Environmental studies

Unit-1 Environment & Ecosystems

Topics to be covered: Definition, scope, and importance Need for public awareness
Concept of an ecosystem, Structure, and function of an ecosystem: Producers, consumers, decomposers, Energy flow in the ecosystems, Ecological succession, Food chains, food webs, and ecological pyramids.

INTRODUCTION

The science of Environment studies is a multi-disciplinary science because it comprises various branches of studies like chemistry, physics, medical science, life science, agriculture, public health, sanitary engineering etc. It is the science of physical phenomena in the Environment. It studies of the sources, reactions, transport, effect and fate of physical a biological species in the air, water and soil and the effect of from human activity upon these.

ENVIRONMENTAL is the representative of physical components of the earth where in man is an important factor affecting the environment.

(i) **Definitions 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.

(ii) **Scope of Environment:** The environment consists of four segments as under:

1. **Atmosphere:** The atmosphere implies the protective blanket of gases, surrounding the earth:
(a) It sustains life on the earth.
(b) It saves it from the hostile environment of outer space.
(c) It absorbs most of the cosmic rays from outer space and a major portion of the electromagnetic radiation from the sun.
(d) It transmits only here ultraviolet, visible, near infrared radiation (300 to 2500 nm) and radio

waves. (0.14 to 40 m) while filtering out tissue-damaging ultraviolate waves below about 300 nm. The atmosphere is composed of nitrogen and oxygen. Besides, argon, carbon dioxide, and trace gases.

2. **Hydrosphere:** The Hydrosphere comprises all types of water resources oceans, seas, lakes, rivers, streams, reserviour, polar icecaps, glaciers, and ground water.

(i) Nature 97% of the earth‟s water supply is in the oceans,

(ii) About 2% of the water resources is locked in the polar icecaps and glaciers.

(iii) Only about 1% is available as fresh surface water-rivers, lakes streams, and ground water fit to be used for human consumption and other uses.

3. **Lithosphere:** Lithosphere is the outer mantle of the solid earth. It consists of minerals occurring in the earth‟s crusts and the soil *e.g.* minerals, organic matter, air and water.

4. **Biosphere:** Biosphere indicates the realm of living organisms and their interactions with environment, viz atmosphere, hydrosphere and lithosphere.

Element of Environment

Environment is constituted by the interacting systems of physical, biological and cultural Elements inter-related in various ways, individually as well as collectively. These elements may be explained as under:

(1) Physical elements

Physical elements are as space, landforms, water bodies, climate soils, rocks and minerals. They determine the variable character of the human habitat, its opportunities as well as limitations.

(2) Biological elements

Biological elements such as plants, animals, microorganisms and men constitute the biosphere.

(3) Cultural elements

Cultural elements such as economic, social and political elements are essentially manmade features, which make cultural milieu.

ENVIRONMENT STUDIES: IMPORTANCE

Importance of Environment Studies: The environment studies enlighten us, about the importance of protection and conservation of our indiscriminate release of pollution into the environment.

At present a great number of environment issues, have grown in size and complexity day by day,

threatening the survival of mankind on earth. We study about these issues besides and effective suggestions in the Environment Studies. Environment studies have become significant for the following reasons:

1. Environment Issues Being of International Importance

It has been well recognised that environment issues like global warming and ozone depletion, acid rain, marine pollution and biodiversity are not merely national issues but are global issues and hence must be tackled with international efforts and cooperation.

2. Problems Cropped in The Wake of Development

Development, in its wake gave birth to Urbanization, Industrial Growth, Transportation Systems, Agriculture and Housing etc. However, it has become phased out in the developed world. The North, to cleanse their own environment has, fact fully, managed to move „dirty" factories of South. When the West developed, it did so perhaps in ignorance of the environmental impact of its activities. Evidently such a path is neither practicable nor desirable, even if developing world follows that.

