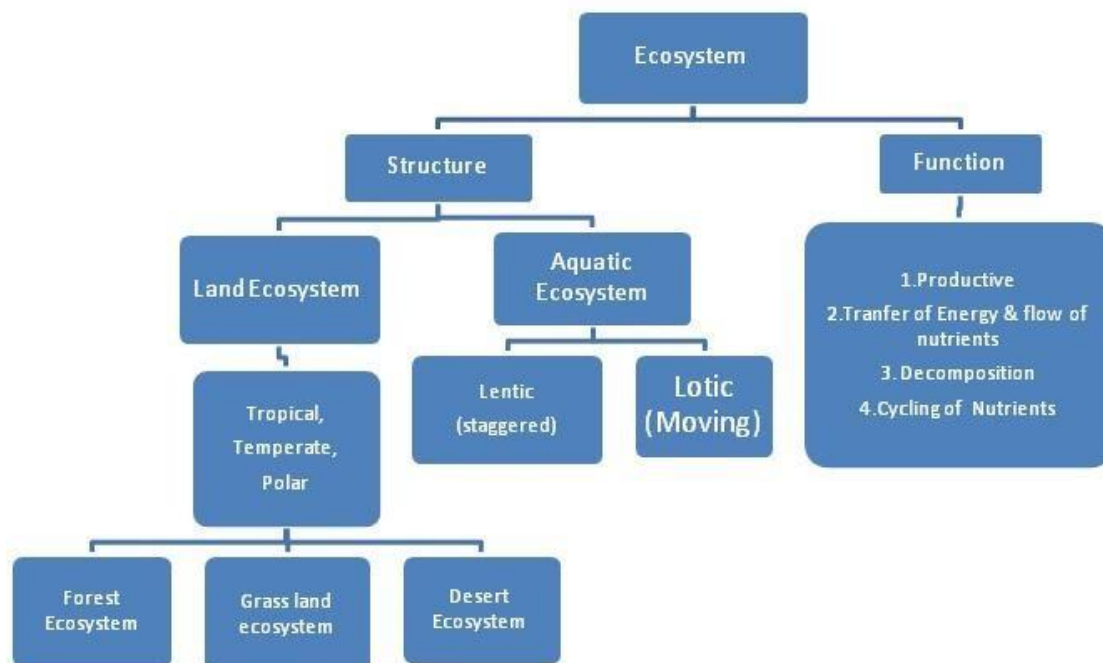
Concept of Ecomark : In order to increase consumer awareness about environment, the Government of India has introduced a scheme of eco- labeling of consumer products as 'Ecomark' in 1991.

In a drive to disseminate environmental awareness '**Eco-Clubs**' for children and '**Eco-task force**' for army men have also been launched by the government.

Learning Outcome of the Class: Students able to learn the scope and importance of Environment and public awareness to save environment

Assignment Questions:

1. Define Environment, Mention its scopes and importance, discuss the need for public awareness

Flow chart to understand the relation between ECOLOGY AND ECOSYSTEM**Environment:****Ecosystem:**

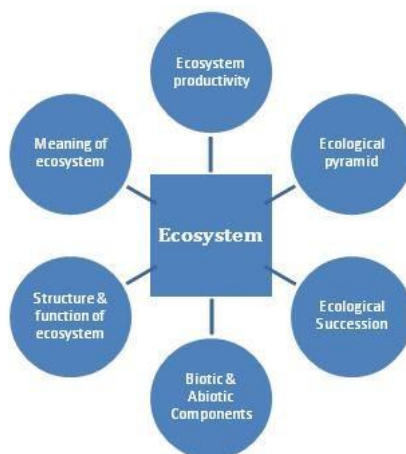
ECOLOGY

Ecology: ecology deals with the study of organisms in their natural home interacting with their surroundings.

The surroundings or environment consists of other living organisms (biotic) and physical (abiotic) components.

Eco system: An ecosystem is a self-regulating group of biotic communities of species interacting with one another and with their non-living environment exchanging energy and matter.

An ecosystem is an integrated unit consisting of interacting plants, animals and micro-organisms whose survival depends upon the maintenance and regulation of their biotic and abiotic structures and functions.



Ecosystems have basically two types of components, the biotic and abiotic, as described below:

BIOTIC COMPONENTS: Different living organisms constitute the biotic component and belong to the following categories:

- **Producers:** These are mainly producing food themselves e.g., Green plants produce food by photosynthesis in the presence of sunlight from raw materials like water and carbon dioxide. They are known as photo-autotrophs (auto = self, photo = light, troph = food). There are some chemo-autotrophs, which are a group of bacteria, producing their food from oxidation of certain chemicals. e.g. sulphur bacteria.
- **Consumers:** These organisms get their food by feeding on other organisms. They are of the following types:
 - Herbivores—which feed on plants e.g. rabbit, insect.
 - Carnivores—which feed on herbivores as secondary carnivores (e.g., frog, small fish) or tertiary carnivores (e.g., snake, big fish), which feed on other consumers.
 - Omnivores—which feed on both plants and animals e.g., humans, rats, many birds.
 - Detritivores—which feed on dead organisms e.g., earth worm, crab, ants.
- **Decomposers:** These are micro-organisms which break down organic matter into inorganic compounds and in this process they derive their nutrition. They play a very important role in converting the essential nutrients from unavailable organic form to free inorganic form that is available for use by plants *e.g.*, bacteria, fungi.

ABIOTIC COMPONENTS: Various physic-chemical components of the ecosystem constitute the abiotic structure:

- **Physical components** include sunlight, solar intensity, rainfall, temperature, wind speed and direction, water availability, soil texture etc.
- **Chemical components** include major essential nutrients like C, N, P, K, H₂, O₂, S etc. and micronutrients like Fe, Mo, Zn, Cu etc., salts and toxic substances like pesticides. These physico-chemical factors of water, air and soil play an important role in ecosystem functioning.

Structure and function of Energy system:

Structure of an Eco system:

As we have looked at the various components of the environment- abiotic and biotic

We studied how the individual biotic and abiotic factors affected each other and their surroundings. Let us look at these components in a more integrated manner and see how the flow of energy takes place within these components of the ecosystem.

Interaction of biotic and abiotic components results in a physical structure that is characteristic for each type of ecosystem. Identification and enumeration of plant and animal species of an ecosystem gives its species composition. Vertical distribution of different species occupying different levels is called stratification. For example, trees occupy top vertical strata or layer of a forest, shrubs the second and herbs and grasses occupy the bottom layers.

