

**LECTURE NOTES**  
**on**  
**ENVOIRMENTAL STUDIES**

On  
3rd Semester of all Engineering Branches

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Environment is derived from French language 'Environ', which means circle or surrounded.

### Definition:-

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

### Importance of Environmental studies:-

- Environment is concerned with day to day interaction with the surrounding with which human being is closely associated.
- Environmental science is related to many branches of science.
- Environment is concern with the importance of wild life and it's protection.
- Environmental science explain the significant role of bio-diversity in establishing ecological balance.
- Environmental science gives information about water conservation, waste management & the importance of water.
- Environmental science gives the information relation population growth, explosion and impact on population growth.

### Scope of Environmental Studies:-

There are many scope available in environmental studies.



## ① Scope of eco system

### Concept of eco system:-

- In an eco system the interaction of life with it's environment take place at many level.
- A single bacteria in the soil interact with water, air around it within in it.
- All the biotic and non-biotic components of an eco system are so inter linked such that their separation from each other is practically difficult.
- In an eco-system both organism and biotic environment, each other are influence the properties with other for maintenance of life.

### Type of eco-system

Eco-system are may be natural or artificial.

- (i) Artificial eco-system:- Artificial pond, Urban area development
- (ii) Natural eco-system:- Nature things
- (iii) Terrestrial eco-system:- Climate, soil structure, rapid exchange of  $O_2$ ,  $H_2O$ ,  $CO_2$ .
- (iv) Aquatic eco-system:- Fresh water, saline water, polluted water



## Chapter-1

- ① Definition, scope & importance
- ② Need for public awareness.

### Definition:-

- The word environment is derived from French word 'Environ' which means surrounding.
- E.S is a multidisciplinary science which combines physics, chemistry, biology, medical wealth science, life science, agricultural science, public health and so on.
- The main objective of environmental science is to protect the environment.
- All the factors such as physical, geographical, chemical, biological, ecological which affects human life & etc existences on this planet are called environment.
- The environment includes earth, trees, forests, farms, vegetation & other biological life such as animals, plants, bacteria & micro-organism etc.
- All the components of the environments are basically divided into two types:
  - a. Biotic environment
  - b. Abiotic environment

### a. Biotic Environment:-

Environments includes all living organisms & biological life such as animals, birds, forests, reptiles, insects, bacteria & micro-organisms like algae, fungus etc.

### b. Abiotic Environment:-

- i. Environments includes all non-living components such as land, mountains, rivers, air, water, temperature, humidity, water vapour, sand, dust, clouds etc.



### Scope:-

- Our surroundings includes forest, rivers, mountains, desert or combination of these elements.
- Most of us live in landscapes that have been heavily modified by the human beings in village town & cities.
- But even those of us who live in cities get out ~~for~~ food supply from surrounding villages.
- We use to water to drink & other day today activities, we breath air, we use resources from which food is made.
- Our depends on nature is so great that we cannot continue to live without protecting the earth environmental resources.

### Importance of Environment:-

- Environment is not a single subject. It is a combination of several subjects that includes both sciences & social sciences.
- To understand all the different aspects of our environment we need to understand biology, Chemistry, physics, geography, resource management, economics and population issue.
- Thus the scope of environmental studies, extremely wide & covers some aspects of nearly every discipline.
- We will in a world in which natural resources are limited. Water, air, soil, minerals, oils, the product we get from forests, grass lands, oceans & from agriculture & from livestock are all the part of our life support system without them life is self will be impossible.



- As we keep on increasing in number the quantity of resources each of ~~of~~ also increases.
- Air pollution leads to respiratory diseases.
- Water pollution leads to gastrointestinal disorder & many pollutants are known to cause cancer.

Need for public awareness:-

- Increasing population, ~~at~~ urbanization & poverty have generated pressure on the natural resources & lead to a degradation of the environment.

Environmental Pollution:-

- Environmental pollution can't be prevented by laws alone. Public participation is equally important with regards to environmental protection.

⇒ Environmental Education (EE):-

Environmental education is a process of learning by giving an overall perspective of knowledge & awareness of the environment. It sensitizes the society about environmental issues & challenges interested individuals to develop skills & appropriate solutions.