3. Explosively Increase in Pollution

World census reflects that one in every seven persons in this planted lives in India.
Evidently with 16 per cent of the world's population and only 2.4 per cent of its land area, there is a heavy pressure on the natural resources including land. Agricultural experts have recognized soils health problems like deficiency of micronutrients and organic matter, soil salinity and damage of soil structure.

4. Need for An Alternative Solution

It is essential, especially for developing countries to find alternative paths to an alternative goal. We need a goal as under:

(1) A goal, which ultimately is the true goal of development an environmentally sound and sustainable development.

(2) A goal common to all citizens of our earth.

(3) A goal distant from the developing world in the manner it is from the over-consuming wasteful societies of the "developed" world.

5. Need To Save Humanity From Extinction

It is incumbent upon us to save the humanity from exinction. Consequent to our activities constricting the environment and depleting the biosphere, in the name of development.

6. Need For Wise Planning of Development

Our survival and sustenance depend. Resources withdraw, processing and use of the product have all to by synchronised with the ecological cycles in any plan of development our actions should be planned ecologically for the sustenance of the environment and development.

7. Misra's Report

Misra (1991) recognized four basic principles of ecology, as under:

(i) Holism

(ii) Ecosystem

(iii) Succession

(iv) Conversation.

Holism has been considered as the real base of ecology. In hierarchical levels at which interacting units of ecology are discussed, are as under:

Individual<population<community<ecosystem<biome<biosphere.

Misra (1991) has recognised four basic requirements of environmental management as under:

(i) Impact of human activities on the environment,

(ii) Value system,

(iii) Plan and design for sustainable development,

(iv) Environment education.

Keeping in view the of goal of planning for environmentally sustainable development India contributed to the United Nations Conference on Environment and Development (UNCED), also referred to as "Earth Summit" held at Rio de Janciro, the Capital of Brazil, 3rd-14th June, 1992.

NEED FOR PUBLIC AWARENESS

It is essential to make the public aware of the formidable consequences of the Environmental Degradation, if not retorted and reformative measures undertaken, would result in the extinction of life. We are facing various environmental challenges. It is essential to get the country

acquainted with these challenges so that their acts may be eco-friendly. Some of these challenges are as under:

1. Growing Population

A population of over thousands of millions is growing at 2.11 per cent every year. Over 17 billion people are added each year. It puts considerable pressure on its natural resources and reduces the gains of development. Hence, the greatest challenge before us is to limit the population growth. Although population control does automatically lead to development, yet the development leads to a decrease in population growth rates. For this development of the women is essential.

2. Poverty

India has often been described a rich land with poor people. The poverty and environmental degradation have a nexus between them. The vast majority of our people are directly dependent on the nature resources of the country for their basic needs of food, fuel shelter and fodder. About 40% of our people are still below the poverty line. Environment degradation has adversely affected the poor who depend upon the resources of their immediate surroundings. Thus, the challenge of poverty and the challenge environment degradation are two facets of the same challenge. The population growth is essentially a function of poverty. Because, to the very poor, every child is an earner and helper and global concerns have little relevance for him.

3. Agricultural Growth

The people must be acquainted with the methods to sustain and increase agricultural growth with damaging the environment. High yielding varities have caused soil salinity and damage to physical structure of soil.

4. Need to Ground water

It is essential of rationalizing the use of groundwater. Factors like community wastes, industrial effluents and chemical fertilizers and pesticides have polluted our surface water and affected quality of the groundwater. It is essential to restore the water quality of our rivers and other water bodies as lakes is an important challenge. It so finding our suitable strategies for consecration of water, provision of safe drinking water and keeping water bodies clean which are difficult challenges is essential.

5. Development And Forests

Forests serve catchments for the rivers. With increasing demand of water, plan to harness the

mighty river through large irrigation projects were made. Certainly, these would submerge forests; displace local people, damage flora and fauna. As such, the dams on the river Narmada, Bhagirathi and elsewhere have become areas of political and scientific debate.

