ENVIRONMENTAL STUDIES

(TH-5)

3rd SEM ELECTRICAL ENGG.

PREPAIRED BY:

Mrs SASWATI PRIYADARSINI BISWAL

[Lecturer Dept. of EE, KALINGA NAGAR POLYTECHNIC ,TARAPUR, JAJPUR ROAD]

UNIT – I
ENVIRONMENT AND ECOSYSTEMS

ENVIRONMENTAL STUDIES

Introduction:

Environment is derived from the French word "*Environ*" which mean "encircle or surround" Environmental Studies deals with every issue that affects an organism. So, Environment refers to surroundings which vary from place to place and continent depending upon Physiography, Topography, Climate and the available Natural resources. Since the beginning of the culture, the natural resources such as Soil, Land, Water etc are being over-exploited causing the environment gets polluted or degraded. This has resulted in multi – dimensional environmental crisis like soil erosion, landslides and in turn have created soil pollution, air pollution, water pollution, noise pollution etc.

Definition:

The sum total of all surroundings of a living organism, including natural forces and other living things, which provide conditions for development and growth .

Importance of Environment:

1.Environment is concerned with day – to – day interaction with the surroundings with which human being is closely associated.

2. Environmental Science is related to many branches of Sciences

3. Environment is concerned with the importance of wild life and its protection.

4. Environmental Science explains the significant role of biodiversity in establishing ecological balance.

5. Environmental Science gives information relating to Population growth, Population explosion and impact on Population growth.

Environmental Science also gives information about water conservation, watershed management and the importance of water

Introduction of Ecology: The term "Ecology" was derived from Greek words viz., **Oikes** means house or place and **logs** means a discussion or study. So, ecology is the **scientific study of the distribution** and the **interactions** between organisms and their natural environment. The environment (surroundings) consists of: **living organisms** (biotic) and **non-living things** (abiotic) such as physical components of wind, temperature, rainfall, water, humidity , light, soil etc and chemical components of C,H,N,K,P,S etc..(in-organic components) and carbohydrates, proteins (organic components). Hence, Ecology involves studying the ecosystems. According to **George Jackson,** an Ecosystem is a natural unit consisting of all plants, animals and micro-organisms in an area functioning together with all of the non-living things. An ecosystem is the smallest unit of biosphere that has all the characteristics to support life. Pond ecosystem, forest ecosystem, desert ecosystem, marine ecosystem, urban ecosystem are some of the examples for ecosystems. An ecosystem varies in sizes from a few square kms to hundreds of square kms. Similarly an ecosystem may be temporary like a fresh pool / agriculture field or permanent like a forest / ocean.

Scope of ecosystem:

Ecology plays an important role in agriculture crop rotation, weed control (unwanted land); management of grasslands, forestry etc., biological surveys, fishery surveys, conservation of soil, wild life, surveys of water bodies like rivers, lakes; ponds etc...

Concept of ecosystem:

In an ecosystem, the interaction of life with its environment takes place at many levels. A single bacteria in the soil interacts with water, air around it within a small space while a fish in a river interacts with water and other animals, rivals in a large space. Considering the operational point of view; the biotic and biotic components of an ecosystem are so interlinked such that their separation from each other is practically difficult. So, in an ecosystem both organisms (biotic communities) and a biotic environment (rainfall, temperature, humidity) each influence the properties with other for maintenance of life.

Types of Ecosystems: Ecosystem may be natural or artificial.

Artificial Ecosystem: These are maintained or created artificially by man. The man tries to control biotic community as well as physico chemical environment.

Eg: Artificial pond, urban area development.

Natural Ecosystem: It consists of Terrestrial and Aquatic Ecosystems which are maintained naturally.

Terrestrial Ecosystem:

This ecosystem relates to biotic components living on the land. Vegetation dominates the community and the types of vegetation affect the climate, soil structure & a rapid exchange of O_2, water & CO_2

Aquatic Ecosystem:

This ecosystem relates to biotic community living in water. The types of water (fresh water, saline water, polluted water) dominate and affect the pH of water, depth of water, temperature of water etc. Aquatic ecosystem has been sub-divided into **fresh water** and **saline water** based on the quality of water.

Sturcture & Function of Ecosystem

The two major aspects of an ecosystem are: (1) Structure and (2) Function together they illustrate the organization of an ecosystem.

The Structure of an ecosystem consists of:

Abiotic structure includes the non-living things of the ecosystem such as physical factors (soil, temperature, light & water) and chemical factors consisting the inorganic compounds (N, C, H, K, P,S) & organic compounds (carbohydrates, proteins).

Biotic structure includes plants, animals & microorganisms present in an ecosystem form the biotic component. These organisms have different nutritional behavior and status in the ecosystem and are known as Autotrophs Producers), Heterotrophy (Consumers) & Micro-consumers (Decomposers) based on how they get their food. Hence, the structure of an ecosystem comprises:

(a) The composition of biological community species (plants, animals, microorganisms), their population, life cycles, distribution in space etc.

(b) The quantity and distribution of non-living things such as soil; water etc.

