



**KIIT POLYTECHNIC**

**LECTURE NOTES**

**ON**

**SWITCHGEAR PROTECTION**

## UNIT 1:

### THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

**Definition :-** The word environment is derived from the French word “environ” means surroundings. So, everything surrounding us is called “environment”. Every organism is surrounded by materials, forces that constitute its environment. It is the environment from where every organism must derive its requirement. The environment creates favourable conditions for the existence and development of living organism. Environment literally means Surrounding in which we are living. Environment includes all those things on which we are directly or indirectly dependent for our survival, whether it is living component like animals, plants or non living component like soil, air water. The survival of any organism requires a steady supply of materials and removal of waste products from its environment. The degradation of the environment has become a serious problems for the existence of human being.

#### **Scope of Environment:**

Environment is not a single subject., it is an integration of several subjects that include both science and social studies. To understand all the different aspects of the environment, it is necessary for us to understand biology, chemistry, physics, geography, economics and population issues. So the scope of environment studies is extremely wide and covers some aspects of nearly every discipline.

The scope of environment studies is categorised into 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).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, reservoir, 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 through atmosphere, hydrosphere and lithosphere.

**The importance's of environmental studies are as follows:**

The EVS highlights about the importance of protection and conservation of resources because we live in a world where natural resources are limited such as water, air, soil, minerals and oil. Usually we get these natural resources from forests and also from agriculture. These are all a part of our life support system because without them we cannot live. So it is the responsibility of our to protect and preserve all the above resources so that we can live longer and maintain a healthy life.

The following points should be considered for the importance of EVS:

1. To clarify modern environmental concept like how to conserve biodiversity.
2. To know the more sustainable way of living.
3. To use natural resources more efficiently.
4. To know the behaviour of organism under natural conditions.
5. To know the interrelationship between organisms in populations and communities.
6. To aware and educate people regarding environmental issues and problems at local, national and international levels.

**Need of Public Awareness:-** It is essential to make the public aware regarding the consequences of the Environmental Degradation. If these are not reported and essential measures will not be taken the society would face a serious problem. We are facing various environmental challenges as discussed below:

**Growing Population:** A population of over thousands of millions is growing. Over 17 million 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.

**Poverty:** India has often been described a rich land with poor people. Poverty and environmental degradation have a nexus between them. The vast majority of our people are directly dependent on the natural resources of the country for their basic needs of food, fuel, shelter and fodder.

**Environment degradation:** has adversely affected the poor who depend upon the resources of their immediate surroundings. Thus, the challenge of poverty and the challenge of environment degradation are two facets of the same challenge.

**Agricultural Growth:** People must be acquainted with the methods to sustain and increase agricultural growth without damaging the environment. High yielding varieties have caused soil salinity and damage to the physical structure of soil.

**Need for Ground water:** It is essential to rationalize the use of groundwater. Factors like community wastes, industrial effluents and chemical fertilizers and pesticides have polluted our surface water and affected the quality of the groundwater. It is essential to restore the water quality of our rivers and other water bodies such as lakes. Deciding on suitable technologies for restoring the quality of groundwater aquifers is essential.

**Degradation of land:** A small portion of land possesses potential for production. Agricultural land suffers from varying degrees of soil degradation. Land degradation mainly occurs due to overgrazing and soil erosion due to wind and water.

**Evil Consequences of Urbanisation:** Nearly 27 per cent of Indians live in urban areas. Urbanisation and industrialisation has given birth to a great number of environmental problems that need urgent attention.

**Air and water Pollution:** Due to increasing population and the vehicles being used along with industrialisation they both are releasing greenhouse gases and contaminate the air and at the same time different pesticides are being used to protect the crops and plants which mix up with groundwater and contaminate the water. So it is the greatest challenge to protect our environment from air pollution and water pollution by implementing different technologies.

So, lastly in today's world because of industrialization, increasing population and urbanization the natural resources have been rapidly utilized and our environment is being increasingly degraded by human activities, so we need to protect the environment.

### **Multidisciplinary Nature of Environmental Studies:**

Because the environment is complex and actually made up of many different environments, including natural, constructed and cultural environments, environmental studies is the interdisciplinary examination of how biology, geology, politics, policy studies, law, geology, religion, engineering, chemistry and economics combine to inform the consideration of humanity's effects on the natural world.

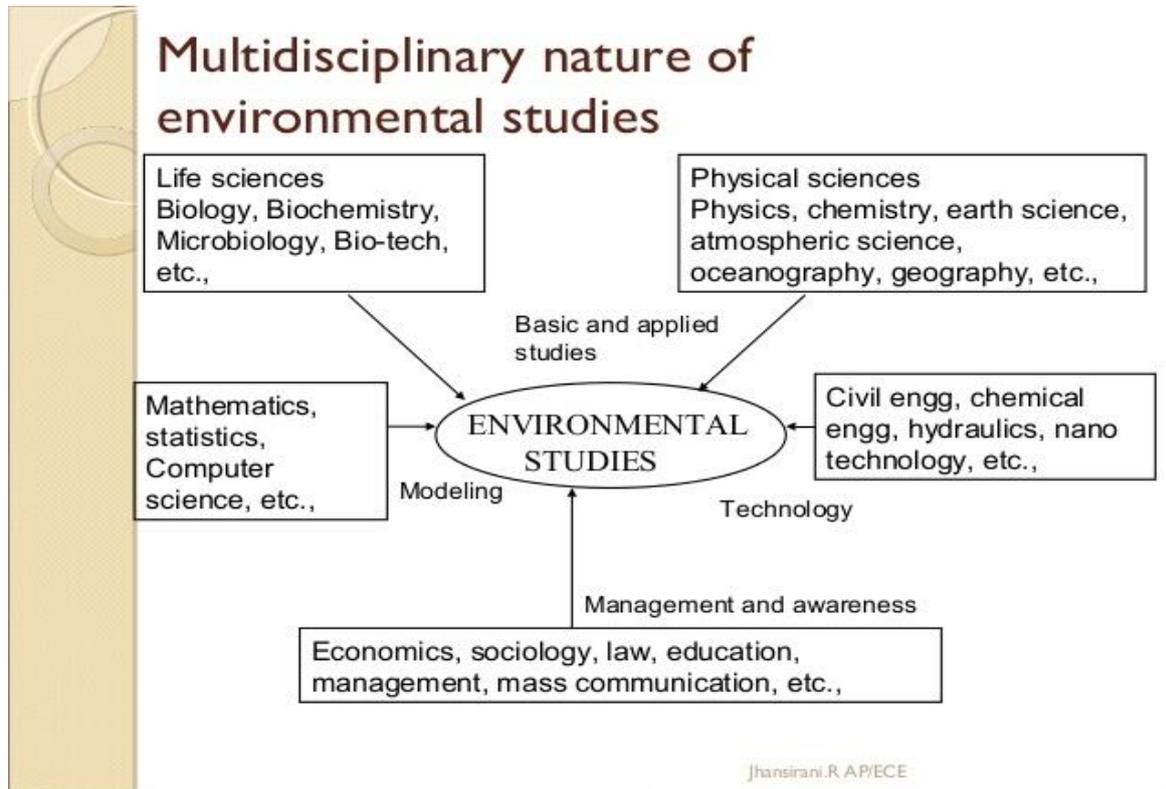
It is essentially a multidisciplinary approach and its components include Biology, Geology, Chemistry, Physics, Engineering, Sociology, Health Sciences, Anthropology, Economics, Statistics and Philosophy.

Environmental studies is therefore multidisciplinary and aims at sorting out the ways in which human beings and nature correlate, sustaining life with limited resources. The study of environmental components is multidisciplinary in nature, since it includes all disciplines. The use of the term Environmental science may imply a single subject, but the essence of environmental science is its multi-disciplinary nature. The subject has evolved from integrated use of many disciplines such as science, humanities, commerce, and geography as follows

1. **Biological sciences or Life Sciences** – It forms an important component of environmental sciences as it is essential to acquire the knowledge of organisms living in it. The basic concepts of botany, zoology, microbiology, biotechnology are studied for studying the difference aspects of environment and their inter relationships.
2. **Physical sciences** – It helps in understanding the changes which are involved with the abiotic system like the energy transfer and nutrients cycling, acid rain, ozone hole etc which require the knowledge of physical chemistry.
3. **Mathematics, statistics and computer sciences** serve as an effective tool for environment modelling.
4. **Civil engineering, Chemical engineering and nanotechnology** provide technical solution for environmental pollution control and water treatment.
5. **Sociology, economics and management** help in dealing with socio-economic aspects of environment.
6. **Environment law** provides legal measures for effective management and protection of environment.
7. **Mass communication** helps in spreading environment awareness.

The following diagram shows why EVS is considered as multidisciplinary approach.

## Multidisciplinary nature of environmental studies



### Scope of Environment

#### (a) Environmental Science:

It deals with the scientific study of environmental system (air, water, soil and land), the inherent or induced changes on organisms and the environmental damages incurred as a result of human interaction with the environment.

#### (b) Environmental Engineering:

It deals with the study of technical processes involved in the protection of environment from the potentially deleterious effects of human activity and improving the environmental quality for the health and well beings of humans.

#### (c) Environmental Management:

It promotes due regard for physical, social and economic environment of the enterprise or projects. It encourages planned investment at the start of the production chain rather than forced investment in cleaning up at the end.

It generally covers the areas as environment and enterprise objectives, scope, and structure of the environment, interaction of nature, society and the enterprise, environment impact assessment, economics of pollution, prevention, environmental management standards etc.

## UNIT-2

### Renewable energy resources:

The energy resources which cannot be exhausted and can be used again and again are called renewable energy resources. For example solar energy, wind energy, tidal energy and hydroelectric etc. :

**Non-renewable energy resources:** The energy resources which can be exhausted one day and cannot be used repeatedly are called non-renewable energy resources. The example of non-renewable energy resources are coal, petroleum, natural gases etc.

S.No	Renewable energy resources	Non-renewable energy resources
1.	It can be used again and again throughout its life.	It cannot be used again and again but one day it will be exhausted.
2.	These are the energy resources which cannot be exhausted.	They are the energy resources which can be exhausted one day.
3.	It has low carbon emission and hence environment friendly.	It has high carbon emission and hence not environment friendly.
4.	It is present in unlimited quantity.	It is present in limited quantity and vanishes one day
5.	Cost is low	Cost is high.
6.	Renewable energy resources are pollution free.	The non-renewable energy resources are not pollution free.
7.	Life of resources is infinite.	Life of resources is finite and vanishes one day.
8.	It has high maintenance cost.	It has low maintenance cost as compared with the renewable energy resources.
9.	Large land area is required for the installation of its power plant.	Less land area is required for its power plant installation.
10.	Solar energy, wind energy, tidal energy etc are the examples of renewable resources.	Coal, petroleum, natural gases are the examples of non-renewable resources

Comparison between renewable and non-renewable resources are given above in tabular form

## Forest Resources

Forests are one of the most important natural resources on this earth. Covering the earth like a green blanket these forests not only produce innumerable material goods, but also provide several environmental services which are essential for life.

### Uses of Forests :

Commercial uses:

Forests provide us a large number of commercial goods which include timber, firewood, pulpwood, food items, gum, resins, non-edible oils, rubber, fibres, lac, bamboo canes, fodder, medicine, drugs and many more items, the total worth of which is estimated to be more than \$ 300 billion per year.

Many forest lands are used for mining, agriculture, grazing, and recreation and for development of dams.

Ecological uses :

- **Production of oxygen:** The trees produce oxygen by photosynthesis which is vital for life on this earth.
- **Reducing global warming:** The main greenhouse gas carbon dioxide (CO<sub>2</sub>) is absorbed by the forests as a raw material for photosynthesis. Thus forest canopy acts as a sink for CO<sub>2</sub> thereby reducing the problem of global warming caused by greenhouse gas CO<sub>2</sub>.
- **Wild life habitat:** Forests are the homes of millions of wild animals and plants. About 7 million species are found in the tropical forests alone.
- **Regulation of hydrological cycle:** Forested watersheds act like giant sponges, absorbing the rainfall, slowing down the runoff and slowly releasing the water for recharge of springs. About 50-80 % of the moisture in the air above tropical forests comes from their transpiration which helps in bringing rains.
- **Soil Conservation:** Forests bind the soil particles tightly in their roots and prevent soil erosion. They also act as windbreaks.
- **Pollution moderators:** Forests can absorb many toxic gases and can help in keeping the air pure. They have also been reported to absorb noise and thus help in preventing air and noise pollution.

### Over-exploitation of forests:

- Since time immemorial, humans have depended heavily on forests for food, medicine, shelter, wood and fuel.
- With growing civilization the demands for raw material like timber, pulp, minerals, fuel wood etc. shot up resulting in large scale logging, mining, road-building and clearing of forests.
- Excessive use of fuel wood and charcoal, expansion of urban, agricultural and industrial areas and overgrazing have together led to over-exploitation of our forests leading to their rapid degradation.

## **Deforestation**

Deforestation is the removal of a forest or stand of trees where the land is thereafter converted to a non-forest use. Examples of deforestation include conversion of forestland to farms, ranches, or urban use.

### **Causes of Deforestation**

Main causes responsible for deforestation are as under:

- Felling of trees to meet the ever increasing demand of the cities.
- Grazing by the local cattle, goats, sheep etc. They not only destroy the vegetation but also pull out the roots of plants.
- Meeting out the growing hunger for land. It has hit the ecology of the country badly very soon India is likely to have more of wasteland than productive land.
- The increase in shifting (jhum) cultivation in North east and Orissa has also laid large forest tracts bare.
- Another major cause of deforestation has been the construction of hill roads. Road construction damages the protective vegetation cover both above and below roads.

### **Consequences of Deforestation**

- It threatens the existence of many wild life species due to destruction of their natural habitat.
- Biodiversity is lost and along with that genetic diversity is eroded.
- Hydrological cycle gets affected, thereby influencing rainfall.
- Problems of soil erosion and loss of soil fertility increase.
- In hilly areas it often leads to landslides.
- Expansion of desert areas.

### **Prevention of Deforestation**

These steps can be adopted to prevent deforestation to a maximum extent :

- Expansion of forest area can be achieved by implanting trees in forest with people's participation.

- Strengthening the central and state forestry administration and institutions.
- Celebrate Environment day to create awareness among people about how forestation can help in improving environment.
- Use of pesticides to reduce damages to forest from pests.
- Encouraging reduce, recycle and reuse of forest products.
- Encouraging afforestation and reforestation.
- Using alternate sources of energy like cooking gas instead of wood.

#### **Timber extraction and its effect on forest and tribal people**

Timber is used as raw materials for various wood based industries like pulp and paper, composite wood, furniture etc. Timber is also used for various developmental activities like railways, boats, road construction etc.

However due to unsustainable extraction of timber, there are adverse effects on forest and tribal people. Some of which are :

- Loss of biodiversity.
- Climate change such as lower precipitation.
- Poor logging results in a degraded forest.
- Floods may be intensified by cutting of trees or upstream watersheds.
- Exploitation of tribal people by the contractors.
- Soil erosion especially on the slopes occur extensively.