Forests in India have been shrinking for several centuries owing to pressures of agriculture and other uses. Vast areas that were once green, stand today as wastelands. These areas are to be brought back under vegetative cover. The tribal communities inhabiting forests respects the trees and birds and animal that gives them sustenance. We must recognize the role of these people in restoring and conserving forests. The modern knowledge and skills of the forest deptt. should be integrated with the traditional knowledge and experience of the local communities. The trategies for the joint management of forests should be evolved in a well planned way.

6. Degradation of Land

At present out of the total 329 mha of land, only 266 mha possess any potential for production. Of this, 143 mha is agricultural land nearly and 85 suffers from varying degrees of soil degradation. Of the remaining 123 mha, 40 are completely unproductive. The remaining 83 mha is classified as forest land, of which over half is denuded to various degrees. Nearly 406 million head of livestock have to be supported on 13 mha, or less than 4 per cent of the land classified as pasture land, most of which is overgrazed. Thus, our of 226 mha, about 175 mha or 66 per cent is degraded to varying degrees. Water and wind erosion causes further degradation of almost 150 mha this degradation is to be avoided.

7. Reorientation of Institutions

The people should be roused to orient institutions, attitudes and infrastructures, to suit conditions and needs today. The change has to be brought in keeping in view India‟s traditions for resources use managements and education etc. Change should be brought in education, in attitudes, in administrative procedures and in institutions. Because it affects way people view technology resources and development.

8. Reduction of Genetic Diversity

Proper measures to conserve genetic diversity need to be taken. At present most wild genetic stocks have been disappearing from nature. Wilding including the Asiatic Lion are facing problem of loss of genetic diversity. The protected areas network like sanctuaries, national parks, biosphere reserves are isolating populations. So, they are decreasing changes of one group breeding with another. Remedial steps are to be taken to check decreasing genetic diversity.

9. Evil Consequences of Urbanisation

Nearly 27 per cent Indians live in urban areas. Urbanisation and industrialisation has given birth to a great number of environmental problem that need urgent attention. Over 30 percent of urban Indians live in slums. Out of India‟s 3,245 towns and cities, only 21 have partial or full sewerage and treatment facilities. Hence, coping with rapid urbanization is a major challenge.

10. Air and water Population

Majority of our industrial plants are using outdated and population technologies and makeshift facilities devoid of any provision of treating their wastes. A great number of cities and industrial areas that have been identified as the worst in terms of air and water pollution. Acts are enforced in the country, but their implement is not so easy. The reason is their implementation needs great resources, technical expertise, political and social will. Again the people are to be made aware of these rules. Their support is indispensable to implement these rules.

VARIOUS TYPES OF ENVIRONMENT

According to Kurt Lewin, environment is of three types which influence the personality of an individual as under:

(a) Physical Environment,

(b) Social and Cultural Environment, and

(c) Psychological Environment.

These may be explained as under:

1. Physical Environment

Physical environment, refers to geographical climate and weather or physical conditions wherein and individual lives. The human races are greatly influenced by the climate. Some examples are as under:

(a) In the cold countries i.e. European countries the people are of white colour. Likewise, in Asian and African countries, that is, in hot countries people are of dark complexion.

(b) The physique of an individual depends on climate conditions as the individual tries to adjust in his physical environment.

(*d*) The human working efficiency also depends on the climatic conditions.

2. Social Environment

Social Environment includes an individual‟s social, economic and political condition

wherein he lives. The moral, cultural and emotional forces influence the life and nature of individual behaviour. Society may be classified into two categories as under:

(i) An open society is very conductive for the individual developement.

(ii) A closed society is not very conductive for the developenment.

3. Psychological Environment

Although physical and social environment are common to the individual in a specific situation. Yet every individual has his own psychological environment, in which he lives. Kurt Lewin has used the term „life space" for explaining psychological environment. The Psychological environment enables us to understand the personality of an individual. Both the person and his goal form psychological environment.

If a person is unable to overcome the barriers, he can either get frustrated or completed to change his goal for a new psychological environment. But adopting this mechanism, the individual is helped in his adjustment to the environment.