- Climate change, loss of biodiversity, declining fisheries, ozone layer depletion, illegal trade of species, destruction of habitats, land degradation, depleting ground water supplies, environmental pollution, solid waste disposal pose a serious threat to ecosystem in forest, rural, urban and marine ecosystem.
- Both formal and informal education on the environment will give the entered individual the



knowledge, values, skills & tools needed to face the environmental challenges on a local and global level.

## 26/01/2022 Chapter-2 Natural Resources

### Resource

→ Anything i.e. used to satisfy human needs typically resource are materials, energy, service etc.

These are two types

(a) Human Resource

(b) Natural Resource

### (a) Human Resource

→ They are aggregate (stagnant) of all those human capability which help of human activities.

Ex:- Human knowledge, Technical knowledge, Physical strength etc.

→ Human knowledge, technical knowledge, Physical strength are resource so long as they are applied on human activities.

→ The strength and knowledge aren't human resource, population isn't human resource is productivity of human activity.

### (b) Natural Resource :-

→ It includes all those known source and materials provided by the nature are consumed by man directly or indirectly for the full fill of needs in natural resource.

→ Various elements are group of element of natural environment such as land, forest, water, mineral are natural resource.



- Natural resource are obtain from nature.
- Natural resource can be defined as the resource that exists on the planet independent of human action.

It is two types

(a) Renewable Source

(b) Non-Renewable Source

(a) Renewable Source

- Renewable source that are infinite quantity of nature and can be repeatedly are called renewable resource.

Ex:- Forest, Water, Wind

(b) Non-Renewable Source

Non-Renewable source that are limited in due to their non-renewable nature and may run out in the future are use for non-renewable resource.

Ex:- Minerals, Fossil

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Forest Resource

- A forest is a natural self community characterised by vertical structure created by presence of trees.
- Trees are large and woody plants.
- Forest can exist in many different region on the earth under a wide range of condition but all true forest share these physical characteristics.
- Because of forest is a natural community so forest is ~~static~~ static in time i.e. because forest community respond to outside influences



## Use and over exploitation:-

→ A forest is a biotic community of trees, shrubs and other woody vegetable. Usually this is an valuable, renewable natural resource to man in many way.

### a) Fuel Wood:-

Wood is used as a source of energy for cooking purpose and for keeping warm.

### b) Timber:-

Wood is used for making furniture, tool handles, boat etc.

### c) Bamboos:-

These are used for matting, basket etc.

### d) Food:-

Fruits, leaves, roots of plants and meat of forest animals from the food of forest tribes.

### e) Shelter:-

~~Moss~~ Mosses, insects, birds, reptiles, mammals and micro-organism are provided shelter by forest.

### f) Paper:-

Wood are use for the manufacturing paper (News, print, stationery, packing paper, ~~etc~~ sanitary paper)



(g) Rayon:-

Wood are used in the manufacture of rayon (Yarn, artificial fiber, silk)

(h) Forest Product:-

Tannins, gums, drugs, spices, insecticides, waxes, honey, musk, etc are all provided by the flora and fauna of forests.

### Forest product from indirect benefits

a) Conservation of Soil:-

Forest prevent soil by binding the soil with the network of roots of the different plants and reduce the velocity of wind and rain which are the chief agents causing erosion.

b) Soil-improvement:-

The fertility of the soil increases due to the humus which is formed by the decay of forest litter.

c) Reduction of atmospheric pollution:-

By using up carbon dioxide and giving off oxygen during the process of photosynthesis, forest reduce pollution and purify the environment.

d) Control of climate:-

Transpiration of plants increases the atmospheric humidity which affects rain fall and cools the atmosphere.



(e) Control of water flow:-

In the forests the thick layer of humus acts like a big sponge and soaks rain water preventing run off thereby preventing flash-floods.

\* Humus prevents quick evaporation of water there by ensuring a perennial supply of water to streams, springs and wells.

Human interactions with forests:-

- Human are indisputably a part of most forests.
- With the exception of extremely inaccessible forestlands all forests present on Earth today have been influenced by human being for tens of thousand of years.
- Because of the widespread nature of human activity in forests it is tempting to think of human endeavours as one more outside factor influencing forest development.
- Examples range from culturally modified trees and edge habitat maintained by the Haida and other in west coastal North America to pre columbian enrichment planting of Brazil nut trees in the Amazon to traditional coppice management in the English lowlands.