#### **Mining and its effect on forest**

Mining is the extraction of valuable minerals or other geological materials from the earth, usually from an ore body, lode, vein, seam, reef or placer deposits.

The adverse effects of mining on forest are as follows :

- Vast areas of forest are directly cleared to accommodate mining sites, construction of roads, processing units and townships for workers.  
Destruction is vast in case of open cast mines.
- Forest land is also used to store the waste materials that remain after the extraction of usable ores.
- Mining also facilitates soil erosion, thereby decreasing the fertility of land leading to land degradation.
- Pollution of both air and water is a common effect of mining.

#### **Dams and their effect on forest and tribal people**

When a dam is constructed across any river a huge artificial lake is developed in the catchment area of that dam. Covering a large surface area it creates a lot of ill effects on the living environment. They are as follows :

- It creates the loss of forest which are submerged under the back waters of the dam.

- It creates danger to the habitat of wildlife. The wildlife are forced to migrate.
- It also affects the land under cultivation in the catchment area, as the crops get submerged under water.
- The road already under existence submerges under-water thus disrupting the road network.
- Water logging and Stalination affects the canal irrigated land, with varying degrees of severity.
- Diseases like malaria spread rapidly in the command areas of reservoirs which severely affect the health condition of tribal living nearby forest areas.

## **Water Resources**

**Water resources** are natural resources of water that are potentially useful. Uses of water include agricultural, industrial, household, recreational and environmental activities. All living things require water to grow and reproduce. 97% of the water on the Earth is salt water and only three percent is fresh water; slightly over two thirds of this is frozen in glaciers. The remaining unfrozen freshwater is found mainly as groundwater. Fresh water is a renewable resource, yet the world's supply of groundwater is steadily decreasing, with depletion occurring most prominently in Asia,

## **Use of Ground Water**

### **Groundwater serves many purposes which are given below**

Fresh groundwater was used for many important purposes, with the largest amount going toward irrigating crops, such as the different plants, fruits and crops. Local city and county water departments withdraw a lot of groundwater for public uses, such as for delivery to homes, businesses, and industries, as well as for community uses such as fire fighting, water services at public buildings, and for keeping local residents happy by keeping community swimming pools full of water. Industries and mining facilities also used a lot of groundwater. The majority of water used for self-supplied domestic and livestock purposes came from groundwater sources.

## **Use of surface water**

The Nation's surface-water resources—the water in the nation's rivers, streams, creeks, lakes, and reservoirs—are vitally important to our everyday life. The main uses of surface water include drinking-water and other public uses, irrigation uses, and for use by the thermoelectric-power industry to cool electricity-generating equipment. The majority of water used for thermoelectric power, public supply, irrigation, mining, and industrial purposes came from surface-water sources. Of all the water used in the United States in 2015, almost 80 percent came from surface-water sources. Water from groundwater sources accounted for the remaining withdrawals. Over 80 percent of all water used in 2015 was freshwater, although saline water was heavily used in the thermoelectric-power industry, and, to a lesser extent, for industrial and mining purposes.

## Impacts of Over Utilization of Underground and Surface Water

The over utilization of underground and surface water has the potential to alter, sometimes irreversibly, the integrity of freshwater ecosystems. Some of the major impacts are summarized below:

### *(i) Loss of integrity of freshwater ecosystems:*

Human activities for infrastructure development like creation of dams, land conversion, etc. are responsible for this loss of integrity of freshwater ecosystems. Water quality and quantity, fisheries, habitats, etc. are at risk due to this loss of integrity.

### **(ii) Risk to ecosystem functions:**

Population and consumption growth increases water abstraction and acquisition of cultivated land. Virtually all ecosystem functions including habitat, production and regulation functions are at risk.

### *(iii) Depletion of living resources and biodiversity:*

Overharvesting and exploitation causes groundwater depletion, collapse of fisheries. Production of food, quality and quantity of water and supply of water gets badly affected by these depletions of living resources and biodiversity.

### *(iv) Pollution of water bodies:*

Release of pollutants to land, air or water alters chemistry and ecology of water bodies. Greenhouse gas emissions produce significant changes in runoff and rainfall patterns. Because of water pollution, water supply, habitat, water quality, food production, climate change, etc. are at risk.

What-is-Flood?

It is a natural event or occurrence where a piece of land (or area) that is usually dry land, suddenly gets submerged under water. Some floods can occur suddenly and recede quickly. Others take days or even months to build and discharge.

### **Causes of flood**

#### **Rains**

Each time there are more rains than the drainage system can take, there can be floods. Sometimes, there is heavy rain for a very short period that result in floods. In other times, there may be light rain for many days and weeks and can also result in floods.

#### **River overflow**

Rivers can overflow their banks to cause flooding. This happens when there is more water upstream than usual, and as it flows downstream to the adjacent low-lying areas

(also called a floodplain), there is a burst and water gets into the land.

### **Strong winds in coastal areas**

Sea water can be carried by massive winds and hurricanes onto dry coastal lands and cause flooding. Sometimes this is made worse if the winds carry rains themselves. Sometimes water from the sea resulting from a tsunami can flow inland to cause damage.

### **Dam breaking**

Dams are man-made blocks mounted to hold water flowing down from a highland. The power in the water is used to turn propellers to generate electricity. Sometimes, too much water held up in the dam can cause it to break and overflow the area. Excess water can also be intentionally released from the dam to prevent it from breaking and that can also cause floods.

### **Ice and snow-melts**

In many cold regions, heavy snow over the winter usually stays un-melted for sometime. There are also mountains that have ice on top of them. Sometimes the ice suddenly melts when the temperature rises, resulting in massive movement of water into places that are usually dry. This is usually called a *snowmelt flood*

### **Effects of flooding**

Floods can have devastating consequences and can have effects on the economy, environment and people.

- **Economic**

During floods (especially flash floods), roads, bridges, farms, houses and automobiles are destroyed. People become homeless. Additionally, the government deploys firemen, police and other emergency apparatuses to help the affected. All these come at a heavy cost to people and the government. It usually takes years for affected communities to be re-built and business to come back to normalcy.

- **Environment**

The environment also suffers when floods happen. Chemicals and other hazardous substances mix up in the water and eventually contaminate the water bodies. Additionally, flooding causes kills animals, and others insects are introduced to affected areas, distorting the natural balance of the ecosystem.

**People and animals**

- Many people and animals have died in flash floods. Many more are injured and others made homeless. Water supply and electricity are disrupted and people struggle and suffer as a result. In addition to this, flooding brings a lot of diseases and infections including different fevers and other diseases.. Sometimes insects and snakes make their ways to the area and cause a lot of havoc.

- **Methods-of-flood-prevention**

Humans cannot stop the rains from falling or stop flowing surface water from bursting its banks. These are natural events, but we can do something to prevent them from having great impact. Here are a few.

- **Sea-Coastal-Defence-Walls**

Sea walls and tide gates have been built in some places to prevent tidal waves from pushing the waters up ashore. In some areas too, sand bags are made and placed in strategic areas to retain floodwaters.

- **Retaining-walls**

In some places, retaining walls levees, lakes, dams, reservoirs or retention ponds have been constructed to hold extra water during times of flooding.

- **Town-planning**

It is important that builders acquire permission before buildings are erected. This will ensure that waterways are not blocked. Also, drainage systems must be covered and kept free from objects that chock them. This way, water can quickly run through if it rains and minimize any chance of town flooding. Drainage systems should also be covered to prevent litter from getting into them.

## **DROUGHT**

The word '*Drought*' is always a difficult one to define, because it is often used in more than one context. In simple terms, it is the absence of water for a long period of time, at a place where it is considered 'not normal' compared to its usual conditions.

### **What-causes-drought?**

#### **➡ Lack-of-rainfall-(or/precipitation)**

Droughts can occur when there is the lack of 'expected' precipitation (rain and snow).

Some regions can go for months without any rain, and that would be 'normal' for them.

Farmers plant in anticipation of rains and so when the rains do not come, and irrigation infrastructure is absent, agricultural drought occur.

#### ► **Surface-water-flow**

Some regions are also well distributed with surface water (streams and rivers) that have their sources from far away mountains and watersheds. These surface waters may dry out if the flow from their sources upstream is affected. Hydro-electric dams and irrigation systems are some of the economic activities that can reduce the amount of water flowing to the other areas downstream.

#### ► **Human-factors**

Forests (trees) play a key role in the water cycle, as they help reduce evaporation, store water and also contribute to atmospheric moisture in the form of transpiration. This means, cutting down trees (deforestation) in the name of economics, will expose surface water to more evaporation. It will also reduce the ability of the ground to hold water and make it easier for desertification to occur

#### ► **Global-warming**

Even though some people do not accept that the average temperature of the earth has risen, it is on record that human actions have contributed to more greenhouse gasses in the atmosphere. As a result, there are warmer temperatures, often resulting in more dryness and bush fires. These conditions also tend to speed up drought conditions.

## **EFFECTS-OF-DROUGHT**

- **Environmental Impacts of Droughts**

Animal and plants die off as a consequence of drought. Mainly, the damages arise out of extensive destruction of the wildlife habitats and reduction in water quality and quantity. Some plants and animals may completely fail to recover after the drought. The overall climate, the rocks, and soils are also affected, negatively impacting various living and non-living factors.

- **Drying out of water bodies**

Surface waters such as lakes, rivers, ponds, creeks, streams and lagoons dry out during extended dry conditions which destroy natural habitats. Most especially, aquatic life and other wildlife dependent on these water bodies die or become endangered, destroying the entire food chain and alters the ecosystem.

- **Reduction in soil quality**

Soil moisture, essential for soil microbial activities, is reduced in drought conditions. As a result, soil quality is lowered because of minimized organic activity and continued dry spell which kills soil organisms. The end result is dry and cracked soil and it even becomes easier for desertification to occur.

- **Unsuitable conditions for plant and vegetation survival**

Drought conditions make it unsuitable for plants and vegetation cover to survive. Besides, fertile lands are lost as a result of drought, and in consequence, desertification sets in. Desertification is whereby the lands become infertile and bare, frequently as a result of overgrazing and is exacerbated by drought which makes it difficult for such lands to recover.

- **Migration and even death of Animals and Wildlife**

Animals and wildlife are forced to migrate in drought conditions since they have to move for long distances to get water and food. The prevailing circumstances during droughts also make it difficult for the survival of the animals. When the wildlife and animals migrate, they end up in new locations where they can be vulnerable, endangered because of new threats. This leads to loss of biodiversity and disruption of the natural ecosystems.

- **Economic Impacts of Droughts**

The economic impacts of drought are realized from monetary and business losses incurred during droughts by governments, businesses, families, and at the individual level. These are some of the examples of economic effects of droughts

- **Increased budgetary spending by farmers**

During droughts, farmers spend more money on crop irrigation so as maintain crop yields. Also, lots of water has to be availed for watering the farm animals to ensure the daily water consumption standards are met. Hence, farmers have to spend more money to buy water or drill wells to keep the crops and livestock nourished with enough water.

- **Hunger, anemia, malnutrition, and deaths**

Hunger, anemia, malnutrition and deaths of people are often witnessed in drought-stricken areas. Drought is a great causal factor for low food production, thus, when experienced in poorer regions the effects of malnutrition, hunger,

anemia and mortalities are compounded since there is little food available for consumption.

- **Migration of people and anxiety**

People are forced to shift to other places in search for better living conditions during droughts. This contributes to loss of livelihoods and disorients small-scale farmers who are dependent on their farm produce. People forced to migrate also undergo lots of stress, anxiety and are compelled to indulge in strenuous activities to provide for their families. Women, children, and the elderly are the most affected.

## **Managing Drought**

### **Education**

It is important that each of us learn about how droughts occur and how they affect us. This empowers us to think of solutions and other things we can do if we find ourselves in a drought. The government (or authorities) also need to educate the public periodically about their environment, climate, weather and some natural disasters that can happen

### **Stop-pollution**

Taking measures to stop all forms of water pollution is important, because on the onset of droughts, humans depends on surface water such as streams and lakes and the like. If those are in great condition, humans can depend on them for drinking and irrigation until things improve.

### **Water-conservation-and-storage**

Water is precious and a scarce commodity everywhere in the world and humans need to use water wisely as such. Even if there is water available, it is important because the practice makes us cope better when there is a shortage. Also, preserving water leaves enough to be stored in dams, reservoirs and even turned into ponds.

### **Conflicts over water**

Water is essential for our existence and is fast becoming scarce. Rapidly increasing population and limited water resources give rise to conflicts over water. These conflicts occur over both freshwater and saltwater, and both between and within nations. However, conflicts occur mostly over freshwater; because freshwater is being used as important resources for agriculture, energy generation, industrial purpose. As freshwater is a vital, and its production is less, its availability putn impacts the living and economic conditions of a country or region.

Construction of dams or power stations:

For hydroelectric power generation, dams are built across the rivers, and this initiates conflicts between the states.

#### Conflict through pollution:

Rivers are also used for industrial purposes. They act as reservoirs for supply of fresh water and also receive waste water and waste from the industry. Water crossing borders that has been polluted by wastes from one country develops into an international conflict.

#### Management of water conflicts

1. Concerted efforts are required to enforce laws that check these practices to control water pollution
2. In order to overcome the problem of sharing river water in a country, the concept of interlinking of rivers has been suggested
3. Rivers should be nationalized, the National Water Authority and River Basin Authority should be given powers to ensure equitable distribution of basin water.

#### **Dams: Benefits and Problems:**

Dams provide a range of economic, environmental, and social benefits, including recreation, flood control, water supply, hydroelectric power, waste management, river navigation, and wildlife habitat. Some of them are given below:-

#### **Hydro Electric Power**

The electricity can be generated through This is usually the main draw for the building of dams in the first place and the influx of power for a town to use and sell can cause cities to grow and thrive.

#### **Tourism and Camping**

Dams are a great draw for tourists and provide an attractive place for families to go camping and fishing etc. This can improve the local economy of an area by attracting travellers who will often spend money at the nearby businesses, and will hence provide more jobs for locals as more labour is needed to keep the tourists 'happy' -- with Hotels etc.

#### **Still Water for Animals**

Some species of animal actually require still water in order to survive. As such, a dam can provide a way for these species to thrive in an area where they otherwise might not have. However, you will see later in this article that dams also cause problems for other such species.

#### **Clean Drinking Water for Nearby Cities and Towns**

Dams can provide a very good source of water for towns and cities in the area. This water can be used for drinking or industry and can take advantage of an otherwise unusable water source.

### **Flooding and Water Management**

They can also be specifically designed to help ease and solve flooding problems within a settled area, and through the dam -- the water can be controlled to provide a form of irrigation for agricultural land and even source of transportation for goods.

### **Water-Storage**

Dams create reservoirs throughout the world that supply water for many uses, including industrial, municipal, agricultural and other activities.