Ecosystems:

The term Ecology was coined by Earnst Haeckel in 1869. It is derived from the Greek words Oikos- home + logos- study. So, 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. Modern ecologists believe that an adequate definition of ecology must specify some unit of study and one such basic unit described by Tansley (1935) was ecosystem. "An ecosystem is a group of biotic communities of species interacting with one another and with their non-living environment exchanging energy and matter". Now ecology is often defined as "the study of ecosystems".

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

The ecosystem is thus, a unit or a system which is composed of a number of subunits that are all directly or indirectly linked with each other. They may be freely exchanging energy and matter from outside—an open ecosystem or may be isolated from outside—a closed ecosystem

ECOSYSTEM CHARACTERISTICS

Ecosystems show large variations in their size, structure, composition etc. However, all the

ecosystems are characterized by certain basic structural and functional features which are common.

STRUCTURAL FEATURES

Composition and organization of biological communities and abiotic components constitute the structure of an ecosystem.

I. Biotic Structure

The plants, animals and microorganisms present in an ecosystem form the biotic component.

(a) Producers: They are mainly the green plants, which can synthesize their food themselves by making use of carbon di oxide present in the air and water in the presence of sunlight by involving chlorophyll, the green pigment present in the leaves, through the process of photosynthesis. They are also known as photo autotrophs (auto=self; troph=food, photo=light).

There are some microorganisms also which can produce organic matter to some extent through oxidation of certain chemicals in the absence of sunlight. They are known as chemosynthetic organisms or chemo-autotrophs. For instance, in the ocean depths, where there is no sunlight, chemoautotrophic sulphur bacteria make use of the heat generated by the decay of radioactive elements present in the earth‟s core and released in ocean‟s depths. They use this heat to convert dissolved hydrogen sulphide (H_2S) and carbon dioxide (CO_2) into organic compounds.

(b) Consumers: All organisms which get their organic food by feeding upon other organisms are called consumers, which are of the following types:

(i) Herbivores (plant eaters): They feed directly on producers and hence also known as primary consumers. e.g. rabbit, insect, man.

(ii) Carnivores (meat eaters): They feed on other consumers. If they feed on herbivores they are called secondary consumers (e.g. frog) and if they feed on other carnivores (snake, big fish etc.) they are known as tertiary carnivores/consumers.

(iii) Omnivores: They feed on both plants and animals. e.g. humans, rat, fox, many birds.

(iv) Detritivores (Detritus feeders or Saprotrophs): They feed on the parts of dead organisms, wastes of living organisms, their cast-offs and partially decomposed matter e.g. beetles, termites, ants, crabs, earthworms etc.

(c) Decomposers: They derive their nutrition by breaking down the complex organic molecules to simpler organic compounds and ultimately into inorganic nutrients. Various bacteria and fungi are decomposers.

In all the ecosystems, this biotic structure prevails. However, in some, it is the primary producers which predominate (e.g. in forests, agroecosystems) while in others the decomposers predominate (e.g. deep ocean).

II. Abiotic Structure

The physical and chemical components of an ecosystem constitute its abiotic structure. It includes climatic factors, edaphic (soil) factors, geographical factors, energy, nutrients and toxic substances.

(a) Physical factors: The sunlight and shade, intensity of solar flux, duration of sun hours, average temperature, maximum-minimum temperature, annual rainfall, wind, latitude and altitude, soil type, water availability, water currents etc. are some of the important physical features which have a strong influence on the ecosystem.

We can clearly see the striking differences in solar flux, temperature and precipitation (rainfall, snow etc.) pattern in a desert ecosystem, in a tropical rainforest and in tundra ecosystem.

(b) Chemical factors: Availability of major essential nutrients like carbon, nitrogen, phosphorus, potassium, hydrogen, oxygen and sulphur, level of toxic substances, salts causing salinity and various organic substances present in the soil or water largely influence the functioning of the ecosystem.