As shown in Flow chart, mainly the structure is divided into 2 types ecosystem

1. Land ecosystem 2. Aquatic ecosystem

Land ecosystem: In the land ecosystem is classified depends on different regions

1. Tropical region 2. Temperate region 3. Polar region

Based on this regions its further classified into three types

- a) Forest ecosystem b) Grassland ecosystem c) Desert Ecosystem

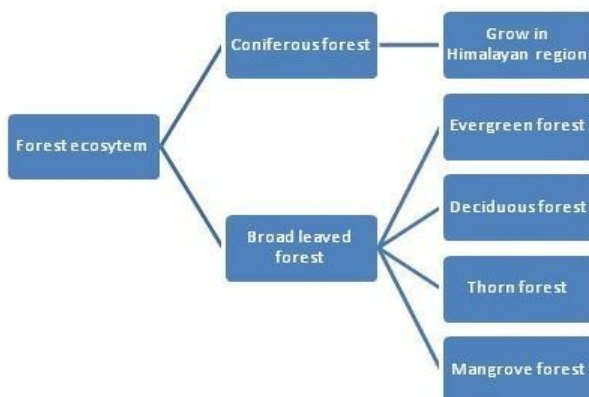
a) Forest ecosystem: Forest are formed by a community of plants which is predominantly structurally defined by its trees, shrubs, climbers and ground cover.

The forest ecosystem has two parts:

- **The non- living or abiotic aspects of the forest:** The types of forest depend upon the abiotic conditions at the site. Vegetation is specific to the amount of rainfall and the local temperature which varies according to latitude and altitude.
- **The living or the biotic aspects of the forest:** The plants and animals form communities that are specific to each forest type. The biotic components includes both the large (macrophytes) and the microscopic plants and animals.

Types of forest ecosystem:

Forest in india can be broadly divided into **coniferous forests** and **broadleaved forests**.



Coniferous forests: Grow in the Himalayan mountain region, where the temperature are low. These forests have tall stately trees with needle like leaves and downward sloping branches so that the snow can slipoff the branches.

Broad leaved forests: They have several types, such as evergreen forests, deciduous forests, thorn forests, and mangrove forests. Broadleaved forests have large leaves of various shapes.

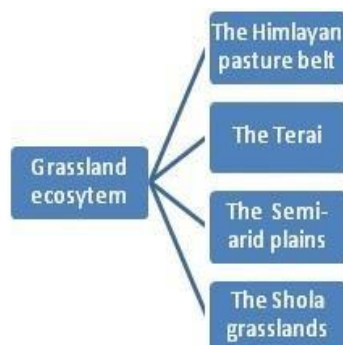
- **Evergreen forests:** Grow in the high rainfall areas of the western ghats, North eastern india and the Andaman & nicobar islands. These forests grow in area where the monsoon lasts for several months. there is no dry leafless phase as in a deciduous forest. An evergreen forest thus looks green throughout the year. The trees overlap with each other to form a continues canopy. Thus very little light penetrates down to the forest floor.
- **Deciduous Forets:** These are found in regions with a moderates amount of seasonal sainfall that lasts for only few months. The deciduous trees shed their leaves during the winter and the hot summer months. The forest frequently has a thick undergrowth as light can penetrate easily onto the forest floor
- **Thorn forests:** these are found in the semi-arid regions of india .The trees, which are sparsely distributues are surrounded by open grassy areas. Thorny plants are able to conserve water.
- **Mangrove forests:** these grow along the coast especially in the river deltas. These plants are able to grow in a mix of saline and fresh water. They grow luxuriantly in muddy areas covered with silt that the river have brought down. The mangrove trees have breathing roots that emerge from the mud banks.
- **Conservation of forest ecosystem:** The forest can be conserved only when its resources are used carefully. This can be done by using alternate sources of energy instead of fuel wood. There is a need to grow more trees than are cut down from forest every year for timber.

Afforestation needs to be done continuously from which fuel wood and timber can be judiciously used. The natural forests with all their diverse species must be protected as national parks and wildlife sanctuaries where all the plants and animals can be preserved.

b) Grass land Ecosystem:

A wide range of landscapes in which the vegetation is mainly formed by grasses and small annual plants forms a variety of grass lands ecosystems with their specific plants and animals. Grasslands covers areas where rainfall is usually low and / or soil depth & quality is poor. The low rainfall prevents the growth of a large number trees and shrubs, but is sufficient to support the growth of grass cover during the monsoon. Each grassland ecosystem has a wide variety of species of grasses and herbs. (Ex: Africa area grass lands)

flowchart :



Types of grass lands:

- **The Himalayan pastures belt:** it extends upto the snowline. The grasslands at a lower form patches along with coniferous or broad leaved forests.

These Himalayan pastures: have a large variety of grasses and herbs, There are also a large number of medicinal plants.

- **The Terai:** This consists of patches of tall grass lands interspersed with a sal forest ecosystem. The patches of tall elephants grass, are located in the low lying waterlogged areas. The Sal forests patches cover the elevated regions and the Himalayan foothills. The terai also includes marshes in low-lying depressions. This ecosystem extends as a belt south of the Himalayan foothills.
- **The Semi-arid plains:** This is located in western india, central india and the deccan are covered by grassland tracts with the patches of thorn forest and are covered with seasonal grasses and herbs on which its fauna is dependent.
- **The Shola grasslands:** It consists of patches on hill slopes along with the shoal forests on the western ghats, nilgiris and annamalai ranges. This forms a patchwork of grassland on the slopes and forest habitats along the streams and low lying areas.
- **Conservation of grass land ecosystem:** Grassland should not be overgrazed and areas of the grasslands should be closed for grazing. A part of the grassland in an area must be closed every year so that a rotational grazing pattern is established. fires must be prevented and rapidly controlled. To protect the most natural undisturbed grassland ecosystem, sanctuaries and national parks must be created.

3) Desert Ecosystem:

Deserts and semi –arid areas are located in western india and the deccan plateau. The climate in these vast tracts is extremely dry, which means the rate of evaporation is more than rate of rainfall. This has sand dunes. These are also areas covered with sparse grasses and few shrubs, which grow if rainfall is scanty and sporadic. In an area it may rain only once or twice every year. Desert and semi-arid regions have a number of highly specialized insects and reptiles.