All times human management has become as intensive as to become the primary set of factors under which the forest system operates.



## Deforestation

- Deforestation is the permanent destruction of indigenous forests and woodlands.
- The term does not include the removal of industrial forests such as plantation of gums or pines.
- Deforestation has resulted in the reduction of indigenous forests to four fifths of their pre-agricultural area.

## Causes of Deforestation

### 1) Population Explosion:

- Population explosion poses a grave threat to the environment.
- Vast areas of forests land are cleared of trees to reclaim land for human settlements (Factories, agriculture, housing, roads, railway tracks).
- Growth of population increases the demand for forest products like timber, firewood, paper and other valuable products of industrial importance all necessitating felling of trees.

### 2) Forest Fires:-

Fires in the forests may be due to natural calamities or human activities:-

- Smoldering of the humus and organic matter forming a thick cover over the forest floor (i.e. ground fires).
- Dried twigs and leaves may catch fire (i.e. surface fires).
- In densely populated forests, tree tops may catch fire by heat produced by constant rubbing against each other (i.e. crown fires).
- Human activities like clearing forest for habitation, agriculture, firewood, construction of roads, railway tracks.



and carelessness (through burning organic stubs on dried foliage).

→ Fire destroys fully grown trees results in killing and smothering of the seeds, human, ground flora and animal life.

3) Overgrazing Animals:-

Trampling of the forest soil in the course of overgrazing by livestock has far reaching effects such as loss of porosity of soil. Soil erosion and desertification of the previously fertile forest area.

4) Pest Attack:-

Forest pests like insects etc. destroy trees by eating up the leaves, boring into shoot and by spreading diseases.

5) Natural Forces:-

Floods, storms, snow, lightning etc. are the natural forces which damage forests.

Effects of Deforestation:-

Forests are closely related with climate change, biological diversity, wild animals, crops, medicinal plants etc.

Large Scale deforestation has many far-reaching consequences:

- a) Habitat destruction of wild animals (tree using animals are deprived of food and shelter).
- b) Increased soil erosion due to reduction of vegetation cover.
- c) Reduction in the oxygen liberated by plants through photosynthesis.



- Increase in pollution due to burning of wood and due to reduction in carbon-dioxide fixation by plants.
- Decrease in availability of forest products.
- Loss of cultural diversity.
- Loss of biodiversity.
- Scarcity of fuel wood and deterioration in economy and quality of life of people residing near forests.
- Lowering of the water table due to more run off and thereby increased use of the underground water increases the frequency of droughts.
- Rise in carbon dioxide level has resulted in increased thermal level of earth which in turn results in melting of ice caps and glaciers and consequent flooding of coastal areas.

### Dams and their effects on forests and Tribal peoples

- When asked to name different causes of deforestation few people will mention hydroelectric dams as being one of them.
- Even fewer will include them as a cause of human rights violations.
- This lack of awareness can be explained by the fact that for many years large hydroelectric dams have been portrayed as synonymous with development.
- Another reason can be that most users of hydroelectricity live far away from the impacted areas than the sites selected for dam building.
- They have also resulted in deforestation elsewhere as farmers displaced by the dams have had to clear forest in other areas in order to grow their crops and building their homes.



- Additionally dams imply road building - thus allowing access to previously remote areas by loggers and developers resulting in further deforestation process.
- Not only are the best agricultural soils flooded by the reservoir.
- But major changes occur in the environment.
- Where the river, flora and fauna beings to disappear with strong impacts on people dependent on those resources.
- At the same time, dams imply a number of health hazards starting with diseases introduced by the thousand of workers.
- That are brought into build the dam (including AIDS, syphilis, tuberculosis, measles and other).
- And ending with diseases related to the reservoir itself (malaria, schistosomiasis, river blindness etc).
- Major examples are the Narmada Bachao Andolan movement in India.

## Water Resources

- Water is a elixir for all living beings.
- Although it is a renewable resource, scarcity of quality water is felt in many parts of the world.
- We need water to grow food, keep clean, generate electricity, control fire, and last but not the least we need it to stay alive.
- Water ocean water covers about 75% of the ~~surface~~ surface of the earth.
- ~~World ocean water~~
- Fresh water is just about 2.7% of the total water.