### **Irrigation**

Most of the countries are depend on dam for their irrigation activities. Thousands of jobs are tied to producing crops grown with irrigated water.

### **Debris-Control**

In some instances, dams provide enhanced environmental protection, such as the retention of hazardous materials and detrimental sedimentation.

### Problems of dams

### **Expensive and Difficulties in Becoming Profitable**

The larger dams are incredibly expensive to build and, as such, they can take many years to pay for themselves and become profitable. Most dams are estimated to operate for at least two to three decades,

### **Disruption to Natural Environment and Water Ecology During Construction**

Building a dam requires diverting water temporarily and it also means a lot of digging and construction on the dam site. While this construction is only temporary, it can have long lasting effects on the environment -- and it will destroy local ecosystems.

### **Geological Disruption and Earthquakes**

The geological disruption that can be caused by larger dams. The weight of the larger dam actually resulted in the compression of the earth in that area which leads to occur minor earthquake and put serious effects on the society.

### **Danger of Dam collapse**

Dams being built today are much more stable than dams built in the past but many older dams have problems and may be collapse and create problems for nearby people..

### **Impacted by Drought**

In times of heavy drought dams will stop functioning properly and some can even lose their structural integrity. If local cities rely on the dam for their power then droughts can be devastating with both power and water becoming scarce.

### **Affects on Water Quality and Flow**

Low oxygen levels in dam water are the result of the hydroelectric production process. The disruption of the natural flow of water can have impacts on the turbidity of water as well, which can seriously harm aquatic life.

## **MINERAL RESOURCES**

Minerals provide the material used to make most of the things of industrial- based society; roads, cars, computers, fertilizers, etc. Demand for minerals is increasing world wide as the population increases and the consumption demands of individual people increase. The mining of earth's natural resources is, therefore accelerating, and it has accompanying environmental consequences.

A mineral is a pure inorganic substance that occurs naturally in the earth's crust. All of the Earth's crust, except the rather small proportion of the crust that contains organic material, is made up of minerals. Some minerals consist of a single element such as gold, silver, diamond (carbon), and sulphur.

### **Types of Minerals:**

1. Precious metallic minerals: Gold, Silver, Platinum, Bauxite.
3. Non metallic Minerals: Graphite, Diamond, Quartz etc.
4. Fuels minerals: Coal, Petroleum, Natural Gas etc.
5. Ferro-alloy metallic minerals: Manganese, Molybdenum, Tungsten, Cobalt, Nickel etc
6. Non ferrous metals: Copper, Zinc, lead etc.

### **Some of the uses of mineral resources are:**

1. Used in construction of buildings, bridges and housing settlement.
2. Development of industries and machinery.
3. Used for generation of energy mainly Coal, petroleum and natural gas.
4. Used for development of defence equipment.
5. Used in the field of communication like telephone, wires, cables, electronic devices etc.
6. Formation of alloys for various purposes.
7. Used for formation of ornaments like jewellery of gold, diamond, silver etc.
8. Used for synthesis of fertilizers, fungicides etc.

## **EXPLOITATION OF MINERAL RESOURCES**

***(a) Mining is hazardous occupation:***

1. This occupation involves several health risk dust produced during mining operation are injurious to health and cause lung diseases.
2. Extraction of some toxic or radioactive minerals leads to life threatening hazards.
3. Dynamite explosion during mining is very risky as fumes produced are extremely poisonous.
4. Underground mining is more hazardous than surface mining as there are more chances if accidents like roof falls, flooding and inadequate ventilation etc.

***(b) Rapid depletion of high grade minerals:***

Increasing demand for high grade minerals has compelled miners to carry out more extraction of minerals, which require more energy sources and produce large amount of waste materials.

***(c) Wastage of upper soil layer and vegetation:***

Surface mining results in the complete destruction of upper soil layer and vegetation. After extraction, the wastes are dumped in an area which destroys the total surface and vegetation.

***(d) Environmental problems:***

Over exploitation of mineral resources resulted in many environmental problems like:

1. Conversion of productive land into mining and industrial areas.
2. Mining and extraction process are one of the sources of air, water and land pollution.
3. Mining involves huge consumption of energy resources like coal, petroleum, natural gas etc. which are in-turn non renewable sources of energy.
4. Surface mining directly degrades the fertile soil surface thus effect ecology and climate if that particular area.

**General Impacts of mining on the environment:**

**Energy Consumption:**

Mining requires vast amounts of energy. The ore and rock has to be transported great distances by large vehicles, which require a large amount of energy in the form of gasoline. Underground mines need extensive hoisting systems to transport the minerals, which also require energy. Controlling the temperature of mines deep underground is very energy consuming as well. Pneumatic equipment, which is used a lot in the mining industry, also takes energy. Smelting ores and metal requires lots of energy

**Air:**

Mining has a great effect on the quality of the air. Since mines need to blast through rock to get to an ore, dust may be produced in the process. Coal mines release methane, which contributes to environmental issues because it is a greenhouse gas. Heavy metals, such as sulphur dioxide, may be polluted into the air .

**Water:**

Mines use a lot of water, though some of the water is reusable. Sulphides-containing minerals negatively impacts groundwater. This happens from both surface and underground mines. Another way surface and underground water are affected is through tailing dams and waste rock heaps, because they are a source of acidic drainage water.

**Land:**

There are many environmental concerns about the effects mining has on the land. Trees need to be cut down in order to have a mine built, and whole forests could be destroyed.. Mining activities also may lead to erosion, which is dangerous and bad for the land. Since the chemicals are poisonous, they make the soil unsuitable for plants to grow. Also, the organisms that live in the soil find the polluted environment hostile for their survival.

**Large-scale-deforestation**

Mining requires large areas of forest area to be cleared so that the land could be dug into by the miners. For this reason, large-scale deforestation is required to be carried out in the areas where mining has to be done. Besides clearing the mining area, vegetation in the adjoining areas also needs to be cut in order to construct roads and residential facilities for the mine workers. Thus, mining is one of the major causes of deforestation and pollution.

**Ecosystem Damage:**

Mines are highly damaging to the ecosystems surrounding them. Many different types of mines affect many different types of ecosystems. Many of the toxins and tailings that are discharged from the mines can disrupt and disturb the way animals live, and their health.

**Loss-of-Biodiversity**

The forests that are cleared for mining purposes are home to a large number of organisms. Indiscriminate clearing of the forests leads to loss of habitat of a large number of animals. This puts the survival of a large number of animal species at stake. The cutting down of trees in itself is a big threat to a number of plants, trees, birds and animals that dwell in the forests.

**Health and Safety:**

Mining can be very safe, but often it is extremely dangerous. Underground mining is usually more unsafe than surface because of the poor ventilation and visibility, as well as

the rock fall hazards. The biggest health risks are from dust, which can cause breathing problems

## **FOOD RESOURCES**

Food is essential for growth and development of living organisms. These essential materials are called nutrients and these nutrients are available from variety of animals and plants. There are thousands of edible plants and animals over the world, out of which only about three dozen types constitute major food of humans.

The majority of people obtain food from cultivated plants and domesticated animals. Although some food is obtained from oceans and fresh waters, but the great majority of food for human population is obtained from traditional land-based agriculture of crops and livestock.

**WORLD FOOD PROBLEMS:** The following are the causes of world food problems which are divided into following categories:

### **World Wide Problems(causes)**

1. Natural calamities:-drought, heavy rain and flooding, crop failures.
2. Environmental degradation of soil erosion and inadequate water resources.
3. Food supply-and-demand imbalances.
4. Inadequate food reserves.
5. Warfare and civil disturbances.
6. migration of refuses
7. Culturally-based food prejudices.
8. Declining ecological conditions in agricultural regions.

### **Problems of the Developing World**

1. Underdevelopment.
2. Excessive population growth.
3. Lack of economic incentives :-farmers using inappropriate methods and labouring on land they may lose or can never hope to own.
4. Parents lacking knowledge of basic nutrition for their children.
5. Insufficient government attention to the rural sector.

### **Problems of the Industrialized World**

1. Excessive use of natural resources.
2. Pollution.
3. Inefficient, animal-protein diets.

4. Inadequate research in science and technology.
5. Excessive government bureaucracy.
6. Loss of farmland to competing uses.

## **CHANGES CAUSED BY AGRICULTURE AND OVERGRAZING**

Agriculture is the world's oldest and largest industry; more than half of all the people in the world still live on farms. But, because of production, processing and distribution of food — and that took on a large scale larger effects on the environment are unavoidable.

Agriculture has both primary and secondary environmental effects. A primary effect is an effect on the area where the agriculture takes place i.e. on-site effect. A secondary effect, also called an off-site effect, is an effect on an environment away from the agricultural site.

**The effects of agriculture on the environment can be broadly classified into three groups, viz. global, regional and local:**

**(1) Global Effects:**

These include climate changes as well as potentially extensive changes in chemical cycles.

**(2) Regional Effects:**

These generally result from the combined effects of farming practices in the same large region. Regional effects include deforestation, desertification, large scale pollution, increase in sedimentation in major rivers and in the estuaries at the mouths of the rivers and changes in the chemical fertility of soils over large areas. In tropical waters, sediments entering the ocean can destroy coral reefs.

**(3) Local Effects:**

These occur at or near the site of farming. These changes / effects include soil erosion and increase in sedimentation downstream in local rivers. Fertilizers carried by sediments can also transport toxins and destroy local fisheries.

***Changes caused by Overgrazing:***

The carrying capacity of land for cattle depends on the fertility of the soil and the rainfall. When the carrying capacity is exceeded, the land is overgrazed.

**The changes that result from overgrazing include:**

- (a) Reduction in the growth of vegetation.

- (b) Reduction in the diversity of plant species.
- (c) Increased soil erosion as the plant cover is reduced.
- (d) Damage from the cattle trampling on the land, like paths made by cattle develop into gullies, which erode rapidly in the rain.
- (e) Dominance of plant species that are relatively undesirable to the cattle.

## **Effects of Overgrazing**

### **1. Soil erosion**

The continued trampling of numerous animals in an average forage land will act to accelerate the death of plants and vegetation cover. This is because the animals will graze even on the slightest shoots of new growth. Without the plants or vegetation cover, the soil is left bare and exposed to harsh weather such as heavy downpour and high temperatures which disintegrates the rocks and carries the top soil away.

### **2 Land degradation**

The acts of compaction and erosion as a result of overgrazing can cause tremendous land degradation. In drier areas, the experience is even worse as a large percentage of pasture and land cover is destroyed, contributing to relentless progression of desertification. In fact, in some areas overgrazing has led to complete desertification. Overgrazing combined with overstocking has the most damaging outcomes to the world's natural environment.

### **3. Loss of valuable species**

The natural composition of plant population and their regeneration capacity is significantly affected by overgrazing. The original pasture crops are composed of high quality pastures and herbs with great nutritional value. When animals intensively graze on such pastures, even the root stocks which contain the reserve food or regeneration capacity get ruined.

### **4. Food shortage/famine**

As earlier stated, overgrazing is a primary contributor to desertification because it converts arable or pasture land into unproductive piece land. The resultant soil is thus not suited for growing food since it loses its essential nutrients. The loss of land productivity directly results in the loss of food available for consumption. This heightens food supply reduction and if population growth is still registered, it causes starvation and economic challenges.

### **5. Death of people and livestock**

The long term effects of overgrazing are food shortage which can make people and cattle die of starvation. Without sufficient pasture for livestock grazing, cattle lack the necessary nutrients for survival. The nutrient deficiencies make the animals unable to gain weight appropriate to their productive stage and life which lowers their chances of survival.

### **Effects of modern agriculture - Fertilizer Pesticide problems, Water logging, Salinity**

#### AGRICULTURE

Agriculture is an art, science and industry of managing the growth of plants and animals for human use. Agriculture includes preparation of soil for cultivation of crops, harvesting crops, breeding and raising livestock, dairying and forestry.

#### MODERN AGRICULTURE

Modern agriculture makes use of hybrid seeds of single crop variety, technologically advanced equipment, fertilizers, pesticides and water to produce large amounts of single crop.

#### Problems using fertilizers

1. **Micronutrient imbalance:** Chemical fertilizers used in modern agriculture contain Nitrogen, Phosphorus and Potassium (N,P,K) which are macronutrients. Excess use of fertilizers in fields causes micronutrient imbalance. Ex: Excessive use of fertilizers in Punjab and Haryana caused deficiency of micronutrient Zinc thereby affecting productivity of soil.
2. **Nitrate pollution:** Excess Nitrogenous fertilizers applied in fields leach deep into the soil contaminating the groundwater. If the concentration of nitrate in drinking water exceeds 25 mg/L it leads to a fatal condition in new-born babies. This condition is termed "Blue Baby Syndrome"
3. **Eutrophication:** The application of excess fertilizers in fields leads to wash off of the nutrient loaded water into nearby lakes causing over-nourishment. This is called "Eutrophication". Eutrophication causes the lakes to be attacked by "algal blooms". Algal blooms use nutrients rapidly and grow fast. Their life is short, they die and pollute water thereby affecting aquatic life in the lake.

#### Problems in using Pesticides:

In order to improve crop yield, pesticides are used indiscriminately in agriculture.

Pesticides are of two types:

1. First generation pesticides that use Sulphur, Arsenic, Lead or Mercury to kill pests
2. Second generation pesticides such as Dichloro Diphenyl Trichloroethane (DDT) used to kill pests. These pesticides are organic in nature. Although these pesticides protect our crops from severe losses due to pests, they have several side-effects as listed below:
  3. Death of non-target organisms: Several insecticides kill not only the target species but also several beneficial non-target organisms
- Pesticide resistance: Some pests that survive the pesticide generate highly resistant generations that are immune to all kinds of pesticides. These pests are called "superpests"
- Bio-magnification: Most pesticides are non-biodegradable and accumulate in the food chain. This is called bio-accumulation or bio-magnification. These pesticides in a bio-magnified form are harmful to human beings.
- Risk of cancer: Pesticide enhances the risk of cancer in two ways (i) It acts as a carcinogen and (ii) It indirectly suppresses the immune system.

## **WATER LOGGING**

### **Definition:**

The water logging may be defined as rendering the soil unproductive and infertile due to excessive moisture and creation of anaerobic conditions. If water stands on land for most of the year, it is called water logging. In water logged conditions, pore-voids in the soil get filled with water and soil-air gets depleted. In such a condition the roots of plants do not get enough air for respiration. Water logging also leads to low mechanical strength of soil and low crop yield.

### **Causes of Water logging**

#### **They are:**

- i. Inadequate drainage of over-land run-off increases the rate of percolation and in turn helps in raising the water table.
- ii. The water from rivers may infiltrate into the soil.
- iii. Seepage of water from earthen canals also adds significant quantity of water to the underground reservoir continuously.
- iv. Sometimes subsoil does not permit free flow of subsoil water which may accentuate the process of raising the water table.
- v. Irrigation water is used to flood the fields. If it is used in excess it may help appreciably in raising the water table. Good drainage facility is very essential.