This ecosystem called as sensitive because a heavy vehicle driven over the topsoil can disturb the vegetation which takes a long time to recover

Plants here adapt themselves in a very interesting manner

- Leaves replaced with thorns to conserve water loss and to keep herbivores away. (cactus plant)
- Some plants with leaves have waxy coating to prevent water loss
- Some plants with leaves have deep roots directly reaching to ground water
- Some plants have spongy tissues in the roots to store water.

Learning Outcome of the Class: Students able to learn the concept of ecosystem, types of land ecosystem in brief

Assignment Questions:

1. Discuss briefly Grassland ecosystem. What are its types? How conservation of grassland can be made
2. What is an ecosystem? Discuss forest ecosystem. Explain how conservation of forest can be done

Aquatic Ecosystem:

Aquatic ecosystem is broadly divided into two types

1. Flowing (Lotic) Ecosystem (ex: rivers, streams, oceans)
2. Stagnant (Lentic) Ecosystem (ex: lake, pond)

The major factors influencing the nature of aquatic ecosystem includes Light, temperature, and nutrients. The division of the aquatic ecosystem along these parameters is termed as **Stratification**.

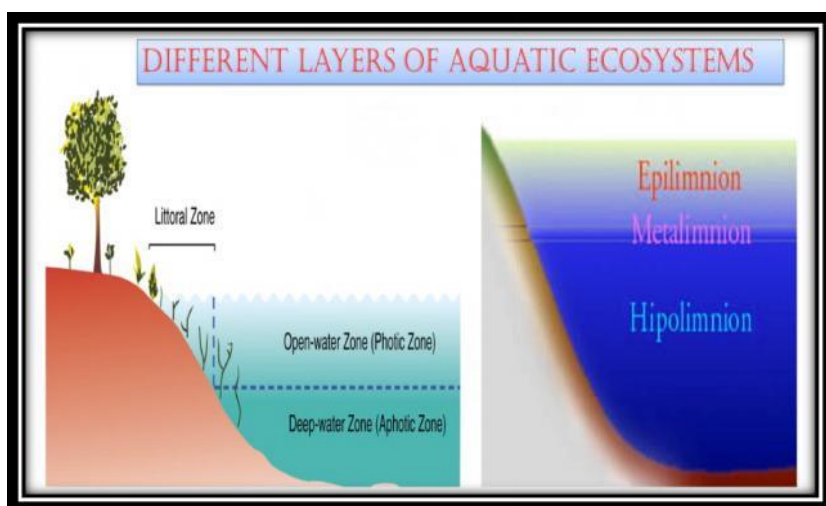


Fig 1

The above figure shows aquatic system is divided into different layer or strator.

The process called as Zonation or stratification, in the left side figure 1. we can see different zone phoic zone and Aphotic zone. It's differed on the basis of sunlight present, if depth is more, no sunlight and the temperature is low.

We can see in right side figure 1 different layers mentioned as epilomnion, metalimnion, hipolimnion and one more layer called as Thermo cline (refer to an are the temperature drastically declines)

The aquatic ecosystem consists the marine environments of the seas and the fresh water systems in lakes, rivers, ponds and wetlands. These ecosystem provide human beings with a wealth of natural resources, the aquatic ecosystem are classified into freshwater, braish and marine ecosystem, which are based on the salinity levels.

Fresh water eco systems: they have running water are streams and rivers. Ponds, tanks, a nd lakes are ecosystems where water does not flow and have expanses of shallow water with aquatic vegetation, which forms an ideal habitat for fish, crustaces and water birds.

Marine ecosystem: are highly saline, while brackish areas have less saline water such as in river deltas

River deltas are covered by mangrove forest and are among the world's most productive ecosystem in terms of biomass production. The largest mangroves swamps are in the sunder bans in the delta of the Ganges.

Aqua system broadly classified based on types of area as below.

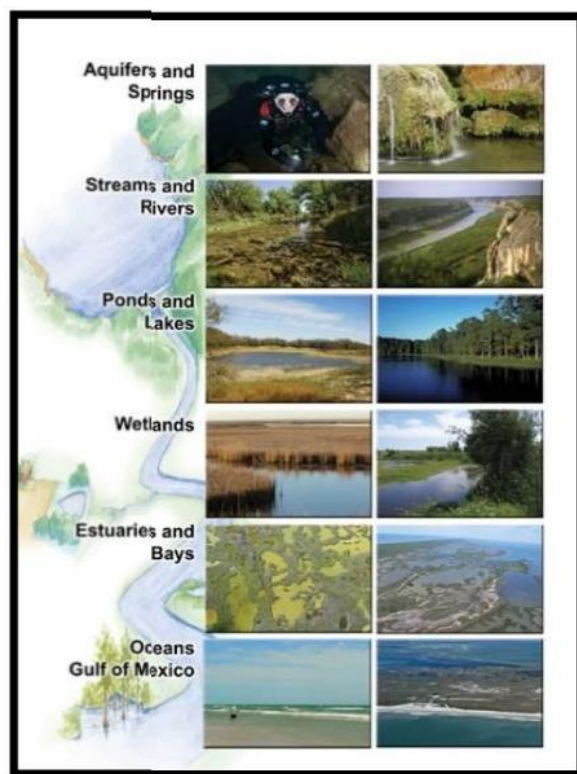


Fig 2

1. Salt water ecosystem
2. Coastal 3 zones- (estuary, wetlands, coral reefs etc)
3. Fresh water systems (Rivers, stream, lakes etc)

Based on food process: Its classified into planktons and Benthos

Planktons:

- a) Phytoplankton's: Photosynthetic producers of the ocean and they form the basis of ocean food web
- b) Zooplanktons: They are primary consumers and feed on phytoplankton's, they inturn become food to newly hatched fish & small organisms & the food chain continuous up to trophic levels.
- c) Nektons: are strong swimmers, include all large organisms like fish,turtle,whales etc

Benthos: are bottom dwellers adapt to living on the floor of water body

- Some fix themselves to spot like sponges, oysters etc
- Others burrow themselves in sand like worms, clams etc
- Some move on the ocean floors like crawfish, brittle stars.

Learning Outcome of the Class: Students able to learn the concept of Aquatic ecosystem, types of Aquatic ecosystem

Assignment Questions:

1. Discuss briefly Aquatic ecosystem. What are its types? Explain based on Area of Aquatic ecosysytem

Function of Ecosystem:

1. It has different food chains and food webs.
2. There is uni-directional flow of energy in an ecosystem.
3. Nutrients (Materials) in an ecosystem move in a cyclic manner.
4. Every ecosystem functions to produce and sustain some primary production (plant biomass) and secondary production (animal biomass).
5. Every ecosystem regulates and maintains itself and resists any stresses or disturbances up to a certain limit.