- Water is renewable but its over use and pollution make it unfit for use.
- Sewage, industrial use, chemical etc. pollute water with nitrates, metals and pesticides.

### Use of Water Resource

- Water resources are used for agricultural, industrial, domestic, recreational and environmental activities.
- Majority of the uses require fresh water.
- However about 97% of water found on the earth is salt water and only three percent of fresh water.

### Agricultural Use

- Agriculture accounts for 69% of all water consumption basically in agricultural economics like India.
- Agricultural, therefore is the largest consumer of the Earth's available fresh water.
- By 2050, the global water demand of agriculture is estimated to increase by a further 19% due to irrigation needs.

### Industrial Use

- Water is the life blood of the industry. It is used as a raw material coolant, a solvent a transport agent, and as a source of energy and as a source of energy.
- Manufacturing ~~industrial~~ industries account for a considerable share in the total industrial water consumption. consumption.



### Domestic Use

- It includes drinking, cleaning, hygiene, cooking, washing of clothes, dishes, vehicle etc.
- Since the end of world war there has been a trend of people moving out of the countryside to the ever-expanding cities.

### Use of Hydropower Generation

- Electricity produced from water is hydro power.
- Hydropower is the leading renewable source of electricity in the world.
- It accounts for about 16% of total electricity generation globally.
- Today the leading hydropower generating countries are China, Brazil, Canada, India and Russia.

### Use of Navigation and Reaction

- Navigable water ways are defined as water courses that have been or may be used for transport of interstate or foreign commerce.

### Floods and Droughts

- Flood and droughts are two well known natural hazards in the world.
- The former is due to excess in water flow and the latter is due to scarcity of water.

### Mineral Resources :-

- Minerals are naturally occurring elements or compounds that have been formed through slow organic processes.



- Modern civilisation is based on the use and exploitation of mineral resources.
- Minerals can be metallic and non-metallic.
- Extraction of mineral is carried out through mining.
- Mineral once extracted from beneath the surface processed and use for different purpose.
- Mineral resources, however are exhaustible and finite which means excessive use may affect their availability in the future.

### Exploitation of Mineral Resource:-

- Exploitation of mineral refers to the use of mineral resource for economic growth.
- Exploitation of mineral resources at a mindless speed to meet the growing needs of modern civilisation has resulted in many environmental problems.
- Excessive exploitation of mineral resources has led to the following severe problems.
  - ★ Deforestation and desertification.
  - ★ Extinction of species.
  - ★ Rapid depletion of high grade minerals
  - ★ Forced migration
  - ★ Wastage of upper soil layer and vegetation soil erosion and oil depletion.
  - ★ Ozone depletion
  - ★ Green house gas increase
  - ★ Environmental pollution



## Land Resources :-

- Land is a naturally occurring finite resource.
- It provides the base for survival of living beings.
- It holds everything that constitutes terrestrial ecosystem.
- Land & Land Resources refer to desirable areas of the earth's terrestrial surface.
- The soil and terrain forms, the surface hydrology. (including shallow lakes, rivers, marshes and)

## Forest Resources :-

- Forest are the dominant terrestrial ecosystem of earth and are distributed across the globe.
- Forests account for 75% of the gross primary productivity of the earth's biosphere and contain 80% of the earth's plant biomass.

## Usefulness of Forest Resources :-

- Forest is an important natural resource.
- Forest are natural and vast reservoir of food and shelter for animals. They provide natural habitats for numerous species of plants animals and micro-organisms.
- Forest are the natural home to medicine herbs and plants.
- Forest prevent flood and soil erosion, land degradation and improve the quality of air and water.

## Energy Resources

- Energy is defined by physicists as the capacity to do work.



- Energy is found on our planet in a variety of forms some of which are immediately useful to do work while others require a process of transformation.
- The sun is the primary energy source in our lives.
- Besides, water, fossil fuel such as coal, petroleum product, water, nuclear power plant are source of energy.

### Growing Energy Needs

- Energy has always been closely linked to man's economic growth and development.
- Present Strategies for development that have focused on rapid economic growth have used energy utilization as an index of economic development.
- For almost 200 years, coal was the primary energy source fueling the industrial revolution in the 19th century.
- Oil accounted for 39% of the world's commercial energy consumption, followed by coal (24%) and natural gas (21%) while nuclear (7%) and hydro/renewable (6%) accounted for the rest.
- According to WEO-2016 published by International Energy Agency.