### **Effects of Water logging:**

### ***1. Creation of Anaerobic Condition in the Crop Root-Zone:***

Excessive moisture content creates anaerobic condition in the soil. The plant roots do not get the required nourishing food or nutrients. As a result crop growth is badly affected.

### ***2. Growth of Water Loving Wild Plants:***

When the soil is waterlogged water loving wild plant life grows abundantly. The growth of wild plants totally prevent the growth of useful crops.

### ***3. Impossibility of Tillage Operations:***

Waterlogged fields cannot be tilled properly. The reason is that the soil contains excessive moisture content and it does not give proper tilth.

### ***4. Accumulation of Harmful Salts:***

The upward water movement brings the toxic salts in the crop root-zone. Excess accumulation of these salts may turn the soil alkaline. It may hamper the crop growth.

### ***5. Lowering of Soil Temperature:***

The presence of excessive moisture content lowers the temperature of the soil. In low temperature the bacteriological activities are retarded which affects the crop growth badly.

### ***6. Reduction in Time of Maturity:***

Untimely maturity of the crops is the characteristic of waterlogged lands. Due to this shortening of crop period the crop yield is reduced considerably.

### **Solution to the Problem of Water logging:**

#### ***Preventive Measures:***

#### **Preventive measures include the following:**

##### **a) By lining the canal section:**

When the canal section is made fairly watertight by providing lining the seepage loss is reduced to quite a good extent.

##### **b) By introducing intercepting drains:**

They are generally constructed parallel to the canal. They give exceptionally good results for the reach where the canal runs in high embankments.

##### **c) Quick disposal of rainwater:**

Quick removal of rainwater by surface or open drains is a very effective method of preventing the rise in water table and consequent water logging of the tract. It is needless to state that the rainwater removed is net reduction in inflow.

##### **d) Installation of lift irrigation systems:**

When a lift irrigation project in the form of a tube well irrigation system is introduced in the waterlogged area the water table gets lowered sufficiently. It is found to be very successful method of reclaiming waterlogged land. Thus a combination of a canal system

and a supplementary tube well irrigation system may be considered to be most successful and efficient irrigation scheme.

#### **e) Implementation of Drainage Schemes:**

The waterlogged area may be reclaimed by introducing underground drainage schemes.

f). Lining of channels (main canal, branches and field channels).

g) Provision of surface drains for drainage of rainwater; and

h) Implementation of tube well projects both extensive and local.

### **SOIL SALINITY**

Soil salinity is a major limiting factor that endangers the capacity of agricultural crops to sustain the growing human population. It is characterized by a high concentration of soluble salts that significantly reduces the development of the crops. Saline soils are characterized by accumulation of soluble salts like sodium chloride, calcium chloride, magnesium chloride, sodium sulphate, sodium carbonate and sodium bicarbonates.

#### **Causes of Soil salinity**

The following are the causes of soil salinity:

- Salts are also deposited via dust and precipitation.
- Human practices can increase the salinity of soils by the addition of salts in irrigation water.
- The change in the level of ground water due to soil erosion, which led to high concentration of salts in the water level.
- Salinity from irrigation can occur over time wherever irrigation occurs, since almost all water (even natural rainfall) contains some dissolved salts. When the plants use the water, the salts are left behind in the soil and eventually begin to accumulate.

#### **Effects of Soil salinity**

The following are the effects of soil salinity:

- Due to salt deposit in the soil the growth of the plant will be reduced.
- The root of the of the plants will become weak due to salt deposit in the soil.
- Salinity affects production in crops, pastures and trees by interfering with nitrogen uptake, reducing growth and stopping plant reproduction.
- If the level of salts in the soil water is too high, water may flow from the plant roots back into the soil. This results in dehydration of the plant, causing yield decline or even death of the plant.

#### **Remedies for soil salinity**

The following are the remedies for soil salinity:

- The first step for reducing soil salinity is to improve drainage system so that the salt deposited in the soil will be flushed out.
- Pour a 2- to 4-inch layer of compost or charcoal over the **soil**.
- Turn the additives into the top 6 inches of **soil** with a tiller or a shovel.

## **ENERGY RESOURCES**

Energy is the capacity to do work and is required for life processes. An energy resource is something that can produce heat, power life, move objects, or produce electricity. Energy is available on earth in a number of forms and some forms may be used immediately while others might require some transformation. It is difficult to imagine life without energy. All the developmental activities in the world are directly or indirectly dependent on energy. Both energy production and energy utilization indicate a country's progress.

### **GROWING-ENERGY-NEEDS**

Energy is essential to the existence of mankind. All industrial processes like mining, transport, lighting, heating and cooling in buildings need energy. With the growing population, the world is facing an energy deficit. Lifestyle change from simple to a complex and luxurious lifestyle adds to this energy deficit. Almost 95% of commercial energy is available from fossil fuels like coal and natural gas. These fossil fuels will not last for more than a few years. Hence, we must explore alternative fuel/energy options.

### **RENEWABLE AND NON-RENEWABLE ENERGY SOURCES**

Based on continual utility, natural resources can be classified into two types:

**Renewable energy sources:** These resources can be generated continuously and are inexhaustible.

Ex: Wood, Solar energy, Wind energy, Hydro power, tidal energy, Geo-thermal energy.

**Non-renewable energy sources:** Non-renewable energy sources are natural resources, that cannot be regenerated once they are exhausted. They cannot be used again.

Ex: Coal, Petroleum, Natural gas and Nuclear fuels

## **USE OF ALTERNATE ENERGY SOURCES**

There are many reasons the world is looking for alternative energy sources in an effort to reduce pollutants and greenhouse gases. Alternative or renewable energy sources show significant promise in helping to reduce the amount of toxins that are by-products of energy use and help preserve many of the natural resources that we currently use as sources of energy.

### 1. Wind Power

Wind energy harnesses the power of the wind to propel the blades of wind turbines. The rotation of turbine blades is converted into electrical current by means of an electrical generator. In the older windmills, wind energy was used to turn mechanical machinery to do physical work, like crushing grain or pumping water. Wind towers are usually built together on wind farms. Now, electrical currents are harnessed by large-scale wind farms that are used by national electrical grids as well as small individual turbines used for providing electricity to isolated locations or individual homes.

#### Advantages

- Wind power produces no pollution that can contaminate the environment, Since no chemical processes take place, as in the burning of fossil fuels, there are no harmful by-products left over.
- Since wind generation is a renewable source of energy, we will never run out of it.
- Farming and grazing can still take place on land occupied by wind turbines which can help in the production of bio fuels.
- Wind farms can be built off-shore.

#### Disadvantages

- Wind power is intermittent. Consistent wind is needed for continuous power generation. If wind speed decreases, the turbine lingers and less electricity is generated.
- Large wind farms can have a negative effect on the scenery.

## 2. Solar Power

Solar energy is used commonly for heating, cooking, the production of electricity, and even in the desalination of seawater. Solar power works by trapping the sun's rays into solar cells where this sunlight is then converted into electricity. Additionally, solar power uses sunlight that hits solar thermal panels to convert sunlight to heat water or air. Other methods include using sunlight that hits parabolic mirrors to heat water (producing steam), or simply opening a rooms blinds or window shades to allow entering sunlight to passively heat a room.

#### Advantages

- Solar power is a renewable resource. As long as the Sun exists, its energy will reach Earth.
- Solar power generation releases no water or air pollution because there is no chemical reaction from the combustion of fuels.
- Solar energy can be used very efficiently for practical uses such as heating and lighting.
- The benefits of solar power are seen frequently to heat pools, spas, and water tanks all over.

#### Disadvantages

- Solar power does not produce energy if the sun is not shining. Night time and cloudy days seriously limit the amount of energy produced.
- Solar power stations can be very expensive to build.

### 3. Geothermal Energy

Geothermal literally means "earth heat." Geothermal energy harnesses the heat energy present underneath the Earth. Hot rocks under the ground heat water to produce steam. When holes are drilled in the region, the steam that shoots up is purified and is used to drive turbines, which power electric generators.

#### Advantages

- If done correctly, geothermal energy produces no harmful by-products.
- Once a geothermal plant is built, it is generally self-sufficient energy wise.
- Geothermal power plants are usually small and have little effect on the natural landscape.

#### Disadvantages

- If done incorrectly, geothermal energy can produce pollutants.
- Improper drilling into the earth can release hazardous minerals and gases.
- Geothermal sites are prone to running out of steam.

### 4. Hydroelectric Energy

Hydroelectric power comes from the potential energy of dammed water driving a water turbine and generator. Hydropower works by harnessing the gravitational descent of a river that is compressed from a long run to a single location with a dam or a flume. This

creates a location where concentrated pressure and flow of water can be used to turn turbines or water wheels to drive an electric generator..

#### Advantages

- Water can be accumulated above the dam and released to coincide with peaks in demand. So, unlike other types of power stations, hydroelectric power stations can promptly increase to full capacity.
- Electricity can be generated constantly, because there are no outside forces, unlike other forms of alternative energy, which affect the availability of water.
- Hydroelectric power produces no waste or pollution since there is no chemical reaction to produce power.
- Water used for hydropower can be reused.

#### Disadvantages

##### **Environmental intervention**

The creation of big reservoirs of water or dams intervenes not only in reshaping and changing the condition of the bodies of water but also to the condition of the fish species. The fish in the river can be affected by the draining of the water from the dam as well as the fish that is in the dam.

##### **Destroying wetlands/lands**

The water that flows from the dam creates a flood on the rivers or in the wetland bodies affecting the organisms living on it. Animals such as birds, cranes, and other aquatic birds mostly thrive in marshy habitats. Aside from that, some plant species grow in the wetlands.

##### **Expensive construction**

Creating hydroelectric power plants and dams need a sufficient budget in order to create a high standard hydroelectric power. Though hydroelectric energy produces a cheap cost, the construction of one dam costs approximately \$20 billion and takes 18 years to finish.

## **LAND RESOURCES**

Land resources mean the resources available from the land, thus the agricultural land which contain natural fertilizer for growth of the products sown; the underground water, the various minerals like coal, bauxite, gold and other raw materials.

The more a country is able to locate and use the raw materials, the more the industrialization of that country, area etc.

Land resource refers to the land available for exploitation, like non agricultural lands for buildings, developing townships etc

Land resources (natural resources) (economically referred to as land or raw materials) occur naturally within environments that exist relatively undisturbed by mankind, in a natural form.

- A natural resource is often characterized by amounts of biodiversity existent in various ecosystems.
- Natural resources are derived from the environment. Many of them are essential for our survival while others are used for satisfying our wants.

### **Land as a resource**

Land is a very valuable resource. It provides food, fibre, wood, medicine and other biological materials needed for food. Soil is a mixture of inorganic materials (rocks and minerals) and organic materials (dead materials and plants). Top soil is classified as a renewable resource as it is continuously regenerated by natural processes at a very slow rate. However, if the rate of erosion is faster than the rate of renewal, the soil becomes a non-renewable-resource.

Uses-Of-land-resources

Land provides food, wood, minerals, etc

1. Land nurtures plants and animals that provide us food and shelter
2. Land may be used as watershed or reservoir.
3. Land acts as a dustbin for the wastes generated by modern society.
4. Land is used for constructing buildings and industries.

### **LAND DEGRADATION**

Land degradation is the major consequences of direct interference of human activities in the natural phenomenon.

#### **Land degradation means:**

1. Loss of natural fertility of soil because of loss of nutrients.
2. Less vegetation cover
3. Changes in the characteristic of soil.
4. Pollution of water resources from the contamination of soil through which water sweeps into ground or runoff to the water bodies.
5. Changes in climatic conditions because of unbalanced created in the environment.

#### **Causes of Land Degradation:**

##### **(a) Deforestation:**

Deforestation is taking place at a faster rate due to increasing demands of timber, fuel and forest products which results into degradation of land resources.

**(b) Overgrazing:**

Overgrazing refers to excessive eating of grasses and other green plants by cattle. It results into reduced growth of vegetation, reduced diversity of plant species, excessive growth of unwanted plant species, soil erosion, and degradation of land due to cattle movement.

**(c) Agricultural practises:**

The modern agricultural practises, excessive use of fertilizers and pesticides has adversely degraded the natural quality and fertility of the cultivation land.

**(d) Industrialization:**

Development of industries for the economic growth of the country leads to excessive deforestation and utilization of land in such a way that it has lost its natural up gradation quality.

**(e) Urbanization:**

Increasing growth of population and demand for more residential areas and commercial sectors is also one of the reasons for land degradation.

**Prevention and Control Measures for Land Degradation:**

Following are some practises for controlling land degradation:

**1. Strip farming:**

Strip farming is another method to prevent soil erosion. It involves planting the main crops in widely spaced rows and filling in the spaces with another crop to ensure complete ground cover. The ground is completely covered so it restricts water flow which thus soaks down into the soil, consequently reducing erosion problems.

**2. Crop Rotation:**

It is one of the agricultural practice in which different crops are grown in same area following a rotation system which helps in replenishment of the soil.

**3. Bio-fertilizers**

Micro-organisms are important constituents of fertile soils. They participate in the development of soil structure, add to the available nutritional elements and improve the physical conditions of soil. A large variety of micro-organisms are used as bio-fertilisers for improving the nutritional status of crop fields.

**4. Construction of Dams:** This usually checks or reduces the velocity of run off so that soil support vegetation.

**5. Contour Farming:**

This type of farming is usually practiced across the hill side and is useful in collecting and diverting the run off to avoid erosion.

## **LANDSLIDES**

Landslides are the downward movement of a slope composed of earth materials such as rock, soil or artificial fills. Landslides are also called rock-slide, debris-slide, slump, earth-flow or soil-creep.

During construction of roads and mining activities huge portions of mountainous fragile areas are cut down and thrown into adjacent areas and streams. These land masses weaken the already fragile mountain slopes leading to man-induced landslides.

### **Causes of Landslides**

#### **Climate**

Long-term climatic changes can significantly impact soil stability. A general reduction in precipitation leads to lowering of water table and reduction in overall weight of soil mass and causes landslide.

#### **Earthquakes**

When earthquakes strike areas with steep slopes, on numerous occasion, the soil slips leading to landslides. In addition, ashen debris flows instigated by earthquakes could also cause mass soil movement.

#### **Weathering**

Weathering is brought about by the chemical action of water, air, plants and bacteria. When the rocks are weak enough, they slip away causing landslides.

#### **Erosion**

Erosion caused by sporadic running water such as streams, rivers, wind, currents, ice and waves wipes out latent and lateral slope support enabling landslides to occur easily.

#### **Volcanic Eruption**

Volcanic eruptions can cause landslides. If an eruption occurs in a wet condition, the soil will start to move downhill cause landslide.

#### **Forest fires**

Forest fires instigate soil erosion and bring about floods, which might lead to landslides.

#### **Mining**

Mining activities that utilize blasting techniques contribute mightily to landslides. Vibrations emanating from the blasts can weaken soils in other areas susceptible to landslides. The weakening of soil means a landslide can occur anytime.