(c) The range or intensity of conditions like temperature, light, rainfall, humidity, wind & topography plays a major role in the structure of ecosystem.

Function of ecosystem means how an ecosystem works/ operates under natural conditions. The rate of biological energy flow ; the rate of nutrient cycles ie Bio- Geo-Chemical cycles and Ecological regulation (means regulation of organisms by Environment and regulation of Environment by organisms) plays a major role in the function of an ecosystem

1. Autotrophic components (Producers):

Autotrophic means self nourishing. Since these organisms are self nourishing, they are also called producers.

Eg: Algae, Green plants, Bacteria of photo synthetic. Green plants prepare their food themselves by making use of CO_2 present in the air & water in the presence of sunlight through the process of photosynthesis.

CO_2 + $2H_2O$ $\rightarrow CH_2O$ + O_2 + H_2O

(Carbon dioxide) (Water)(Carbohydrates) (Oxygen) (Water)

A few micro-organisms which can produce organic matter (nutrients) to some extent through oxidation of certain chemicals in the absence of sunlight known as chemo autotrophs.

Eg: In the Ocean depths, where there is no sunlight, chemo-autotrophic bacteria make use of the heat generated by the decay of radioactive elements for preparation of their food.

2. Hetero-trophic components (Consumers):

Hetero-trophic means dependent on others for nourishment directly or indirectly upon the utotrophs (producers) for their food. These are of the following types:

a. Herbivores (Primary consumers): These animals feed directly on living plants or remains of plants. Eg: Rabbits, Deer's, Insects.

b. Carnivores (secondary consumers): These carnivores (flesh eating) feed on the herbivores. Eg: Snakes, birds, Lizards, fox.

c. Tertiary consumers (or) Tertiary carnivores: These feed on the primary & secondary consumers. Eg: Lions, Tigers.

d. Omnivores: These consumers feed on both plants & animals. Eg Human beings, Birds (hawk)

3. Decomposers or Micro consumers: They feed on organic compounds of dead or living plants and animals for their food and energy. They absorb some of the products from decomposed material and release organic compounds (nutrients) making them available to producers.

Eg: Bacteria, Fungi, and Flagellates. The decomposers are also called as "Saprotrophs".

Food Chain:

The transfer of food energy from the producers (plants) through a series of organisms (Herbivores, Carnivores) successively with the repeated activities of eating and being eaten is known as food chain. In an ecosystem(s), one organism is eaten by the second who in turn is eaten by the third and so on... This kind of feeding relationship is called food chain.

Examples of food chain:

1. Grass→ Grasshopper→ Frog→ Snake→ Hawk.
2. Grass→ Mouse→ Snake →Hawk.

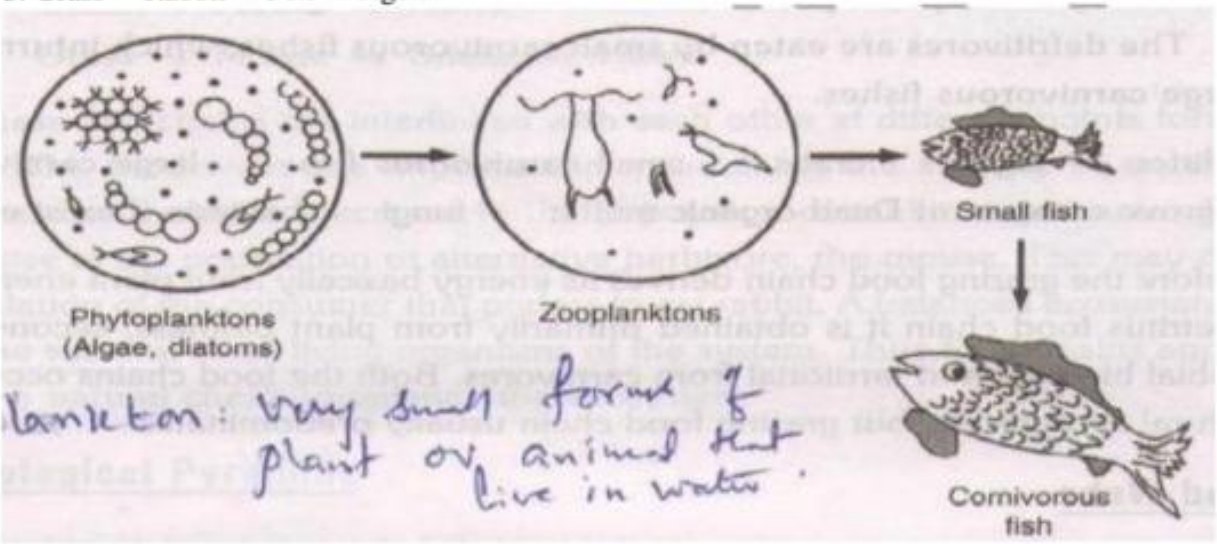
3. Grass→ Rabbit→ Man.
4. Grass→ Mouse→ Hawk.
5. Plant leaf →Caterpillar →Sparrow →Hawk.