### Renewable Energy Resources

- Renewable energy system use resources that are constantly replaced and are usually less polluting.
- Examples include hydropower, solar, wind and geothermal.

#### Wind energy:-

- The moving air or wind has huge amounts of kinetic energy and it can be transferred into electrical



energy using turbines

- The wind moves the blades which spins a shaft, which is further connected to a generator, which generates electricity.
- An average wind speed of 11 miles per hour is needed to convert wind energy into electricity.
- Wind generated electricity met nearly 4% of global electricity demand in 2015 with nearly 63 GW of new wind power capacity installed.

Solar Energy:-

- Solar energy is the light and heat procured from the sun.
- It is harnessed using an ever evolving technologies.
- In 2014 global solar generation was 186 Terawatt, how slightly less than 1% of the world's total grid electricity.

Biomass Energy:-

- When a log is burned we are using biomass energy.
- As plants and trees depend on sunlight to grow biomass energy is form of stored solar energy.
- Although wood is the largest source of biomass energy, agricultural waste, sugarcane wastes, and other farm by products are also used to produce energy.

Hydro power:-

- Energy produced from water is called hydropower.
- Hydroelectric power stations both big and small are set up to produce electricity in many parts of the world.
- In 2015 hydropower generated 16.6% of the world's total electricity and 70% of all renewable electricity.



## Tidal and wave power:

- The earth's surface is 70% water.
- By warming the water the sun creates ocean currents and wind that produces waves.
- It is estimated that the solar energy absorbed by the tropical oceans in a week could equal the entire oil reserves of the world - 1 trillion barrels of oil.

## Geothermal Energy

- It is the energy stored within the earth.  
(Geo for earth and thermal for heat)
- Geothermal energy starts with hot, molten rock deep inside the earth with surface at some parts of the earth's crust.
- The heat rising from the magma warms the underground pools of water known as geothermal reservoirs.

## Food Resources:-

- Food refers to anything eaten by man which gives energy and which is able to meet physiological needs for growth of human body.
- Food is a source of energy for man. It is used for maintaining all body processes and activities.
- For physical and mental development.
- For protection and regulation of body needs.

## Role of an individual in the conservation of natural resources:

- Natural resources like forest, water, soil, food, minerals and energy resources play an important role in the economy and development of a nation.
- Human can play important role in the conservation of natural resources.



→ A little effort by individuals can help to conserve these resources which are a gift of nature to mankind.

A brief description of the role individual to conserve different type.

1) Roles to conserve water:

- Improve water efficiency by using the optimum amount of water in the washing machines.
- Install water-saving toilets which use less water per flush.
- Recycle water from the washing clothes for gardening.

2) ~~Conservation~~ Energy conservation for future use:-

- Turn off all electric appliances such as lights fans, televisions, computers etc when not in use.
- Clean all the lighting sources regularly because dust on lighting sources decreases lighting level up to 20-30%.
- Minimize the use of air conditioner to save energy.

3) Protect soil health:-

- Use organic compost to maintain soil fertility.
- To avoid soil erosion do not irrigate the plant by using the fast flow of water.
- Use sprinkler irrigation to conserve the soil.
- Provide vegetation cover by growing of the ornamental plants, herbs and trees in your garden.

Equitable use of resources for sustainable development:-

- Sustainable development basically means that the process of development need to be sustained.
- Therefore, it calls for planned or judicious utilization



of available limited resources with least possible degradation of environment while maintaining quality of life at the same time.

- The commission on environment and development in its report our common future.

### Carrying Capacity:

- Carrying capacity of a region/system could be described broadly as number of individuals of a species that it can sustain.
- In case of human beings it is rather a complex situation.

### Green Accounting:-

- Green accounting is widely prevalent concept both in developed and developing countries.
- It underlines basically the same principles as enumerated in concepts of sustainable development and carrying capacity.
- It is use of natural resources base in planned and judicious manner without impacting the quality of environment.