#### **Clear cutting**

Clear cutting is a technique of timber harvesting that eliminates all old trees from the area. This technique is dangerous since it decimates the existing mechanical root structure of the area.

## **Effects of Landslides**

### **Lead to economic decline**

Landslides have been verified to result in destruction of property. If the landslide is significant, it could drain the economy of the region or country. After a landslide, the area affected normally undergoes rehabilitation. This rehabilitation involves massive capital outlay.

### **Decimation of infrastructure**

The force flow of mud, debris, and rocks as a result of a landslide can cause serious damage to property. Infrastructure such as roads, railways, leisure destinations, buildings and communication systems can be decimated by a single landslide.

### **Loss of life**

Communities living at the foot of hills and mountains are at a greater risk of death by landslides. A substantial landslide carries along huge rocks, heavy debris and heavy soil with it. This kind of landslide has the capacity to kill lots of people on impact. **Affects**

### **beauty of landscapes**

The erosion left behind by landslides leaves behind rugged landscapes that are unsightly. The pile of soil, rock and debris downhill can cover land utilized by the community for agricultural or social purposes.

### **Impacts river ecosystems**

The soil, debris, and rock sliding downhill can find way into rivers and block their natural flow. Many river habitats like fish can die due to interference of natural flow of water. Communities depending on the river water for household activities and irrigation will suffer if flow of water is blocked.

## **SOIL EROSION**

**Soil erosion** is defined as the wearing away of topsoil. Topsoil is the top layer of soil and is the most fertile because it contains the most organic, nutrient-rich materials. Therefore, this is the layer that farmers want to protect for growing their crops and want to protect for growing grasses for their cattle to graze on.

## **Causes of Soil Erosion**

**Rain and rainwater runoff:** In a particular heavy rain, soil erosion is common. First of all, the water starts to break down the soil and the rain water will runoff organic matter, and other nutrients causes soil erosion.

**Farming:** When land is worked through crops or other agricultural processes, it reduces the overall structure of the soil, in addition to reducing the levels of organic matter, making it more susceptible to the effects of rain and water and causes soil erosion

**Slope of the land:** The physical characteristics of the land can also contribute to soil erosion. For example, land with a high hill slope will perpetuate the process of rainwater or runoff saturation in the area, particularly due to the faster movement of the water down a slope.

**Lack of vegetation:** Plants and crops help maintain the structure of soils, reducing the amount of soil erosion. Areas with less vegetation may be prone to erosion.

**Wind:** Wind can be a major factor in reducing soil quality and promote erosion, particularly if the soil's structure has already been loosened up.

## **Effects of Soil Erosion**

Some of the greatest effects of soil erosion include:

**Loss of topsoil:** Obviously, this is the biggest effect of soil erosion. Because topsoil is so fertile, if it is removed, this can cause serious harm to farmer's crops or the ability to effectively work their land.

**Reduced organic and fertile matter:** As mentioned, removing topsoil that is heavy with organic matter will reduce the ability for the land to regenerate new flora or crops. When new crops or plants can't be placed successfully in the area, this perpetuates a cycle of reduced levels of organic nutrients.

**Issues with plant reproduction:** When soil is eroded in an active cropland, wind in that particular area usually puts effect on new seeds which leads to less poor future production.

**Soil acidity levels:** When the structure of the soil becomes compromised, and organic matter is greatly reduced, there is a higher chance of increased soil acidity, which will significantly impact the ability for plants and crops to grow.

**Long term erosion:** Unfortunately, if an area is prone to erosion or has a history of it, it becomes even harder to protect it in the future. The process has already reduced the soil structure and organic matter of the area, meaning that it will be harder to recover in the long run.

## **DESERTIFICATION**

“Desertification is a type of land degradation in which a relatively dry land region becomes increasingly arid, typically losing its bodies of water as well as vegetation and wildlife. It is caused by a variety of factors, such as climate change and human activities. Desertification is a significant global ecological and environmental problem.”

### **Causes of Desertification**

**Overgrazing:** Animal grazing is a huge problem for many areas that are starting to become desert biomes. If there are too many animals that are overgrazing in certain spots, it makes it difficult for the plants to grow back

**Deforestation:** When people are looking to move into an area, or they need trees in order to make houses and do other tasks, then they are contributing to the problems related to desertification. Without the plants (especially the trees) around, the rest of the biome cannot thrive.

**Farming Practices:** Some farmers do not know how to use the land effectively. They may essentially strip the land of everything that it has before moving on to another plot of land. By stripping the soil of its nutrients, desertification becomes more and more of a reality for the area that is being used for farming.

**Urbanization and other types of land development.** As mentioned above, development can cause people to go through and kill the plant life. It can also cause issues with the soil due to chemicals and other things that may harm the ground. As areas become more urbanized, there are less places for plants to grow, thus causing desertification.

**Climate Change:** Climate change plays a huge role in desertification. As the days get warmer and periods of drought become more frequent, desertification becomes more and more eminent. Unless climate change is slowed down, huge areas of land will become desert; some of those areas may even become uninhabitable as time goes on.

**Stripping the land of resources.** If an area of land has natural resources like natural gas, oil, or minerals, people will come in and mine it or take it out. This usually strips the soil of nutrients, which in turn kills the plant life, which in turn starts the process toward becoming a desert biome as time goes on.

**Natural Disasters:** There are some cases where the land gets damaged because of natural disasters, including drought. In those cases, there isn't a lot that people can do

except work to try and help rehabilitate the land after it has already been damaged by nature.

### **Effects of Desertification**

**Farming becomes next to impossible.** If an area becomes a desert, then it's almost impossible to grow substantial crops there without special technologies. This can cost a lot of money to try and do, so many farmers will have to sell their land and leave the desert areas.

**Hunger:** Without farms in these areas, the food that those farms produce will become much scarcer, and the people who live in those local areas will be a lot more likely to try and deal with hunger problems. Animals will also go hungry, which will cause even more of a food shortage.

**Flooding:** Without the plant life in an area, flooding is a lot more eminent. Not all deserts are dry; those that are wet could experience a lot of flooding because there is nothing to stop the water from gathering and going all over the place. Flooding can also negatively affect the water supply, which we will discuss next.

**Poor Water Quality:** If an area becomes a desert, the water quality is going to become a lot worse than it would have been otherwise. This is because the plant life plays a significant role in keeping the water clean and clear; without its presence, it becomes a lot more difficult for you to be able to do that.

**Overpopulation:** When areas start to become desert, animals and people will go to other areas where they can actually thrive. This causes crowding and overpopulation, which will, in the long run, end up continuing the cycle of desertification .

**Poverty:** All of the issues that we've talked about above (related to the problem of desertification) can lead to poverty if it is not kept in check. Without food and water, it becomes harder for people to thrive, and they take a lot of time to try and get the things that they need.

### **Role of an Individual in Conservation of Natural Resources**

'Environment protection' means limiting the impairment of environment and it includes conservation of resources. It has three main objectives:

1. To prevent damage and discomfort
2. To improve productivity and pleasure and,
3. To maintain balance of the ecosystem.

### **Conservation**

Conservation is sustainable use of natural resources, such as soils, water plants, animals and minerals. To conserve natural resources an individual can do these things.

1. Turn off the lights when you leave a room.

2. Replace energy-hungry incandescent lights with fluorescent lighting.
3. Check with your utility company for energy conservation tips.
4. Use a programmable thermostat that automatically turns off the air conditioner or heater when you don't need them.
5. Use a fan instead of air-conditioning.
6. Choose recycled products.
7. Have your gas appliances and heaters regularly inspected and maintained.
8. Walk or use on a bike.
9. Be within the set speed limit.
10. Replace your car's air filter.
11. Ensure that the tires are adequately inflated.
12. Report smoking vehicles.
13. Improve the quality of landscapes, which includes soils, water, etc.
14. Maintain the production of 'clean' food.
15. Don't waste water.
16. Stop hunting and over-exploitation, mainly for commercial and often illegal purposes.
17. Stop improper use of agro-chemicals, and reduce the pollution.
18. Plant trees. Stop illegal cutting of trees.

### **Equitable use of resources for sustainable lifestyles**

Standard of living refers to the consumption of goods and services by an individual. It relates directly to the economic development whereas the well-being or quality of life of a population refers to a combination of attributes that provide physical, mental, spiritual and social wellbeing.

•Sustainable Development (SD) implies economic growth together with the protection of environmental quality, each reinforcing the other. Sustainable Development, thus, is maintaining a balance between the human needs to improve lifestyles and feeling of well-being on one hand, and preserving natural resources and ecosystems, on which we and future generations depend.

\_A desirable human condition : a society that people want to sustain because it meets their needs. An ecosystem that maintains its capacity to support human life and others. A balance between present and future generations; and within the present generation.

**SUSTAINABLE CONSUMPTION:** Sustainable consumption is related to production and distribution, use and disposal of products and services and provides the means to rethink our lifecycle. The aim is to ensure that the basic needs of the entire global community are met, excess is reduced and environmental damage is avoided.

## UNIT 3

### **Concept of an Ecosystem:**

Living organisms cannot live isolated from their non-living environment because the latter provides materials and energy for the survival of the former i.e. there is interaction between a biotic community and its environment to produce a stable system; a natural self-sufficient unit which is known as an ecosystem.

An ecosystem is, therefore, defined as a natural functional ecological unit comprising of living organisms (biotic community) and their non-living (abiotic or physio chemical) environment that interact to form a stable self-supporting system. A pond, lake, desert, grassland, meadow, forest etc. are common examples of ecosystems.

### **Structure and Function of an Ecosystem:**

#### **Each ecosystem has two main components:**

(1) Abiotic

(2) Biotic

(1) Abiotic Components: The non living factors or the physical environment prevailing in an ecosystem form the abiotic components. They have a strong influence on the structure, distribution, behaviour and inter-relationship of organisms.

#### **Abiotic components are mainly of two types:**

##### **(a) Climatic Factors:**

Which include rain, temperature, light, wind, humidity etc.

##### **(b) Edaphic Factors:**

Which include soil, pH, topography minerals etc.

#### **The functions of important factors in abiotic components are given below:**

Abiotic components are the physical and/or the chemical factors that act on the living organisms at any part of their life. These are also called as the ecological factors. The physical and chemical factors are characteristic of the environment. Light, air, soil, and nutrients etc. form the abiotic components of an ecosystem.

The abiotic factors vary from ecosystem to ecosystem. In an aquatic ecosystem, the abiotic factors may include water pH, sunlight, turbidity, water depth, salinity, available nutrients and dissolved oxygen. Similarly, abiotic factors in terrestrial ecosystems can include soil, soil types, temperature, rain, altitude, wind, nutrients, sunlight etc.

Here, the sun is the energy source. Producers/plants use this energy to synthesize food in the presence of carbon dioxide and chlorophyll. The energy from the sun, through several chemical reactions, turns into chemical energy.

## **(2) Biotic Components:**

The living organisms including plants, animals and micro-organisms (Bacteria and Fungi) that are present in an ecosystem form the biotic components.

**On the basis of their role in the ecosystem the biotic components can be classified into three main groups:**

(A) Producers

(B) Consumers

(C) Decomposers or Reducers.

### **(A) Producers:**

The green plants have chlorophyll with the help of which they trap solar energy and change it into chemical energy of carbohydrates using simple inorganic compounds namely water and carbon dioxide. This process is known as photosynthesis. As the green plants manufacture their own food they are known as Autotrophs (i.e. auto = self, trophos = feeder)

The chemical energy stored by the producers is utilised partly by the producers for their own growth and survival and the remaining is stored in the plant parts for their future use.

### **(B) Consumers:**

The animals lack chlorophyll and are unable to synthesise their own food. Therefore, they depend on the producers for their food. They are known as heterotrophs (i.e. heteros = other, trophos = feeder)

**The consumers are of four types, namely:**

#### **(a) Primary Consumers or First Order Consumers or Herbivores:**

These are the animals which feed on plants or the producers. They are called herbivores. Examples are rabbit, deer, goat, cattle etc.

#### **(b) Secondary Consumers or Second Order Consumers or Primary Carnivores:**

The animals which feed on the herbivores are called the primary carnivores. Examples are cats, foxes, snakes etc.

#### **(c) Tertiary Consumers or Third Order Consumers:**

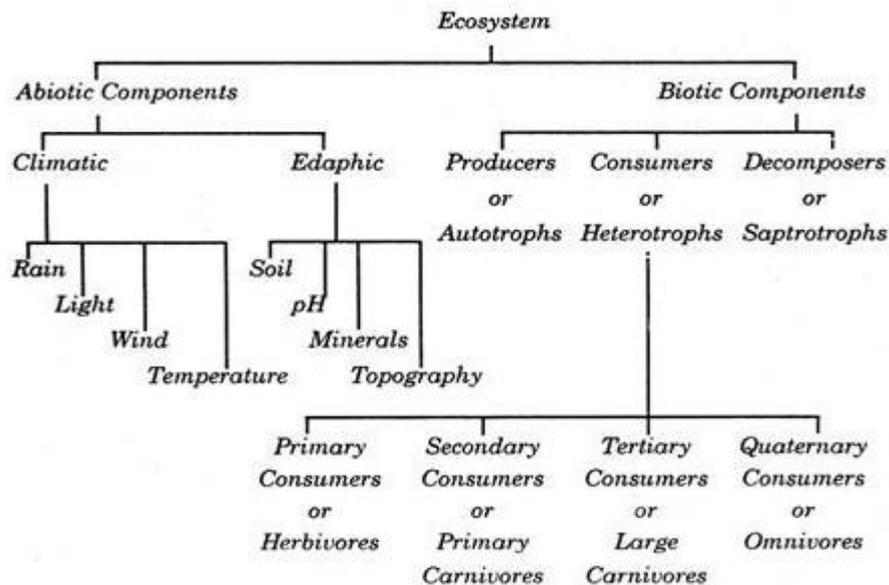
These are the large carnivores which feed on the secondary consumers. Example are Wolves.

#### **(d) Quaternary Consumers or Fourth Order Consumers or Omnivores:**

These are the largest carnivores which feed on the tertiary consumers and are not eaten up by any other animal. Examples are lions and tigers.

### (C) Decomposers or Reducers:

Bacteria and fungi belong to this category. They breakdown the dead organic materials of producers (plants) and consumers (animals) for their food and release to the environment the simple inorganic and organic substances produced as by-products of their metabolisms.



**Schematic Representation of the Structure of an Ecosystem.**

### FUNCTION OF ECOSYSTEM

An ecosystem is a discrete structural, functional and life sustaining environmental system. The environmental system consists of biotic and abiotic components in a habitat. Biotic component of the ecosystem includes the living organisms; plants, animals and microbes whereas the abiotic component includes inorganic matter and energy.

Abiotic components provide the matrix for the synthesis and perpetuation of organic components (protoplasm). The synthesis and perpetuation processes involve energy exchange and this energy comes from the sun in the form of light or solar energy.

**Thus, in any ecosystem we have the following functional components:**

- (i) Inorganic constituents (air, water and mineral salts)
- (ii) Organisms (plants, animals and microbes), and
- (iii) Energy input which enters from outside (the sun).