The components of the ecosystem are seen to function as a unit when you consider the following aspects:

- i) Productivity (ii) Decomposition
(iii) Energy flow (iv) Nutrient cycling.

1) Productivity:

The manner of energy being transferred from one trophic level to another trophic level is determined as Productivity of the Eco system. It is basically concerned about the proper and distribution of energy transfer & the amount of energy transfer in trophic levels

Definition: The rate of Production of biomass in the particular ecosystem

Mainly they are two types:

1. Gross primary productivity [GPP]
2. Net primary productivity [NPP]

GPP: The rate of production of organic matter during photosynthesis. (The total amount of energy produced during photosynthesis)

It is expressed in terms of $\text{g}^{-2}\text{yr}^{-1}$ (Bio mass-gram/yr) or $(\text{Kcal m}^{-2}) \text{yr}^{-1}$ (for energy)

NPP: it is defined as Actual amount of energy available for consumption for next level consumer

W.k.t due to the complete amount of energy cannot be transferred to any trophic level, there will be a certain losses in that one of the losses is Respiratory losses.

Therefore,

$$\text{NPP} = \text{GPP} - \text{R} \quad \text{Where R - Respiratory losses}$$

A constant input of solar energy is the basic requirement for any ecosystem to function and sustain.

Basically productivity can be explained in Three stages:

- 1, Primary productivity
2. Secondary productivity
3. Standing crop

Primary productivity: The amount of biomass or organic matter produced per unit area over a time of period by plants (producer) during photosynthesis

Secondary productivity: The rate of formation of new organic matter by consumers

Standing crop: The amount of organic material available in a particular area at a particular time

Because of all these conditions we applied universal standard rule as 10% rule that is explained in Energy flow diagram.

2) Decomposition:

- Similarly, decomposers break down complex organic matter converted into inorganic substances like carbon dioxide, water and nutrients and the process is called decomposition.
- Decomposition is a sequential process of steps that degrade the biomass and return them back nature
- Dead plant remains such as leaves, bark, flowers and dead remains of animals, including fecal matter, constitute detritus, which is the raw material for decomposition.

NOTE: Decomposition chain also called as “Detritous food chain” & decomposers also called as “Saprotrophs”

The important 5 steps in the process of decomposition are

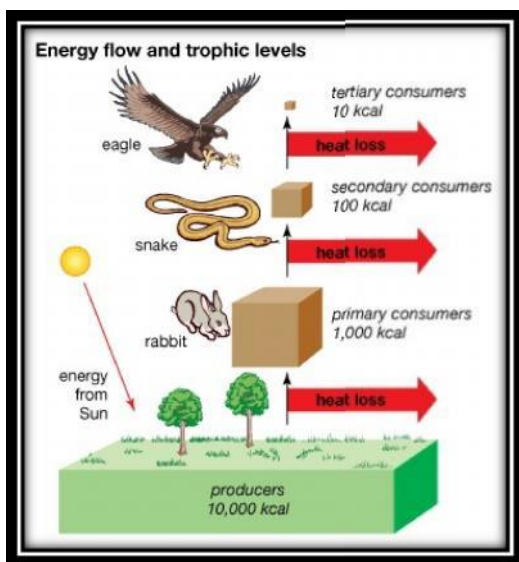
1. Fragmentation 2. Leaching 3. Catabolism 4. Humification 5. Mineralization

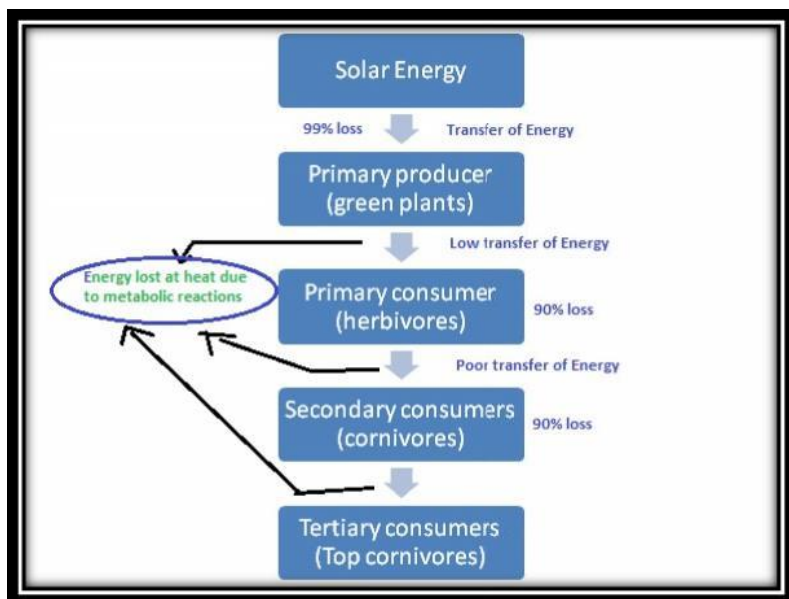
- 1) **Fragmentation:** Detritus (complex matter) broken down into smaller fractions. (the body will shrink)
- 2) **Leaching:** Water soluble inorganic nutrients precipitate as unavailable salts, which means the process of leaching, water-soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts
- 3) **Catabolism:** Bacterial and fungal enzymes degrade detritus into simpler inorganic substances. This process is called as catabolism
- 4) **Humification:** Slow decomposition leads to formation & accumulation of dark color amorphous substance, which means now the complex material is broken down in fragmentation and salt formation in leaching & bacteria also convert to inorganic in catabolism and now only few shrink portion is left that is black kind of mass that is called as humification
- 5) **Mineralization:** Even humus also further degraded by microbes and there is increase in inorganic nutrients and that is in one of the form of gases in atmosphere. And nutrients also added in soils.

Important condition for Decomposition:

1. Optimum temperature
2. Moisture contents
3. Area availability
4. Different forms and rate of decomposition

3) Energy Flow:





Every ecosystem has several interrelated mechanism that affects human life.