Explanation: A caterpillar eats a plant leaf, a sparrow eats the caterpillar, and a hawk eats the sparrow. When they all die, they are all consumed by micro organisms like bacteria (or) fungi which break down the organic matter and convert it into simple inorganic substances that can again be used by the plants.

In nature, there are two basic types of food chains
viz: 1. Grazing food chain and (2) Detritus food chain

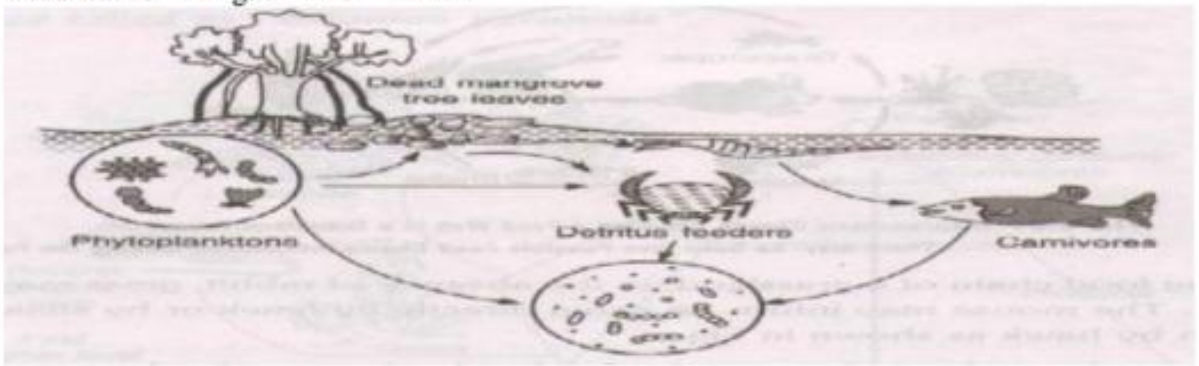
Grazing food chain: This food chain starts with green plants (primary producers) and goes to herbivores and on to carnivores.

1. Phytoplankton's→ Zooplanktons →Small fish→ Tuna.
2. Phytoplankton's→ Zooplanktons→ Fish→ Man.
3. Grass→ Rabbit→ Fox→ Tiger.



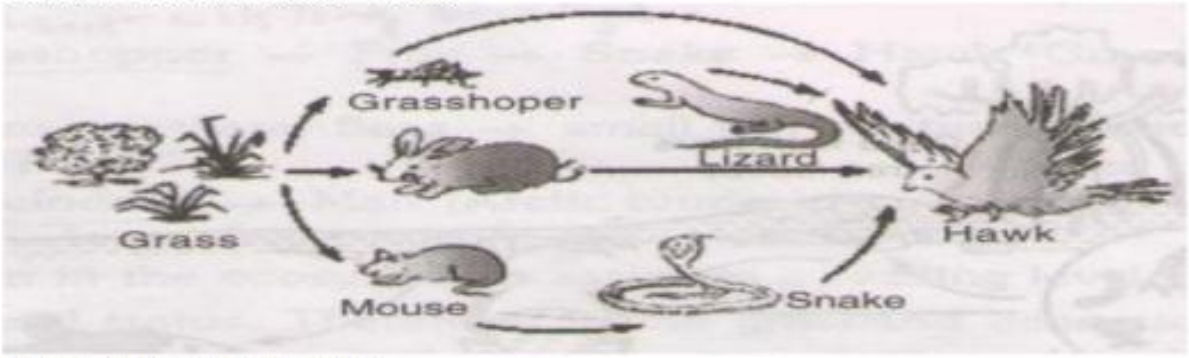
Detritus food chain: This food chain starts from dead organic matter (dead leaves/ plants / animals) and goes to Herbivores and on to Carnivores and so on.....

Leaves or dead plants→ Soil mites→ Insects→ Birds.
Dead organic matter→ Bacteria → Insects.
Dead leaves → Algae→ Fish→ Man.



FOOD WEB: Food web is a net work of food chains where different types of organisms are connected at different trophic levels so that there are a number of options of eating and being eaten at each trophic level. (A trophic level refers to an organism's position in the food chain).

1. Grass→ Grasshopper→ Hawk
2. Grass→ Grasshopper→ Lizard→ Hawk
3. Grass→ Rabbit→ Hawk
4. Grass→ Mouse→ Hawk
5. Grass→ Mouse→ Snake→ Hawk



ECOLOGICAL PYRAMID:

Ecological pyramids were first studied by a British ecologist Charles Eltan (1927). An Ecological Pyramid is a graphical representation consisting varioustrophic levels with producers forming the base and top occupy the carnivores. In an ecological pyramid the huge number of tiny individuals form at the base and a few large individuals occupy the top / apex . This formation is known as ecological pyramid. Hence, all producers (micro & macro plants) belong to the *I trophic level*; all primary consumers belong to *II trophic level* and organisms feeding on these consumers belong to the *III trophic level* and so on.

The ecological pyramids are of three types. They are:

1. The pyramid of Numbers (showing population).
2. The pyramid of Biomass (showing total mass of organisms).
3. The pyramid of energy (showing energy flow).