These three interact and form an environmental system. Inorganic constituents are synthesized into organic structures by the green plants (primary producers) through photosynthesis and the solar energy is utilized in the process. Green plants become the source of energy for renewals (herbivores) which, in turn become source of energy for the flesh eating animals (carnivores). Animals of all types grow and add organic matter to their body weight and their source of energy is complex organic compound taken as food.

They are known as secondary producers. All the living organisms whether plants or animals in an ecosystem have a definite life span after which they die. The dead organic remains of plants and animals provide food for saprophytic microbes, such as bacteria, fungi and many other animals. The saprobes ultimately decompose the organic structure and break the complex molecules and liberate the inorganic components into their environment.

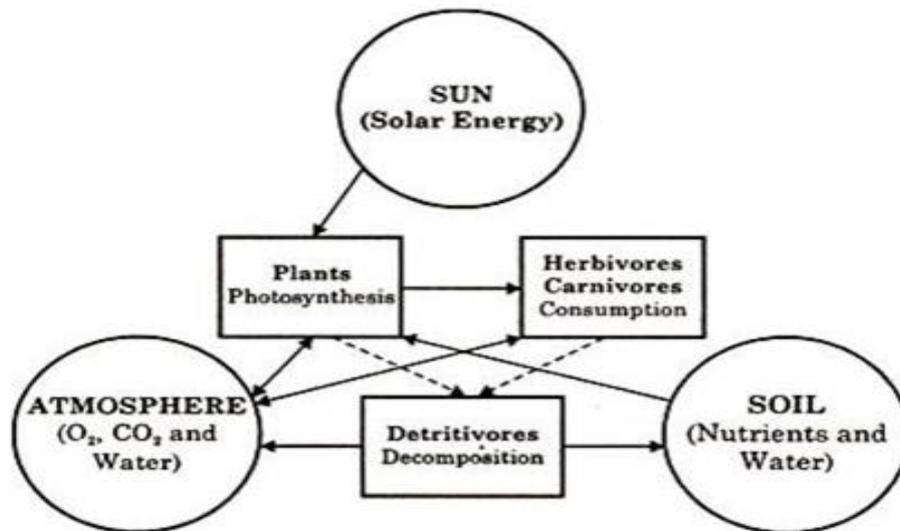
These organisms are known as decomposers. During the process of decomposition of organic molecules, the energy which kept the inorganic components bound together in the form of organic molecules gets liberated and dissipated into the environment as heat energy. Thus in an ecosystem energy from the sun, the input is fixed by plants and transferred to animal components.

**Thus the principal steps in the operation of ecosystem are as follows:**

- (1) Reception of radiant energy of sun,
- (2) Manufacture of organic materials from inorganic ones by producers,
- (3) Consumption of producers by consumers and further elaboration of consumed materials; and.
- (4) After the death of producers and consumers, complex organic compounds are degraded and finally converted by decomposers and converters into such forms as are suitable for reutilization by producers.

The principal steps in the operation of ecosystem not only involve the production, growth and death of living components but also influence the abiotic aspects of habitat. It is now clear that there is transfer of both energy and nutrients from producers to consumers and finally to decomposers and transformers levels. In this transfer there is a progressive decrease of energy but nutrient component is not diminished and it shows cycling from abiotic to biotic and vice versa.

The flow of energy is unidirectional. The two ecological processes—energy flow and mineral cycling which involve interaction between biotic and abiotic components lie at the heart of ecosystem dynamics. The principal steps and components of ecosystem are given below through diagram:



**Relationship within an Ecosystem.**

## ENERGY FLOW IN AN ECOSYSTEM

Each organism living in an ecosystem plays an important role in the flow of energy within the food web. Ecologists have defined three ways that living creatures use energy and interact with one another. Organisms are defined as producers, consumers, or decomposers. Here is a look at each of these roles and their place within an ecosystem.

### Producers

The main role of producers is to capture the energy from the sun and convert it into food. Plants, algae, and some bacteria are producers. Using a process called photosynthesis, producers use the sun's energy to turn water and carbon dioxide into food energy. They earn their name, because - unlike the other organisms in an ecosystem - they can actually produce their own food. Producers are the original source of all food within an ecosystem.

In most ecosystems, the sun is the source of energy that producers use to create energy. But in a few rare cases - such as ecosystems found in rocks deep beneath the ground - bacterial producers can use the energy found in a gas called hydrogen sulfide, that is found within the environment, to create food even in the absence of sunlight!

### Consumers

Most organisms in an ecosystem cannot make their own food. They depend upon other organisms to meet their food needs. They are called consumers - because that is what they do - consume. Consumers can be broken down into three classifications: herbivores, carnivores, and omnivores.

- *Herbivores*. Herbivores are consumers that only eat plants. Deer and caterpillars are herbivores found commonly in a number of environments.
- *Carnivores*. Carnivores are consumers that only eat other animals. Lions and spiders are examples of carnivores. There is a special category of carnivore called *scavengers*. Scavengers are animals that eat only dead animals. Catfish and vultures are examples of scavengers.
- *Omnivores*. Omnivores are consumers that eat both plants and animals depending upon the season and availability of food. Bears, most birds, and humans are omnivores.

### **Decomposers**

Consumers and producers can live together nicely, but after some time, even the vultures and catfish would not be able to keep up with all of the dead bodies that would pile up over the years. That's where decomposers come in. Decomposers are organisms that break down and feed off of the waste and dead organisms within an ecosystem.

Decomposers are nature's built-in recycling system. By breaking down materials - from dead trees to the waste from other animals, decomposers return nutrients to the soil and create another food source for herbivores and omnivores within the ecosystem. Mushrooms and bacteria are common decomposers.

Every living creature in an ecosystem has a role to play. Without producers, consumers and decomposers would not survive because they would have no food to eat.

Without consumers, the populations of producers and decomposers would grow out of control. And without decomposers, producers and consumers would soon become buried in their own waste.

### **ECOLOGICAL SUCCESSION**

Ecological succession is a process through which ecosystems tend to change over a period of time. Succession can be related to seasonal environmental changes which create changes in the community of plants and animals living in the ecosystem. Other succession events may take much longer periods of time, extending to several decades. If a forest is cleared it is initially colonised by a certain group of species of plants and animals. The most frequent example of succession changes occur in a pond ecosystem where it fluctuates from a dry terrestrial habitat to the early colonisation stage by small aquatic species after the monsoon which gradually passes through to a mature aquatic

ecosystem and the reverts back to its dry stage in summer and at that time as a result the aquatic life remains dormant.

### **FOOD CHAINS, FOOD WEBS AND ECOLOGICAL PYRAMID**

**FOOD CHAIN:-** It is the sequence of transfer of matter and energy in the form of food and energy from organism to organism. In other words the most obvious aspect of nature is that energy must pass from one living organism to another. For example, plants which convert solar energy to food by photosynthesis are the primary food source. When herbivores animal feed on plants, energy is transferred from the plants to the animals. In all ecosystem some of the animals feed on other living organisms while some feed on dead organic matter.

Producer-→primary consumer→secondary consumer→tertiary consumer-→quaternary consumer.

### **FOOD WEB :-**

Food web is an important ecological concept. Basically, food web represents feeding relationships within a community. It also implies the transfer of food energy from its source in plants through herbivores to carnivores. Normally, food webs consist of a number of food chains meshed together. Or in other words A food chain is natural interconnection of food chain and a graphical representation of what—eat—what in an ecological community. A food chain is a linear network of links in a food web starting from producer organisms and ending at predator species.

Producer-→primary consumer→secondary consumer→tertiary consumer-→quaternary consumer.

Plant-→Rabit, Goat, Deer-→cats, fox, snakes. jackal→woolves→Lion, Tiger

Difference between food chain and food web- :

- Food chain is a single linear pathway through which food energy and nutrients travels in the ecosystem while food web is number of interconnected food chains through which energy and nutrients travels in the ecosystem.
- In food chains, usually member of high tropic level feed upon a single type of organism of lower tropic level while in food web members of higher tropic level feed upon many organisms of lower tropic level.

- In food chains, separate and isolated food chains increases the instability of the ecosystem. In food web, stability of the ecosystem increases by the presence of complex food webs.
- Food chains have no effect on improving the adaptability and competitiveness of the organisms while more complex food webs improves the adaptability and competitiveness of the organisms.

## **Ecological Pyramid**

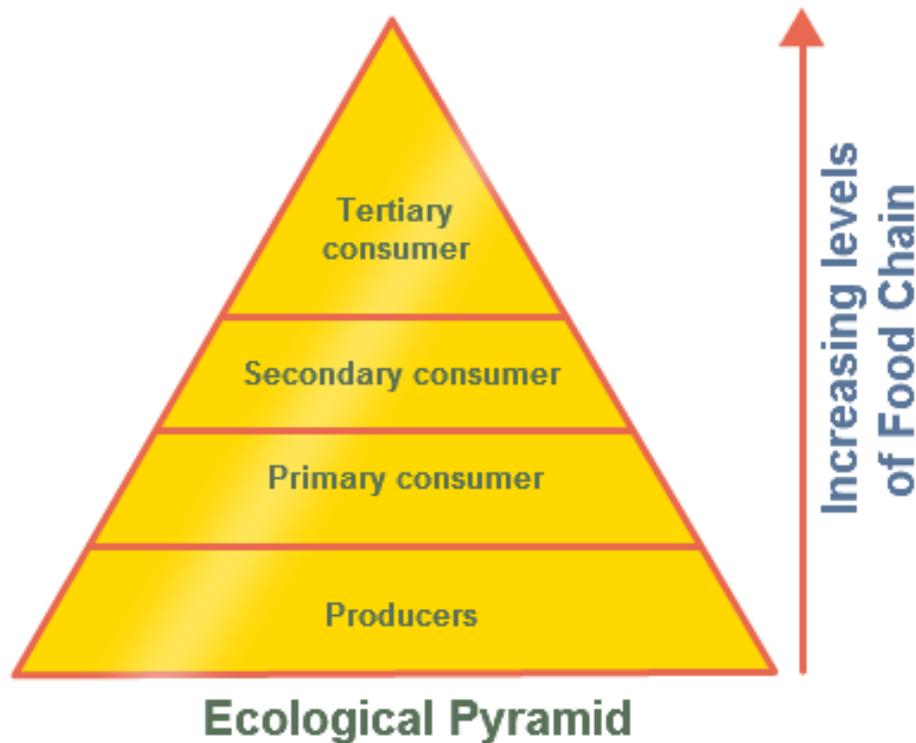
The concept of ecological pyramid was developed by Charles Elton. These pyramids are also known as Eltonian pyramids. The pyramids are a graphical representation which depicts the number of organisms, biomass and productivity at each trophic level. All ecological pyramids begin at the bottom with the producers and processed through different trophic level.

*It is a graphic representation of the relationship between organisms at various trophic levels in a food chain.* The basis of an ecological pyramid is the biomass, energy, and number. The bottom of an ecological pyramid is the broadest and is occupied by the producers, which form the first trophic level. Producers are at the lowest level. Just as in a food chain, the producers are consumed by the primary consumers, in an ecological pyramid; the next level is occupied by the primary consumers. The next level of the pyramid is occupied by the secondary consumers and the last, by the tertiary consumers. It is graphically represented to show the biomass or productivity at each trophic level in an ecosystem.

### **Types of Ecological Pyramids**

Depending on the factors that we use to represent an ecological pyramid, there are three types. They are:

- *Pyramid of numbers*– Here the factor that is taken into account is the number of organisms in each trophic level. As we go up the levels of the pyramid, the number of organisms decreases. The producers form the largest number and hence are at the bottom of the pyramid.
- *Pyramid of energy*– This is an upright pyramid that represents the flow of energy from the producers to the final consumers.
- *Pyramid of biomass* – This pyramid represents the amount of biomass of the organisms present at each trophic level. Biomass is nothing but the weight of the organisms.



## Forest Ecosystem: Types, Characteristic Features and Structure

**Types and Characteristic Features:** \_\_\_\_\_

### ***(a) Temperate Forest Ecosystem:***

The temperate forest ecosystem is very important on Earth. Temperate forests are in regions where the climate changes a lot from summer to winter. Tropical rain forests are in regions where the climate stays constant all year long. Temperate forests are almost always made of two types of trees, deciduous and evergreen. Deciduous trees are trees that lose their leaves in the winter.

Evergreens are trees that keep them all year long, like pine trees. Forests can either be one or the other, or a combination of both. A fourth kind of forest is a temperate rain forest. These are found in California, Oregon and Washington in the United States.

### ***(b) The Tropical Rain Forest Ecosystem:***

Tropical rain forests are one of the most important areas on Earth. These special ecosystems are homes to thousands of species animals and plants. Contrary to popular belief, rain forests are not only densely packed plants, but are also full of tall trees that form a ceiling from the Sun above. This ceiling keeps smaller plants from growing. Areas where sunlight can reach the surface are full of interesting plants.

#### **(i) Insects of the Tropical Rain Forest:**

The most feared and well known spider( Tarantulas), butterflies in the world resides in the jungle .Most species of tarantula have poisonous fangs for killing prey and for protection.

#### **(ii) Tropical Rain Forest Birds:**

The birds of the rain forest are the most beautiful in the world. Hundreds of species of parrot, Toucans live in the rain forest.

**(iii) Tropical Rain Forest Reptiles:**

The tropical rain forests of the world are full of reptiles. Reptiles are cold blooded, which means their body temperature depends on their environment. So, it is important for them to stay in warm climates. Snakes are reptiles, and the rain forests are home to many. The mamba family is the most poisonous of all. They kill their prey by injecting poison with their sharp fangs. Anacondas make up another snake family. They are some of the longest creatures in the world, as they can reach 30 feet in length.

**(iv) Tropical Rain Forest Primates:**

Monkeys and their cousins are all primates. Humans are also primates. There are many species of monkeys in the tropical rain forests of the world. Monkeys can be divided into two groups: new world monkeys and old world monkeys. New world monkeys live only in South and Central America. Spider monkeys live in the rain forests in the Andes Mountains.

**(c) Boreal or Taiga Forests:**

The boreal forest ecosystem is the contiguous green belt of conifer and deciduous trees that encircles a large portion of the Northern Hemisphere. In North America, the boreal forest stretches across most of northern Canada and into Alaska. It has long been identified as one of the world's great forest ecosystems.

**Structure of Forest Ecosystems:**

Different organisms exist within the forest layers. These organisms interact with each other and their surroundings. Each organism has a role or niche in sustaining the ecosystem.

**Some provide food for other organisms; others provide shelter or control populations through predation:**

***Producers:***

All living organisms' intake energy in order to survive. In a forest ecosystem, trees and other plants get their energy from sunlight. Plants produce their own food, in the form of carbohydrates. Plants are, therefore, called the primary producers, since they produce the basic foodstuffs for other organisms within food chains and food webs. Photosynthesis is the chemical reaction that allows plants to produce their own food.