FUNCTIONAL FEATURES

Every ecosystem performs under natural conditions in a systematic way. It receives energy from the sun and passes it on through various biotic components and in fact, all life depends upon this flow of energy.

The major functional attributes of an ecosystems are as follows:

(i) Food chain, food webs and trophic structure.

(ii) Energy flow.

(iii) Cycling of nutrients (Biogeochemical cycles).

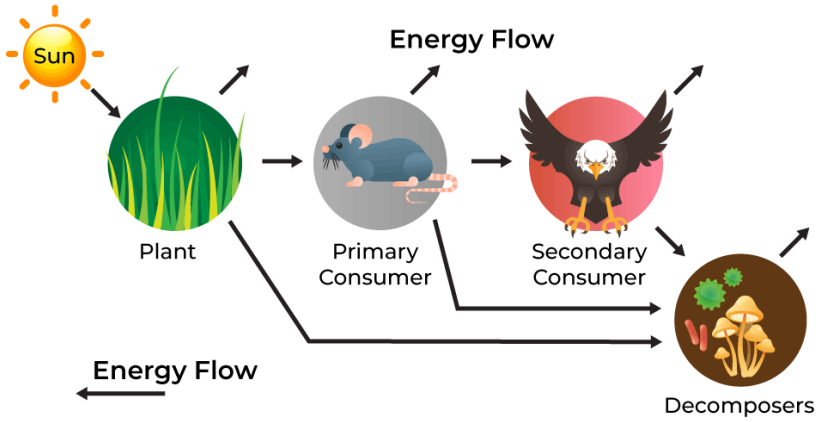
(iv) Primary and Secondary production.

(v) Ecosystem development and regulation.

Tropic structure: The structure and functions of the ecosystem are interrelated and influence each other. The flow of energy is mediated through a series of feeding relationships in a definite sequence or pattern which is known as Food chain. Nutrients too move along the food chain. The producers and consumers are arranged in an ecosystem in a definite manner and their interaction along with the population size is expressed together as Trophic structure. Each food level is known as Trophic level and the amount of living matter at each Trophic level at a given time is known as standing crop or standing biomass.

What is Energy Flow of Ecosystem?

Energy flow in an ecosystem is defined as the movement or transfer of energy from one trophic level to another in an ecosystem. The energy that is passed is in the form of chemical energy. Energy flow is the phenomenon that is responsible to sustain life on this planet. All the biotic components in this ecosystem need energy for their survival. If the energy flow in an ecosystem is disturbed, then it leads to ecological imbalance.



FOOD CHAINS

• The sequence of eating and being eaten in an ecosystem is known as food chain.

• All organisms, living or dead, are potential food for some other organism and thus, there is essentially no waste in the functioning of a natural ecosystem.

Some common examples of simple food chains are:

Grass → grasshopper → Frog → Snake → Hawk (Grassland ecosystem)

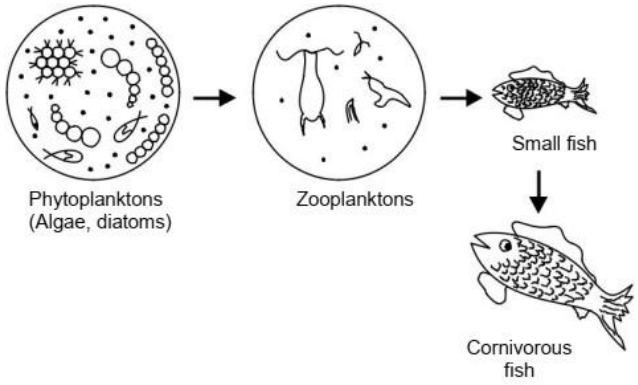
Phytoplankton‟s → water fleas → small fish → Tuna (Pond ecosystem)

Each organism in the ecosystem is assigned a feeding level or trophic level depending on its nutritional status. Thus, in the grassland food chain, grasshopper occupies the Ist trophic level, frog the IInd and snake and hawk occupy the IIIrd and the IVth trophic levels, respectively.