The above flow chart represents Energy flow and loss of energy in ecosystem

- Some amount of energy from sun is consumed by plants
- When energy transferred from one form to another level, there is always loss of energy from beginning
- Only small amount of biomass will be produced, as we know plants are more efficient but complete energy from sun cannot be utilized by plants
- In the first process, the small amount radiation taken by plant, photosynthesis process taken place, it creates energy
- When animal consumes the plants, the amount of energy is less compared to the first stage so the amount of biomass stored is less
- Similarly the amount of energy is very less when it reaches at carnivorous or predators levels.
- So the proper interaction between biotic and abiotic term called as productivity.

Detail Explanation:

Except for the deep sea hydro-thermal ecosystem, sun is the only source of energy for all ecosystems on Earth. Of the incident solar radiation less than 50 per cent of it is photosynthetically active radiation (PAR). We know that plants and photosynthetic bacteria (autotrophs), fix sun's radiant energy to make food from simple inorganic materials. Plants capture only 2-10 per cent of the PAR and this small amount of energy sustains the entire living world. So, it is very important to know how the solar energy captured by plants flows through different organisms of an ecosystem. All organisms are dependent for their food on producers, either directly or indirectly.

Learning Outcome of the Class: Students able to learn the Function of Ecosystem wrt different components based on functions

Assignment Questions:

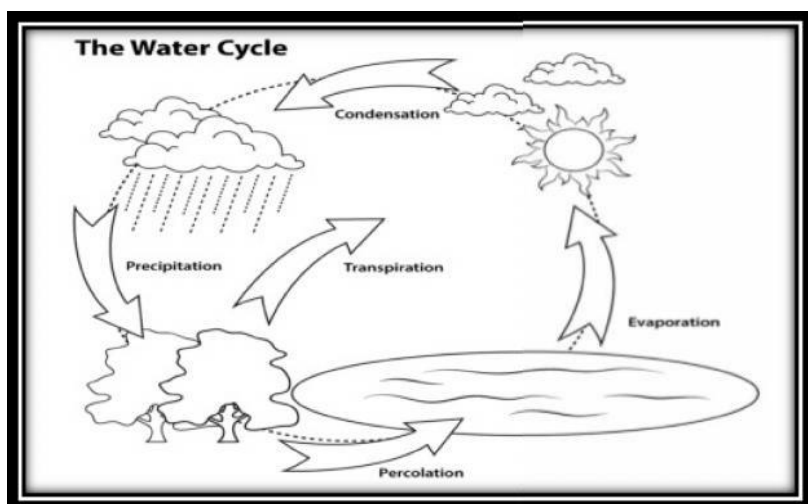
1. Discuss briefly Productivity of ecosystem and explain the steps involved in ecosystem
2. With neat flow chart Explain Energy flow diagram briefly

4. Nutrient cycle:

In every eco system is controlled by below mentioned cycles , in each eco system it biotic and abiotic features are distinct from each other.

1. Water cycle
2. Carbon cycle
3. Nitrogen cycle
4. Oxygen cycle
5. Energy cycle

1. Water cycle:



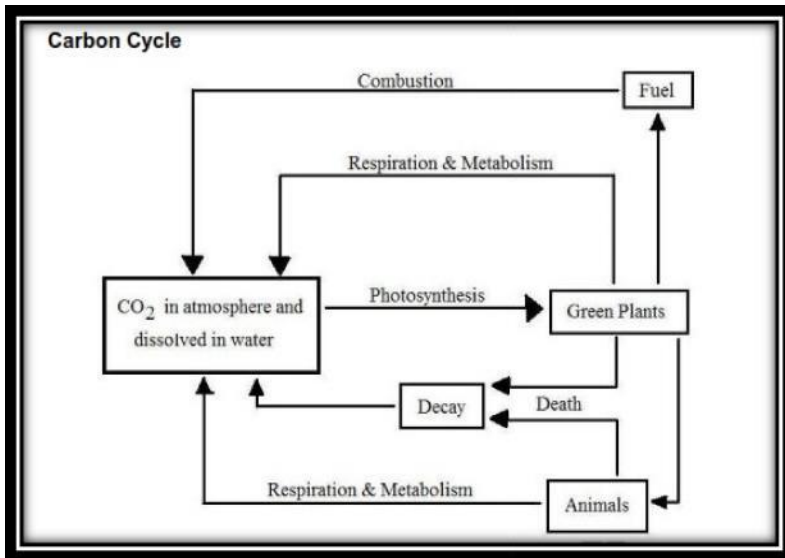
- when it rains, the water runs along the ground & flow into rivers or flows directly into the sea.
- A part of rain water that falls on land percolates into the ground this is stored underground throughout the rest of the years.
- The water is drawn up from the ground by plants along with the nutrients from the soil. the water is transpired from the leaves as water vapour and returned to the atmosphere. As it is lighter than the air, water vapour rises and form clouds.
- Winds blows the cloud for long distances and when the cloud ride higher , the vapour condenses and change into droplets , which falls on the land as rain.

Learning Outcome of the Class: Students able to learn the Function of Energy flow water cycle

Assignment Questions:

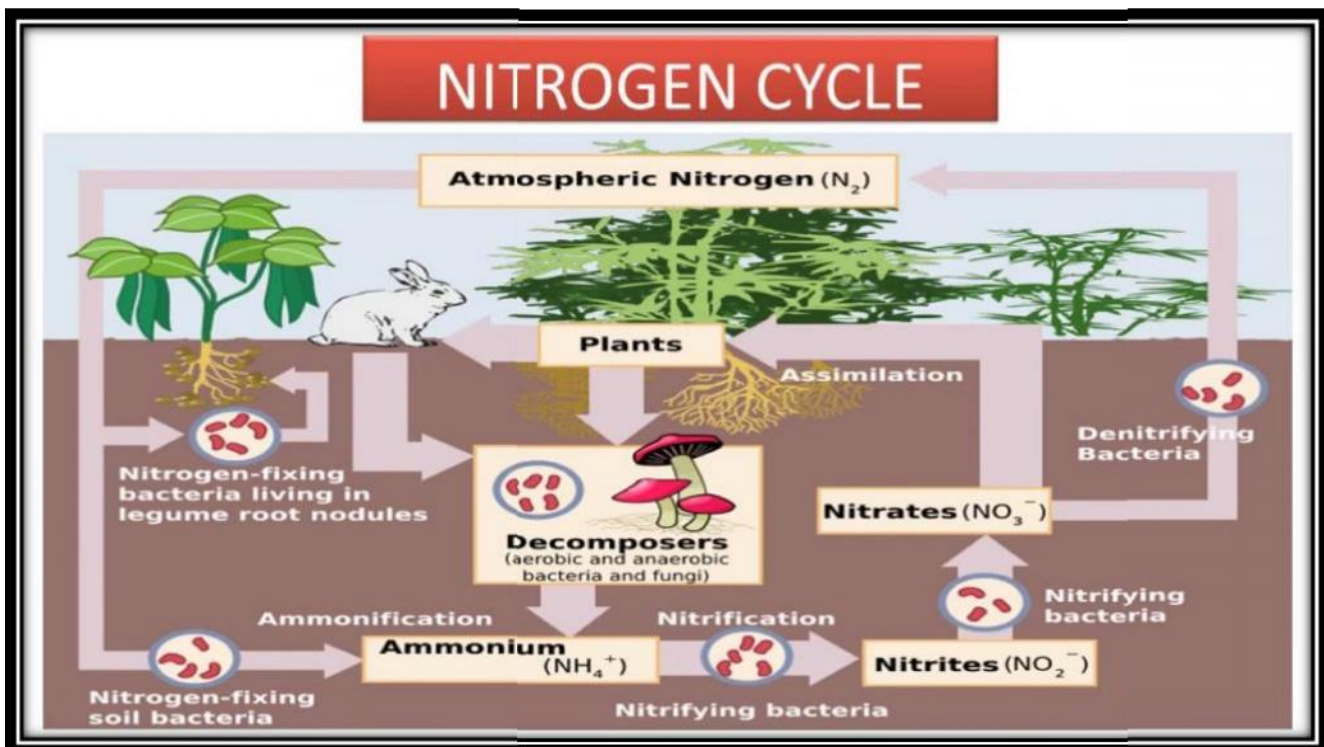
1. Elaborate how the water cycle ecosystem operates in Ecosystem

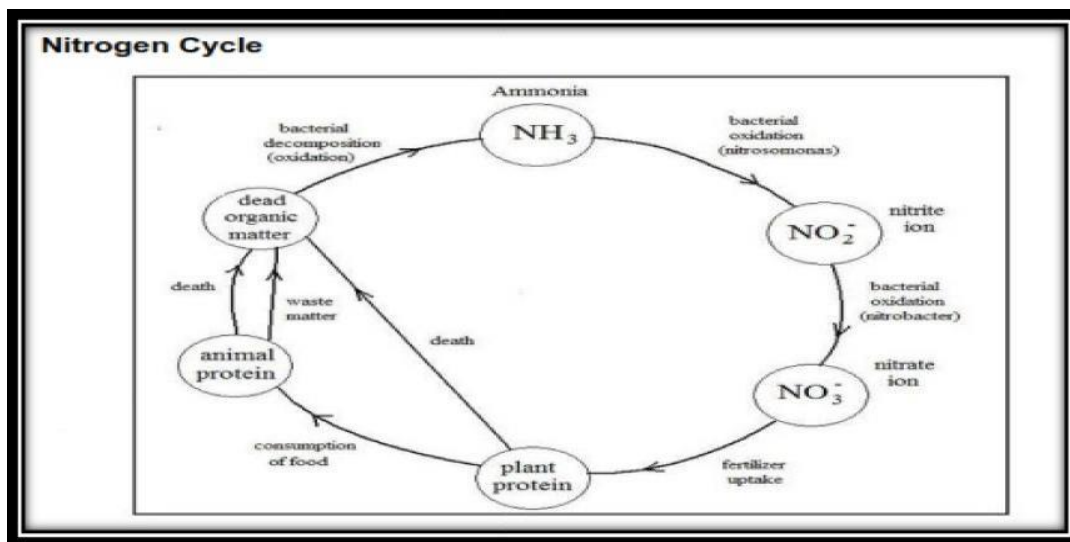
2. Carbon Cycle:



- The carbon which occurs in organic compounds, is included in both biotic and abiotic parts of the eco system.
- Plants use photosynthesis process for their growth and development.
- In this process, plants release oxygen into the atmosphere on which animals depend for their respiration.
- Herbivorous animals feed on plant material, which is used by them for energy and for their growth.
- Both plants release oxygen and animals release carbon dioxide during respiration. They also return fixed carbon to the soil in the waste they excrete.
- When plants and animals die, they return their carbon to the soil. These processes complete the carbon cycle.

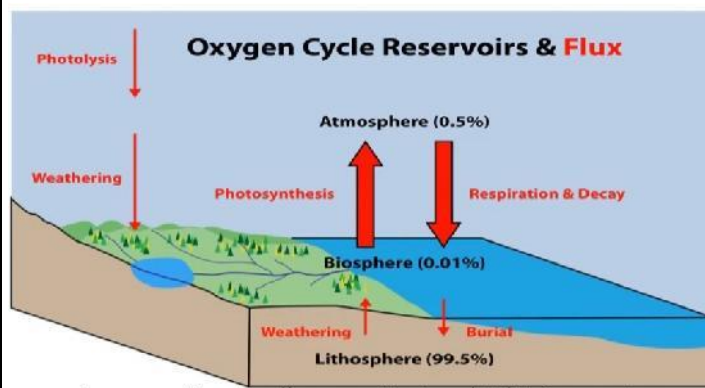
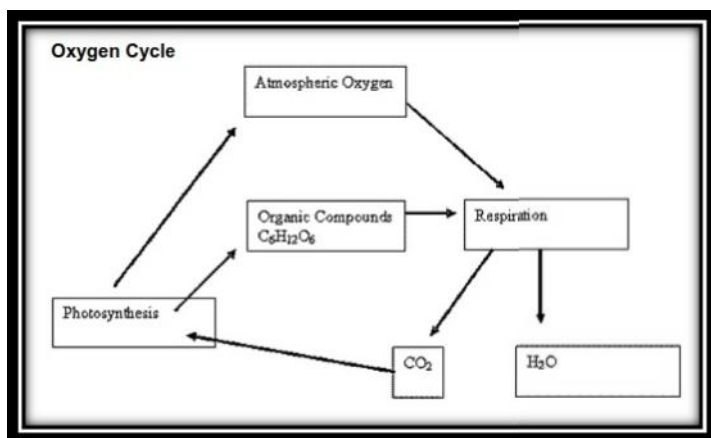
3. Nitrogen cycle