***Consumers:***

Animals cannot produce their own food. They must consume food sources for the energy they need to survive. All animals, including mammals, insects, and birds, are called

consumers. Consumers rely on plants and other animals as a food source. Details of these animals in a forest ecosystem have been given earlier.

Primary consumers only eat plants and are referred to as herbivores. Secondary consumers are referred to as carnivores and feed on herbivores. Tertiary consumers are carnivores that feed on other carnivores. Omnivores eat both plant and animal matter.

### ***Decomposers:***

Leaves, needles, and old branches fall to the forest floor as trees grow. Eventually all plants and animals die. So what happens to all of this plant and animal material? Does it sit on the forest floor forever? Thankfully no. These materials are decomposed by worms, microbes, fungi, ants, and other bugs.

Decomposers break these items down into their smallest primary elements to be used again. Decomposers are important in that they sustain the nutrient cycle of ecosystems.

### ***Humans are part of Forest Ecosystem:***

Humans are consumers. We get food and materials from forests. Because of this, we are a part of the forest ecosystem. Human consumption alters forest ecosystems. Human intervention may be necessary to sustain forest communities under the increased pressure of human use.

### **Aquatic Eco system**

**An aquatic ecosystem** is an ecosystem that is water based. The word 'aquatic' comes from the Latin word for water. An ecosystem is a distinct community of organisms in a specific environment.

So, we can say that an aquatic ecosystem is a community of organisms that live together, interact, and to an extent depend on each other in a water based environment.

There are various different types of aquatic ecosystem and this article explains all about four main types of aquatic habitats for animals. So, read on to find out all about them.

Characteristics of aquatic ecosystems.

Characteristics of aquatic ecosystems include:

- Being underwater, or
- Being based around water.
- Being a community of organisms.
- Being a distinct community that is more or less self contained.

Types of aquatic ecosystems.

The following are the different types of ecosystem : marine ecosystem and freshwater ecosystem – pond ecosystems, lake eco-system, river ecosystems, stream ecosystem, ocean ecosystem and estuaries..

### **A. Marine ecosystems – salty water.**

Marine is a word that comes from the Latin word for sea – mar. So, a marine ecosystem is any ecosystem that exists within the sea. Our seas and oceans are vast bodies of salt water and so – while it may be argued that the whole ocean is one giant ecosystem – it may be also argued that several different ecosystems can coexist within a single ocean. A whole host of different organisms live in marine ecosystems. When it comes to plant life, for example, we have seaweeds and marine algae. Invertebrates that live in the marine ecosystem include jellyfish and crustaceans. Meanwhile, there are fish such as sharks and eels, and mammals such as whales and seals. There are also various sea birds in all parts of the sea: they feed off the fish and other organisms that live there. Humans may also form part of the marine ecosystem if they fish in the sea for food.

### **B. Freshwater ecosystems.**

Contrary to the marine water ecosystem that contains salty water, freshwater ecosystem has little or no salt. The major types of freshwater ecosystem includes pond ecosystem, lake ecosystem and river ecosystem.

#### ***Pond ecosystems.***

Many different plants, fish and animals can live in these types of ecosystems. Frogs, newts, water weeds and water lilies are all examples of pond creatures. In addition, various types of fish can live in a pond. Ponds can be natural or human made ecosystems; if human made, it is not uncommon for goldfish or ornamental carp (such as koi carp) to live in a pond ecosystem. In addition, certain birds and insects may visit the pond ecosystem with regularity. For example, we might see dragonflies or herons around the pond. It may be up for debate whether these visitors are truly part of the ecosystem as they may also visit other ecosystems. But, A pond ecosystem refers to the freshwater ecosystem where there are communities of organism dependent on each other with the prevailing water environment for their nutrients and survival. Ponds are shallow water bodies with a depth of 12-15 feet in which the sun rays can penetrate to the bottom permitting the growth of plants there.

On the basis of the depth of water, penetration of light and the types of plants and animals in the pond, the pond is divided into different zones. They are:

#### **Littoral**

It is a peripheral shallow water zone in which light can reach up to the bottom. It contains warm and oxygen rich circulating water. So, this zone includes abundant rooted vegetations and different types of consumers.

#### **Limnetic**

The limnetic zone is a central part of a pond up to where there is penetration of effective light. The associated organisms are small crustaceans, rotifers, insects and their larvae

and algae. The water level, oxygen content, and temperature in this zone varies time to time. Decomposers are almost absent here.

### **Profundal**

This is the deep-water region where there is no effective light penetration. There the microscopic plants and decomposers are present. So it is called Hypolimnion.

e ecosystem – and that it has an impact on them.

### ***Lake ecosystems.***

Because they tend to be physically enclosed by the earth, rock or mountains around them, freshwater lakes are also identifiable as a distinct habitat that is inhabited by a distinct community of organisms. In a freshwater lake ecosystem, we can find all kinds of different organisms, including crustaceans (such as shrimp and crayfish), fish (like carp, trout and pike) and many birds, reptiles and amphibians. Freshwater lakes can be home to some beautiful plant life, such as tall purple irises, and the flora and fauna that abound within them may also change with the seasons. Some animals may only use lakes for looking after their offspring in, such as frogs that may leave frogspawn in a lake before leaving to inhabit other ecosystems.

### **Freshwater river ecosystems.**

River ecosystems are slightly different to ponds and lakes because whilst the latter two ecosystems offer stagnant (static) water, river water is always flowing. That means that these river ecosystems are the homes of animals and plants that are best adapted to living in flowing water. Salmon are a key example, as they use the flowing motion of a river to help them with their annual migration. And, in general, organisms that prefer to migrate – whether to seek food or to seek a partner – are often to be found in freshwater river ecosystems because the motion of the river suits their style of life (whilst they, in their turn, have evolved to suit a flowing environment). Rivers tend to flow into the sea, and in this way river ecosystems and marine ecosystems meet each other. It may well, therefore, be up for debate to what extent river ecosystems are closed systems. But it is definitely clear that these are distinct types of fresh water ecosystems.

### **Ocean**

The earth has five major oceans: Pacific Ocean, Indian Ocean, Arctic Ocean, Atlantic Ocean and Southern (Antarctic) Ocean. Although the oceans are connected, each of them has unique species and features. According to Barbara A. Somerville (Earth's Biomes: Oceans, Seas, and Reefs), the Pacific is the largest and deepest ocean and the Atlantic is second in size.

Oceans are home to different species of life. The waters of the Arctic and Southern Oceans are very cold, yet filled with life. The largest population of krill (small, shrimp-like marine creatures) lies under the ice of the Southern Ocean.

### **Estuaries**

Estuaries are places where rivers meet the sea and may be defined as areas where salt water is diluted with fresh water. River mouths, coastal bays, tidal marshes and water bodies behind barrier beaches are some examples of estuaries. An estuary is an area where a freshwater river or stream meets the ocean. In estuaries, the salty ocean mixes with a freshwater river, resulting in brackish water. Brackish water is somewhat salty, but not as salty as the ocean. An estuary may also be called a bay, lagoon, sound or slough.

In estuaries, water level and salinity rise and fall with the tides. These features also rise and fall with the seasons. During the rainy season, rivers may flood the estuary with freshwater. During the dry season, the outflow from rivers may slow to a trickle. During a storm season, storm surges and other ocean waves may flood the estuary with saltwater. Most estuaries, however, are protected from the ocean's full force. Geographical features such as reefs, islands, mud, and sand act as barriers from ocean waves and wind.

### **TYPES-OF-ESTUARY**

There are four different kinds of estuaries, each created a different way: 1) coastal plain estuaries; 2) tectonic estuaries; 3) bar-built estuaries; and 4) Coastal plain estuaries.

### **Stream Ecosystem**

The plants, the animals, and the stream itself are all part of a small ecosystem, a community of living and nonliving things. Fish, insects, birds, and other living things that are part of this community depend on the stream and one another to **survive**. Every part of the ecosystem has a role to play. Even the sunlight that filters through the trees is important

The importance of ecosystem

The health of aquatic ecosystems is crucial to the health of the planet as a whole. Our earth is not called the blue planet for nothing: the seas with their fish, weeds, invertebrates and mammals and the rivers, lakes, streams, swamps and ponds of this world are all precious repositories of biodiversity. The seas help to regulate the world's temperature, too, and to lock carbon away from the atmosphere. Though we should all try and cut down on fish as a food source, there is no denying that fish and other aquatic organisms are irreplaceable links in the food chain for many terrestrial animals (i.e. animals that live on earth) as well.

### **GRASSLAND ECOSYSTEM**

Grasslands (also called Greenswards) are areas where the vegetation is dominated by grasses and other herbaceous (non-woody) plants. Grasslands occupy about 24% of the earth's surface. They occur in regions too dry for forests and too moist for deserts. A grassland consists of large rolling fields of grasses, flowers and herbs. Grasslands ecosystems emerge due to low levels of sporadic precipitation that is only substantial enough to support smaller plants. Grass survives in these arid conditions because of its deep and highly elaborate root system that enables it to access moisture hidden deep in the soil.

The annual rainfall ranges between 25- 75 cm, usually seasonal. The principal grasslands includes Prairies (Canada, USA), Pampas (South America), Steppes (Europe and Asia), and Veldts (Africa).

The highest abundance and greatest diversity of large mammals are found in these ecosystems. The dominant animal species include wild horses, asses and antelope of Eurasia, herds of Bison of America; and the antelope and other large herbivores of Africa.

### ***Biotic Components:***

#### **1. Producer Organisms:**

In grassland, producers are mainly grasses; though, a few herbs and shrubs also contribute to primary production of biomass. Some of the most common species of grasses are: Brachiaria sp., Cynodon sp., Desmodium sp., Digitaria sp.

#### **2. Consumers:**

**In grassland, consumers are of three main types:**

##### **a)Primary Consumers:**

The primary consumers are herbivores feeding directly on grasses. These are grazing animals such as Cows, Buffaloes, Sheep, Goats, Deer, and Rabbits etc. Besides them, numerous species of insects, termites, etc. are also present.

##### **(b) Secondary Consumers:**

These are carnivores that feed on primary consumers (Herbivores). These include;-Frogs, Snakes, Lizards, Birds, Foxes, Jackals etc.

##### **(c) Tertiary Consumers:**

These include hawks etc. which feed on secondary consumers.

#### **3. Decomposers:**

These include wide variety of saprotrophic microorganism like: Bacteria; Fungi; Actinomycetes.

### ***A-biotic Components:***

These include basic inorganic and organic compounds present in the soil and aerial environment. The essential elements like C, H, N, O, P, S etc. are supplied by water, nitrogen, nitrates, sulphates, phosphates present in soil and atmosphere.

There are two main types of grasslands -- tropical and temperate -- with several subcategories within each type.

### **Tropical Grasslands**

Tropical grasslands are warm all year round with established rainy and dry seasons. During the rainy season, tropical grasslands receive between 50 and 130 centimeters of rain. Most notable of the tropical grasslands is the African savanna, which has an occasional tree and is home to many of the world's most spectacular species, such as elephants, giraffes, lions and zebras. Savanna grass is usually quite short, making for excellent grazing and hunting grounds.

### **Temperate Grasslands**

Temperate grasslands also have two seasons, growing and dormant. During the dormant season, no grass or crops grow because it's too cold. These grasslands make for excellent farming because of their deep and nutrient-rich soils. Temperate grasslands receive between 25 and 75 centimeters of rain a year. The most notable temperate grasslands are the North American prairies, which are home to a wide variety of wildlife, including pronghorn antelope, mice, jack rabbits, foxes, snakes and coyotes. Grass here can grow quite tall, reaching up to seven meters in height. Trees are restricted to where there is a large concentration of water such as a river or lake

## UNIT-4

### **Biodiversity - Genetic, Species and Ecosystem diversity**

Biodiversity or Biological diversity is a term that describes the variety of living beings on earth. In short, it is described as degree of variation of life. Biological diversity encompasses microorganism, plants, animals and ecosystems such as coral reefs, forests, rainforests, deserts etc.

Biodiversity is classified into three types:

1. Genetic diversity
2. Species diversity and
3. Community or Ecosystem diversity

**Genetic diversity** - A species with different genetic characteristics is known genetic diversity. Within individual species, there are varieties, that are slightly different from one other. These differences are due to differences in the combination of genes. Genes are the basic units of hereditary information transmitted from one generation to the other.

**Ex: (i)** Rice varieties -There are thousands of rice varieties that show variation at the genetic level in the form of different size, shape and colour.

**(ii)** Teak wood varieties: The various teak wood varieties available are - Indian teak, Burma teak, Malaysian teak etc.

**Species diversity** - A discrete groups of organisms of the same kind is known as species. Species diversity is the diversity between different species. The sum of varieties of all living organisms at the species level is known as species diversity. The biotic component is composed of a large number of species of plants, animals and microorganisms which interact with each other and with the abiotic component of the environment. **Plant species like Apple, mango, grapes. Animal species like Tiger, Lion and Elephant.**

**Community or Ecosystem diversity** - Ecosystem diversity is a type of biodiversity. It is the variation in the ecosystems found in a region or the variation in ecosystems over the whole planet. Biodiversity is important because it clears out our water, changes out climate, and provides us with food. Ecological diversity includes the variation in both terrestrial and aquatic ecosystems. Ecological diversity can also take into account the variation in the complexity of a biological community, including the number of different niches, the number of trophic levels and other ecological processes. An example of ecological diversity on a global scale would be the variation in ecosystems, such as deserts, forests, grasslands, wetlands and oceans.

## Biogeographical classification of India

India has different climate and topography in different parts and hence is termed as a mega diversity country. India occupies **10th place among plant rich countries of the world**. It is essential to acquire knowledge about the distribution and environmental interaction of flora and fauna of India.

Biogeographers have classified India into ten biogeographic zones with each zone having characteristic climate, soil and biodiversity. These zones are described below:

**Trans-Himavlayas** The trans-himalayas is an extension to the Tibetan plateau. This region harbors the high-altitude cold desert in Ladakh (Jammu and Kashmir) and Lahaul Spiti (Himachal Pradesh). It accounts for 5.7% of the country's landmass.

1. **Himayalas** The Himalayas are the northern boundaries of India. The entire mountain chain is running from Kashmir in the North-west to Assam in the north-east. The Himalayas comprise of a diverse range of biotic provinces and biomes. The Himalayas cover 7.2% of the country's landmass

2. **Desert** The extremely dry area west of the Aravalli hill range, is comprising both the salty desert of Gujarat and the sandy desert of Rajasthan. Deserts occupy around 6.9% of the country's land mass. The kinds of deserts found in India are:

1. The desert of western Rajasthan
2. The desert of Gujarat
3. The high-altitude cold desert of Jammu & Kashmir and Himachal Pradesh. The Indian deserts have more diversified fauna.

3. **Semi-arid** This zone lies between the desert and the Deccan plateau. It includes the Aravalli hill range. It covers approximately 15.6% of the country's landmass.