The decomposers consume the dead matter of all these trophic levels. In nature, we come across two major types of food chains.

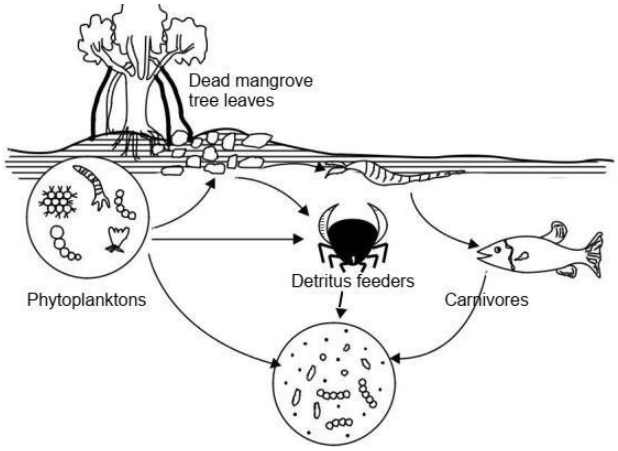
1. Grazing food chain: It starts with green plants (primary producers) and culminates in carnivores. All the examples cited above show this type of food chain. Another example could be

Grass → Rabbit → Fox



A grazing food chain in a pond ecosystem

2. Detritus food chain: It starts with dead organic matter which the detritivores and decomposers consume. Partially decomposed dead organic matter and even the decomposers are consumed by detritivores and their predators. An example of the detritus food chain is seen in a Mangrove (estuary)



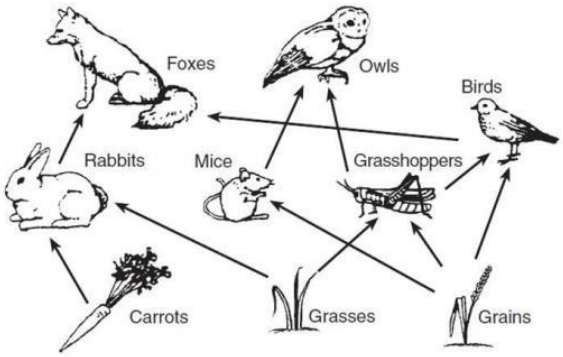
A detritus food chain in an estuary based on dead leaves of mangrove trees

Leaf litter → algae → crabs → small carnivorous fish → large carnivorous fish (Mangrove ecosystem)

Dead organic matter → fungi → bacteria (Forest ecosystem)

FOOD WEB

Food chains in ecosystems are rarely found to operate as isolated linear sequences. Rather, they are found to be interconnected and usually form a complex network with several linkages and are known as food webs. Thus, “food web is a network 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.”



Significance of food chains and food webs

Food chains and food webs play a very significant role in the ecosystem because the two most important functions of energy flow and nutrient cycling take place through them.

• The food chains/food web also help in maintaining and regulating the population size of different animals and thus, help maintain the ecological balance.

• Food chains/food webs show a unique property of biological magnification of some chemicals.

ECOLOGICAL SUCCESSION

Ecological succession is the process by which the structure and composition of a biological community change over time. Each of the ecological succession stages is characterized by different species compositions and environmental conditions.

Ecological succession is the gradual process of change in the species composition of an ecosystem over time. It occurs as a result of natural disturbances like fires, floods, or human activities such as farming or deforestation. In the initial stages of succession, pioneer species, like mosses and lichens, colonize barren environments, gradually paving the way for more complex communities of plants and animals.

As these communities develop, they change the environmental conditions which make it more suitable for different species to thrive. This process continues until a stable climax community is reached. It is characterized by a range of species which are well adapted to the prevailing environmental conditions. The ecological succession and its types include – Primary and Secondary Succession.