- Carnivorous animal feeds on herbivorous animals that live on plants.
- When animals defecate, this waste material is broken down by worms and insects mostly beetles & ants. These small 'soil animals' break the waste material into smaller bits on which microscopic bacteria and fungi can act.
- This material is thus broken down further into nutrients that plant can absorb & use their growth. Thus the nutrients are recycled back from animals to plants.
- Similarly, the bodies of dead animals are also broken down into nutrients that are used by the plants for their growth. Thus the nitrogen cycle on which life is dependent is completed

4. Oxygen cycle:

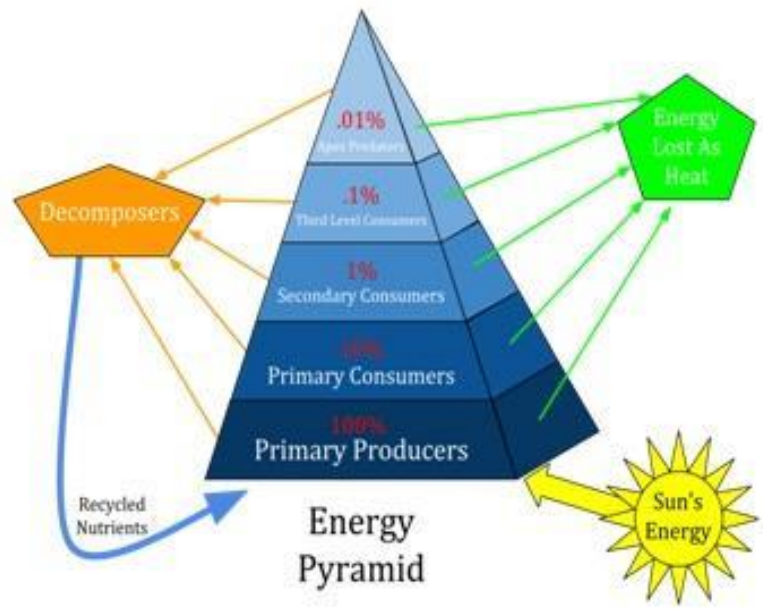
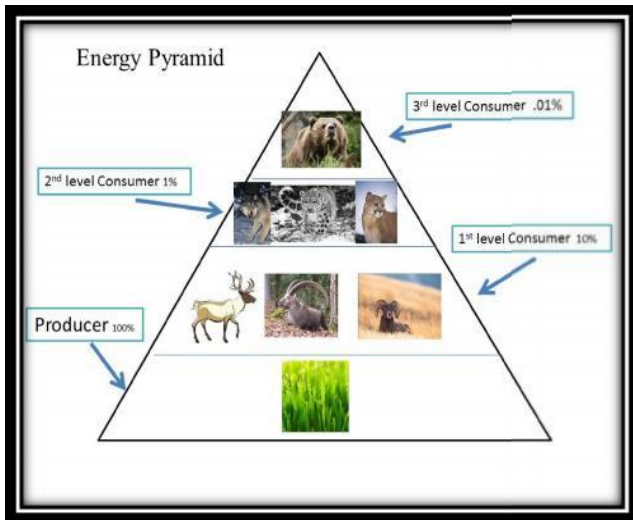


- The oxygen cycle is the bio-geo- chemical cycle that describes the movement of oxygen within and between its three main reservoirs
 1. The atmosphere (air)
 2. The bio sphere (living things)
 3. Lithosphere (earth crust)
- The main driving factor of the oxygen cycle is photosynthesis, which is responsible for the modern earth atmosphere and life.
- Plants are the main creators of oxygen in the atmosphere through the process of photosynthesis. Here the trees use sunlight and carbon dioxide to produce energy and releases oxygen.
- The animals breathe oxygen and prethe out carbon di oxide, the plant can then use this carbon dioxide and cycle is complete

Learning Outcome of the Class: Students able to learn the Function of Energy flow Carbon, Oxygen, Nitrogen cycle

Assignment question: 1. Enumerate the utilization of carbon, nitrogen and oxygen cycle in ecosystem

5. Energy cycle [Ecology pyramid]



Energy cycle is based on the flow of energy through the ecosystem.

It is the graphical representation of the ecosystem with each trophic level.

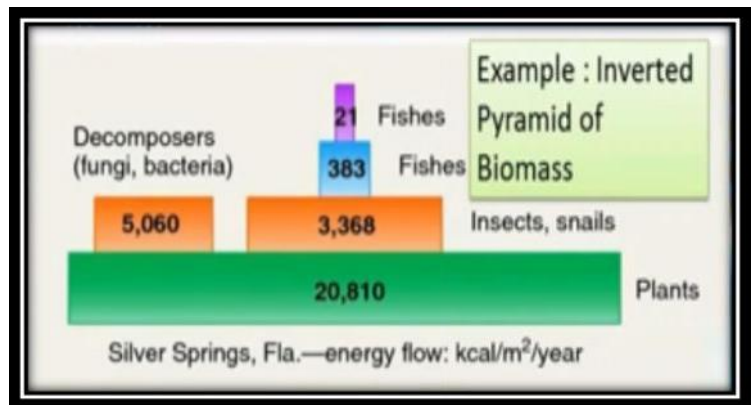
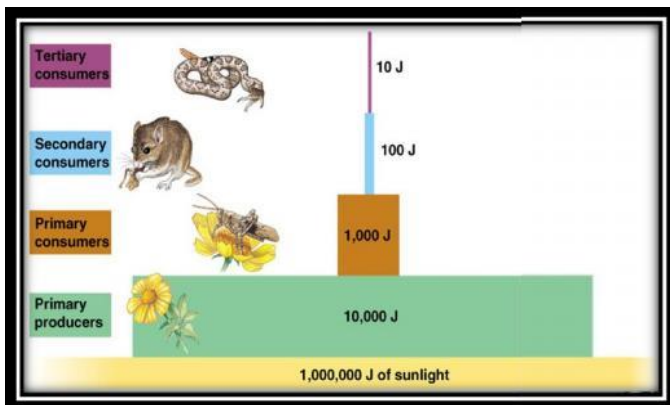
Mainly we are defining Ecological pyramid in three ways.

1. Pyramid of numbers
2. Pyramid of biomass
3. Pyramid of Energy

Pyramid of Numbers: In this simply we will count the number of different number of consumer and we we will conclude based on that.

Pyramid of biomass: In this we will find out dry and wet biomass quantity or Net primary biomass by considering respiratory losses

Pyramid of Energy: In this we are define based on Energy content in each consumer's level.