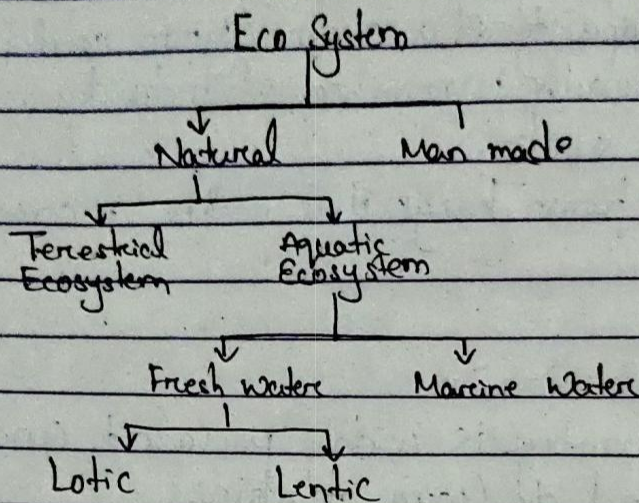
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## Chapter-3

## Systems

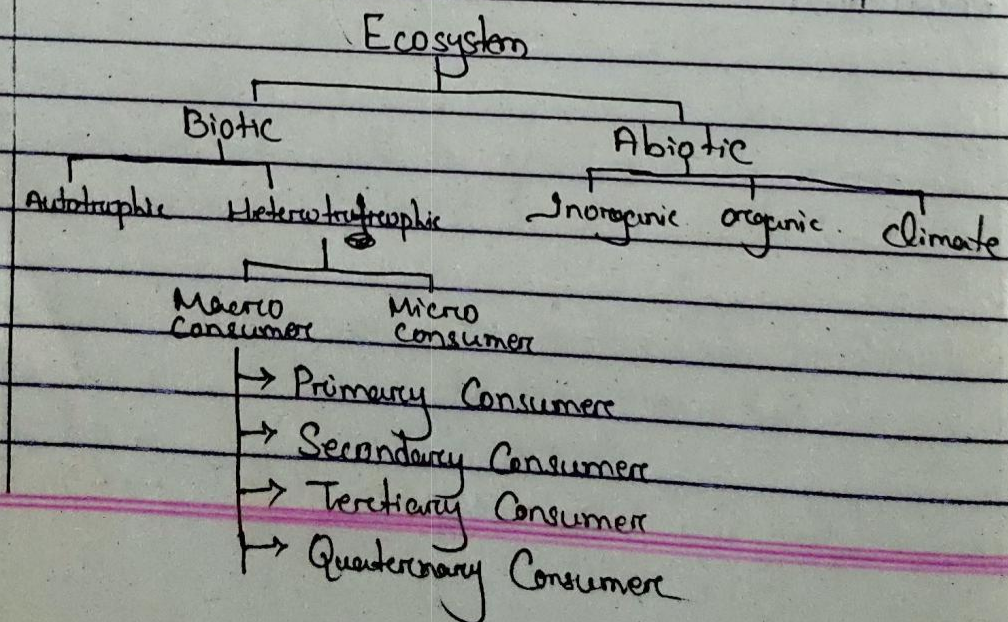
### Ecosystem

An ecosystem concept is that the living organism of a community not only interact among themselves but also a functional relationship with their non-living environment. The structural and functional system of community and their environment is called eco-system.



### Ecology

Study of interaction among organism with their environment. The flow of energy and materials between Abiotic & Biotic components of the ecosystem.





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### Biotic Structure:-

- Producers, Consumers and de-composers are component of biotic ecosystem. Living things are made of carbon and other chemicals with a lot of water added.
- Biotic structure includes plants, animals and micro organism present in an eco-system. We have identified producers, de-composers and consumers are the basic components of biotic eco-system.

### Producers:-

- All green plants are producers. They are also called as ~~convert~~ converters.
- They are living members of the eco-system that ~~use~~ utilize sunlight as their energy source and single in-organic materials from soil, air and water to transform them by photosynthesis plants and their kind of eco-system.

### Consumer:-

Consumer are living organism and their food directly or indirectly from the producers. The food is a simple substance which the consumers body and release the waste product to the environment.

### Primary Consumer:-

These are also called as herbivores which feed directly on the producers. They vary with the kind of eco-system.

Ex:- A deer is a primary consumer in forest eco-system, while cow or goat is in a grassland eco-system.



Secondary Consumer

They are also called Carnivorous