Types of Ecological Succession

Primary Succession: Primary succession is the succession that begins in lifeless areas such as the regions devoid of soil or barren lands where the soil is unable to sustain life. When the planet was first formed there was no soil on earth. The earth was only made up of rocks. These rocks were broken down by microorganisms and eroded to form soil. This is a process called erosion. The soil then becomes the foundation of plant life. These plants help in the persistence of different animals and progress from primary succession to the climax community. When the primary ecosystem is destroyed, secondary succession takes place.

Secondary Succession: Secondary succession occurs when the primary ecosystem gets wiped out. For e.g., a climax community gets destroyed by fire. It gets recolonized after the devastation. This is known as secondary ecological succession. Small plants emerge first, followed by larger plants. The tall trees block the sunlight and change the structure of the organisms below the canopy.

What is Cyclic Succession?

The change in the structure of an ecological system on a cyclic basis is called cyclic succession. There are some plants that stay dormant for most of the year but emerge all at once. This can cause structural variations in the ecosystem.

Causes of Ecological Succession

- Climatic Causes: these can be rainfall, temperature variations, humidity, gas composition, etc.
- Biotic Causes: the organisms in a community compete to thrive for existence. Some of them are lost in the process while some new ones are incorporated.
- External Causes: soil conditions are affected by the process of migration, invasion, and competition amongst various species.

Characteristics of Ecological Succession

- It results from the disparity in the physical atmosphere of the community.
- It is a systematic procedure of community development.
- It involves variations in species structure and it increases the diversity of species.
- Nutrient variation regulates the settlement of new communities.
- Succession operates in a stabilized ecosystem.

Mechanism of Ecological Succession

The entire process of primary succession is accomplished through a series of progressive steps followed one after another. The different sequential steps may be outlined as below:

Nudation: It is a process of formation of a bare area without any form of life for the arrival of new species. The causes of nudation may be:

- Topographic: The existing community may fade away due to soil erosion, landslide, volcanic activity, etc.
- Climatic: The existing community may be demolished due to storm, fire, frost, drought.
- Biotic: The community may also be destroyed by anthropogenic activities like the destruction of the forest, the destruction of grassland, etc.

Invasion: The successful establishment of a species in a vacant area is called invasion. This process of establishment is completed in three successive steps:

- Migration (dispersal): The seeds, spores of the species are carried to the unadorned area by the agents like air, water, etc.
- Establishment: The process of the successful establishment (germination and growth) of the species in the new area as a result of adjustment with the prevailing conditions is known as ecesis.
- Aggregation: After ecesis, the individuals of species increase their number by reproduction and thus, are aggregated in a particular area.

Competition and Coaction: As the species aggregate within a restricted space, there happens competition for space and nutrition. Secondly, the life process of one individual is affected by the surrounding species in various ways which are known as coaction.

Reaction: The species present in an environment constantly interact with it by causing its modification. The mechanism of the modification of the environment through the influence of living organisms on it is known as a reaction. Hence, the existing community may be replaced by another community.

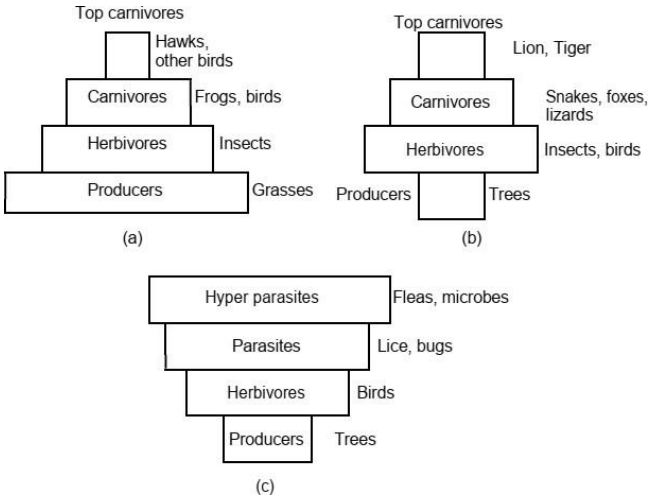
Stabilization: At last, a final or terminal community is established which can maintain equilibrium. This community is known as the climax community.