Learning Outcome of the Class: Students able to learn the Function of Ecological pyramid

Assignment question: 1. Explain the concept of Ecological pyramid

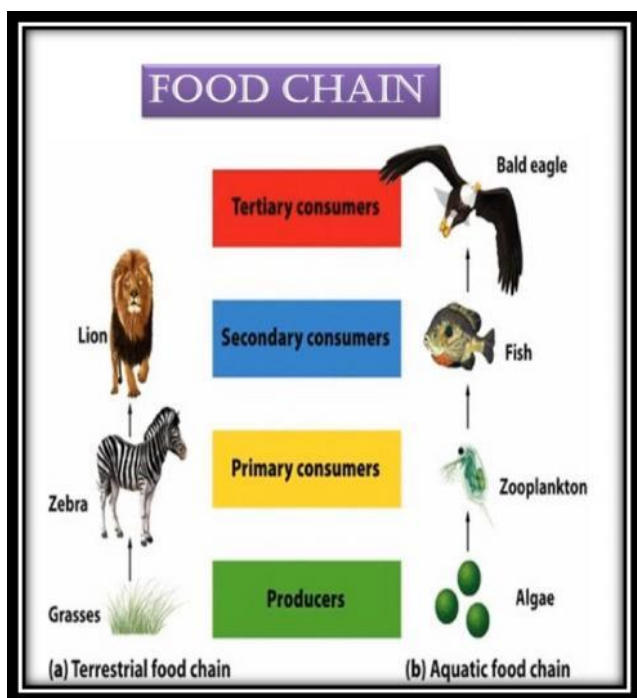
Detail Explanation:

The energy from the sunlight is converted by plants themselves into growing new plants materials which includes leaves, flower, fruits, branches, trunks, and roots of plants known as producer on the ecosystem. The plants are used by herbivores animals as food, which gives them energy.

The carnivores in turn depends on herbivores animals on which they feed. Thus the different plant and animals species are linked to one another through food chain.

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 plant called as **producer's**. the pyramid has a narrower middle section that depicts the number and biomass of herbivores animals, which are called '**first order consumers**'. The apex depicts the small biomass of carnivores animals called as '**second order consumers**'

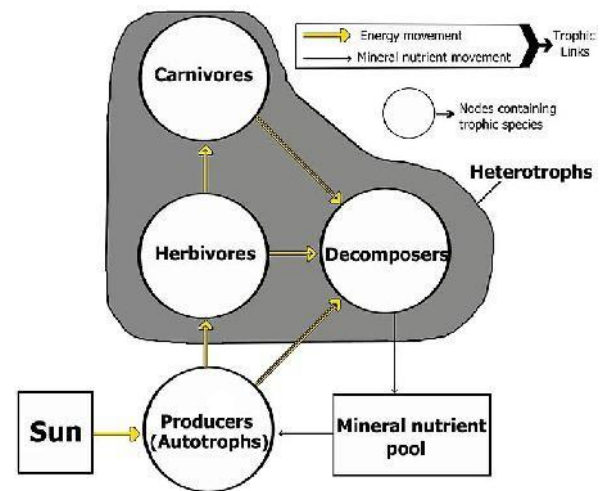
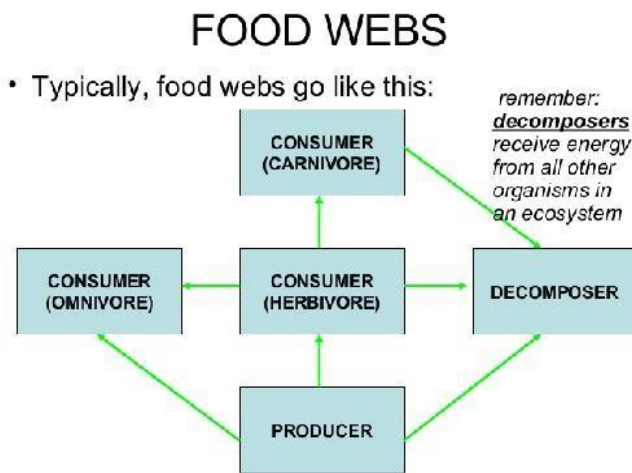
The plants and animals die, this material is returned to the soil after being broken down into simpler substances by **decomposer** such as insects, worms, bacteria and fungi. So that the plants can absorb the nutrients through their roots. Animals excrete waste products after digestion food, which goes back to the soil. This links the energy cycle to the nitrogen cycle.

Food Chains:

It's very simple in structure, **it is defined as uni- liner transfer of energy from one trophic level to next trophic level, called as food chain.**

The sequence of the transfer of food energy from one organism to another in an ecological community.

In atypical food chain plants are eaten by herbivores, which are then eaten by carnivores. These carnivores are inturn eaten by other carnivores.

Food web:

Food web (or **food cycle**) is a natural interconnection of food chains and a graphical representation (usually an image) of what-eats-what in an ecological community. Another name for **food web** is consumer-resource system.

A simplified food web illustrating a three trophic food chain (producer-herbivores-carnivores) linked to decomposer. The movement of mineral nutrients is cyclic, which is linked with multiple things.

Ex: man eats chicken, plants, all kind of foods, this is the example, for food web

Ecological Succession:

The process of sequential changes by which an ecosystem is established or The successive replacement of one community by another until the establishment of a stable ecosystem takes place.

Mainly it is categorized in four different ways,

1. Pioneer community- Initial stage to develop ecosystem
2. Seres (stages)
3. Climax community- final stage of an ecosystem
4. Stable community- cycling of nutrients

It is process to through which ecosystem tend to change over period of time. Succession can be related as to seasonal environmental changes, which creates changes in the community of plants and animals living in the ecosystem .

There is a tendency for succession to produce a more or less stable state at the end of the succession stages. The successive stages are related to way in which energy flows through the biological systems.

Example 1: pond ecosystem: Fluctuation from 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 stages in summer where its aquatic life remains dormant.

Example 2: Empty land-By air-seeds- plants-flower-butterfly/honeybee-birds-animals-bacteria-decomposition-nutrients

Learning Outcome of the Class: Students able to learn the Function of food chain and food web, Ecological pyramid

Assignment question: 1. Write a short note on (1) Ecological succession (2) food chain (3) food web (4) Ecological pyramid

ENERGY & ENVIRONMENT (18ME751)

Name of the Faculty: Asst. Prof. Parashuram A K Department: Mechanical Engineering KSIT Bangalore