ECOLOGICAL PYRAMIDS

Graphic representation of tropic structure and function of an ecosystem, starting with producers at the base and successive trophic levels forming the apex is known as an ecological pyramid.

Ecological pyramids are of three types:

a) Pyramid of numbers: It represents the number of individual organisms at each trophic level. We may have upright or inverted pyramid of numbers, depending upon the type of ecosystem and food chain as shown in below Fig.

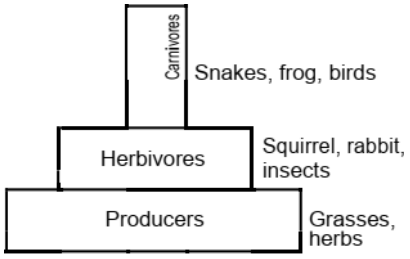


• A grassland ecosystem (Fig. a) and a pond ecosystem show an upright pyramid of numbers. The producers in the grasslands are grasses and that in a pond are phyto planktons (algae etc.), which are small in size and very large in number. So the producers form a broad base. The herbivores in a grassland are insects while tertiary carnivores are hawks or other birds which are gradually less and less in number and hence the pyramid apex becomes gradually narrower forming an upright pyramid.

• In a forest ecosystem (Fig. b), big trees are the producers, which are less in number and hence form a narrow base. A larger number of herbivores including birds, insects and several species of animals feed upon the trees (on leaves, fruits, flowers, bark etc.) and form a much broader middle level. The secondary consumers like fox, snakes, lizards etc. are less in number than herbivores while top carnivores like lion, tiger etc. are still smaller in number. So the pyramid is narrow on both sides and broader in the middle.

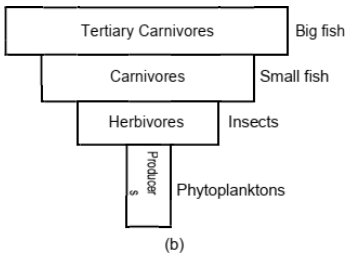
• Parasitic food chain shows (Fig. c) an inverted pyramid of number. The producers like a few big trees harbour fruit eating birds acting like herbivores which are larger in number. A much higher number of lice, bugs etc. grow as parasites on these birds while a still greater number of hyper parasites like bugs, fleas and microbes feed upon them, thus making an inverted pyramid.

b) Pyramid of biomass: It is based upon the total biomass (dry matter) at each trophic level in a food chain. The pyramid of biomass can also be upright or inverted.



(a)

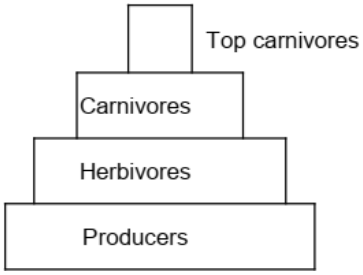
above Fig. (a, b) shows pyramids of biomass in a forest and an aquatic ecosystem. The pyramid of biomass in a forest is upright in contrast to its pyramid of numbers. This is because the producers (trees) accumulate a huge biomass while the consumers‟ total biomass feeding on them declines at higher trophic levels, resulting in broad base and narrowing top.



(b)

The pond ecosystem shows an inverted pyramid of biomass (Fig. b). The total biomass of producers (phytoplankton‟s) is much less as compared to herbivores (zooplanktons, insects), Carnivores (Small fish) and tertiary carnivores (big fish). Thus the pyramid takes an inverted shape with narrow base and broad apex

c) Pyramid of Energy: The amount of energy present at each trophic level is considered for this type of pyramid. Pyramid of energy gives the best representation of the trophic relationships and it is always upright.



At every successive trophic level, there is a huge loss of energy (about 90%) in the form of heat, respiration etc. Thus, at each next higher level only 10% of the energy passes on. Hence, there is a sharp decline in energy level of each successive trophic level as we move from producers to top carnivores. Therefore, the pyramid of energy is always upright as shown in Fig.