4. **Western Ghats** The western ghats are a mountain range that runs along the western coast of India. They are a range extending north-south from southern tip of Gujarat in the north to Kanyakumari in the south. The mountains cover an area of about 160,000 sq. km. This ghat section covers an extremely diverse range of biotic provinces and biomes. It covers about 5.8% of the country's landmass.

5. **Deccan plateau** It is a large triangular plateau south of the Narmada valley. Three sides of the plateau are covered by mountains slopes towards east. Satpura mountains cover the north while western ghats cover the west side and eastern ghats cover the eastern side of the plateau. It is the one of largest zones

covering the southern and south-central plateau with mostly deciduous trees. It covers 4.3% of the country's land mass.

6. **Gangetic plain** This plain covers the area between the south Himalayas to the Tropic of Cancer. These plains were formed by the Ganges river system and are relatively homogeneous. This region experiences 600 mm rainfall annually. *Sunderbans* forests are located in this region and it covers 11% of the country's land mass.

7. **North-east India** These are plains and non-Himalayan ranges of northeastern India and have a wide variety of vegetation. It covers around 5.2% of the country's land mass.

8. **Islands** The Andaman and Nicobar Islands in the Bay of Bengal has almost 300 big and small islands. Among these, only five islands are inhabited. Only tribes are found in the island of Nicobar. These islands have a highly diverse set of biomes and occupy 0.03% of the country's biomass.

9. **Coasts** India has a large coastline distributed both to the east and west with distinct differences between the two. The Lakshadweep islands are included in this but the area of these islands is negligible.

#### **INDIA IS A MEGA-BIODIVERSITY NATION.**

1. India is rich in biodiversity from north to south and from east to west. India contains many species that the world has. It has 14 major numerous rivers. The annual rainfall varies from less than 37 cm in Rajasthan to 1500 mm in Cherapunji. The country experiences three different seasons – winter, summer, and monsoons. It has two global terrestrial biodiversity hot spots – the North-eastern States and the Western Ghats. The Western Ghats have moist deciduous forests and rainforests. This region shows high species diversity as well as high levels of endemism. Around 62% of reptile and 77% of amphibians are found in here. The North-eastern States depicts high altitudinal variations. This area has at least 163 globally threatened species like one-horned rhinoceros and the wild Asian water buffalo.

2. India has 15,000 species of flowering plants, 53,430 species of insects; 5050 species of mollusks, 6,500 species of other invertebrates; 2,546 species of fishes; 1228 species of birds, 446 species of reptiles, 372 species of mammals and 204 species of amphibians have been identified. India's biodiversity is estimated to be over 45,000 plant species representing about 7% of the world's flora and India stands tenth in 25 most plant-rich countries of the world. Its variety of animal life represents 6.5 per cent of world's fauna. Being one of the oldest and largest agriculture societies, India has at least 166 species of crop plants and 320 species of wild relatives of cultivated crops

3.To preserve the rich biodiversity, nine biosphere reserves have been set up in specific biogeographic” zones: the biggest being in the Deccan Peninsula in the Nilgiris covering Tamil Nadu, Andhra Pradesh, and Karnataka. Others include the Nanda Devi in Uttarakhand in the Western Himalayas, the Nokrek in Meghalaya, Manas, and Dibru Saikhowa in Assam, the Sunderbans in the Gangetic plain in West Bengal, Similar in Orissa, the Great Nicobar and the Gulf of Mannar in Tamil Nadu. As per satellite imaging, about 19 percent of the land area of the country comprise of forests. It has 80 national parks at present, which houses the largest number of tigers and one-horned rhinos found in the world, Asiatic lions and a large percent of elephants.

### **1.HOT SPOT BIODIVERSITY**

Very rich in species and highly endangered - that are the two criteria that make a place a biodiversity hotspot. Of course, there are many places where lots of species grow and live. But to qualify as a hotspot, a place needs to host more than 0.5 percent (that is 1,500) of the world’s vascular plant species as “endemics”. Species are endemic to a region, when they naturally grow/live only within that region instead of being artificially introduced by agriculture or humans for example.

### **VALUE OF BIODIVERSITY**

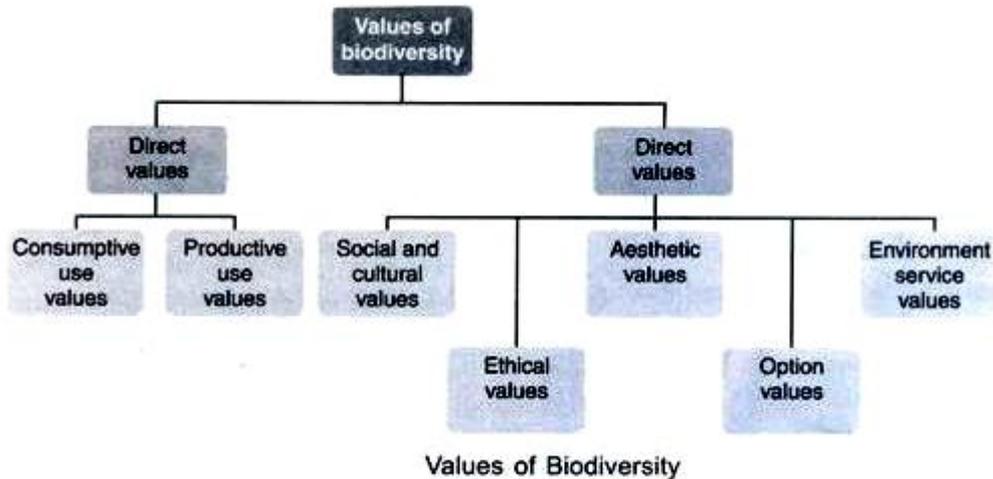
Some of the major values of biodiversity are as follows: 1. Environmental Value 2. Social Value 3. Ecosystem Services 4. Economic Value 5. Consumptive use value 6. Productive Use Value 7. Ethical and Moral Value 8. Aesthetic Value.

Biodiversity is the most precious gift of nature mankind is blessed with. As all the organisms in an ecosystem are interlinked and interdependent, the value of biodiversity in the life of all the organisms including humans is enormous.

The role of biodiversity in providing ecosystem services is twofold.

Firstly, biodiversity is directly used as a source for food, fibre, fuel and other extractable resources. Secondly, biodiversity plays an important role in ecosystem processes providing the regulating, cultural and supporting services.

Biodiversity has a fundamental value to humans because we are so dependent on it for our cultural, economic, and environmental well-being. Elements of biodiversity can contribute to cultural identity, and many ecosystem characteristics are frequently incorporated into cultural traditions.



### 1. Environmental Value:

The environmental value of biodiversity can be found by examining each ecosystem process and identifying the ecosystem services that result. For instance, in wetlands the vegetation captures water- carried sediment and the soil organisms break down a range of nutrients and pollutants washed into the area. These processes provide the ecosystem service of purifying water. Wetlands also act as spawning and nursery grounds for some fish and provide a refuge for animals in times of drought. Water tables have raised carrying dissolved salts which then concentrate in the soil. Forests regulate the amount of carbon dioxide in the air by releasing oxygen as a by-product during photosynthesis, and control rainfall and soil erosion.

### 2. Social Value:

The social value of biodiversity includes aesthetic, recreational, cultural and spiritual values. To this can be added health benefits resulting from recreational and other activities. While traditional societies which had a small population and required less resources had preserved their biodiversity as a life supporting resource, modern man has rapidly depleted it even to the extent of leading to the irrecoverable loss due to extinction of several species.

The life of the indigenous people in many parts of the world still revolves around the forests and environment, even in these modern times, many of them still live in the forests and meet their daily requirements from their surroundings.

The biodiversity in different parts of the world has been largely preserved by the traditional societies. Since the indigenous people always protect the forests for their own benefit. In ancient times, especially in India, the environment in totally i.e., flora, fauna, etc., were held in high esteem.

Trees like Peepal, Banyan and Tulsi are still worshipped. Ladies offering water to Tulsi daily is considered good and there are festivals when ladies tie sacred threads around Peepal and Banyan trees and pray for the welfare of their families.

### **3. Ecosystem Services:**

These services also support human needs and activities such as intensely managed production ecosystems.

#### **Ecosystem service includes:**

- a. The production of oxygen by land based plants and marine algae;
- b. The maintenance of fresh water quality by vegetation slowing run off, trapping sediment and removing nutrients and by soil organisms breaking down pollutants;
- c. The production and maintenance of fertile soil as a result of many interacting processes;
- d. The provision of foods such as fish, pastures for cattle and sheep, timber, fire wood and harvested wildlife such as kangaroos and native cut flowers;
- e. The provision of native species and genes used in industry research and development, for instance, in traditional breeding and biotechnology applications in agriculture, forestry, horticulture, mariculture, pharmacy, chemicals production and bioremediation;
- f. Pollination of agricultural crops, forest trees and native flowering plants by native insects, birds and other creatures;
- g. Pest control in agricultural land by beneficial native predators;
- h. Flood mitigation by vegetation slowing run off and trapping sediment;
- i. Breakdown of pollutants by micro-organisms in soil and aquatic ecosystems and sequestration of heavy metals in marine and fresh water sediments;
- j. Greenhouse gas reduction by, for instance, sequestering atmospheric carbon in wood and marine calcium carbonate deposits;
- k. Maintenance of habitats for native plants and animals; and
- l. Maintenance of habitats that are attractive to humans for recreation, tourism and cultural activities and that has spiritual importance.

### **4. Economic Value:**

The economic potential of biodiversity is immense in terms of food, fodder, medicinal, ethical and social values. Biodiversity forms the major resource for different industries, which govern the world economy.

**The salient features regarding the economical potential of biodiversity are given below:**

1. The major fuel sources of the world including wood and fossil fuels have their origin due to biodiversity.

2. It is the source of food for all animals and humans.
3. Many important chemicals have their origin from the diverse flora and fauna, used in various industries.
4. Diverse group of animals are used for medical research during the testing of new drugs.

**5. *Consumptive use value:***

This is related to natural products that are used directly for food, fodder, timber, fuel wood etc. Humans use at least 40,000 species of plants and animals on a daily basis. Many people around the world still depend on wild species for most of their needs like food, shelter and clothing. The tribal people are completely dependent on the forests for their daily needs.

**6. *Productive Use Value:***

This is assigned to products that are commercially harvested and marketed. Almost all the present date agricultural crops have originated from wild varieties. The biotechnologists continuously use the wild species of plants for developing new, better yielding and disease resistant varieties. Biodiversity represents the original stock from which new varieties are being developed.

**7. *Ethical and Moral Value:***

It is based on the principle of 'live and let others live'. Ethical values related to biodiversity conservation are based on the importance of protecting all forms of life. All forms of life have the right to exist on earth. Man is only a small part of the Earth's great family of species.

Don't plants and animals have an equal right to live and exist on our planet which is like an inhabited spaceship? Morality and ethics teach us to preserve all forms of life and not to harm any organism unnecessarily.

Some people take pleasure in the hunting of animals. People also sometimes degrade and pollute the environment by their unethical actions. Through proper education and awareness, the people's conscience against such practices must be raised.

**8. *Aesthetic Value:***

The beauty of our planet is because of biodiversity, which otherwise would have resembled other barren planets dotted around the universe. Biological diversity adds to the quality of life and provides some of the most beautiful aspects of our existence. Biodiversity is responsible for the beauty of a landscape.

People go far off places to enjoy the natural surroundings and wildlife. This type of tourism is referred to as eco-tourism, which has now become a major source of income in

many countries. In many societies, the diversity of flora and fauna has become a part of the traditions and culture of the region and has added to the aesthetic values of the place.

### **Biodiversity at Global, National and Local Levels**

#### ***Global Level:***

Conservative estimates of the existing biodiversity is ten million species, but if estimates for insects are correct then it could be around 30 million species, we have till now enlisted about 1.4 million species.

It includes among others about 98% birds, 95% reptiles and amphibians, 90% fish and about 85% higher plants known to exist on this Earth (Table 4.1)

#### ***National and Local Level:***

India has over 108,276 species of bacteria, fungi, plants and animals already identified and described (Table 4.2). Out of these, 84 percent species constitute fungi (21.2 percent), flowering plants (13.9 percent), and insect (49.3 percent). In terms of the number of species, the insecta alone constitute nearly half of the biodiversity in India

These species occur on land, fresh and marine waters, or occur as symbionts in mutualistic or parasitic state with other organisms. In the world as a whole, 16, 04,000 species of Monera, Protista, Fungi, Plantae and Animalia have been described so far. However, it is estimated that at least 179, 80,000 species exist in the world, but as a working figure 122, 50,000 species are considered to be near reality. Percentage of Different Biota in India

**Table 4.2 : Number of Species of Bacteria, Fungi, Plants and Animals**

<b>Taxon</b>	<b>Number of Species</b>	<b>Percentage</b>
Bacteria	850	0.8
Fungi	23,000	21.2
Algae	2,500	2.3
Bryophyte	2,564	2.4
Pteridophyta	1,022	0.9
Gymnosperms	64	0.1
Angiosperms	15,000	13.9
Insecta	53,430	49.3
Mollusca	5,050	4.7
Pisces	2,546	2.4
Amphibian	204	0.2
Reptilia	446	0.4
Aves	1,228	1.1
Mammalian	372	0.3
<b>Total</b>	<b>108,276</b>	<b>100.00</b>

India is 10th among the plant rich countries of the world, fourth among the Asian countries, eleventh according to the number of endemic species of higher vertebrates (amphibia, birds and mammals), and tenth in the world as far as richness in mammals is concerned. Out of the 10 'Hot spots' identified in the world, India has four. These are Eastern Himalaya, North East India, Western Ghats and Andaman & Nicobar Islands.

The crops which first grew in India and spread throughout the world include rice, sugarcane, Asiatic vignas, jute, mango, citrus, and banana, several species of millets, spices, medicinal, aromatics and ornamentals. India ranks sixth among the centres of diversity and origin in terms of agro-biodiversity.

### **Threats of Biodiversity**

**1. Extinction of many species:** The biodiversity of earth's surface has now been faced with mass extinction of many species on a global scale. Rising sea levels, warmer temperatures and melting ice caps destroy animals' habitats.

Every type of organism such as microorganisms, fungi, plants, and animals all are threatened with dire consequences.

Many of the animal's species have already been lost. Moreover nearly 650 mammals, 210 reptiles and 1100 birds are threatened with extinction.

**2. Massive destruction of forest land:** humans cutting down precious forests for agriculture, fuel or to build houses. The eco-system has been highly disturbed as a result of massive destruction of forests. Many forests have been destroyed:

- to extract wood and other precious herbs,
- for expansion of agricultural land,
- for expansion of habitable area,
- for industrialization.

**3. Industrialization:** In many cases the production (usually industrial) and release of wastes acting as pollutants have completely destroyed the habitat of many species. Excessive release of greenhouse gases and the resultant global warming and climate are real threats to biodiversity.

**4. Shrinking habitat:** The habitat areas in most cases have got shrunk due to many reasons and stand as isolated patches or islands. The smaller the area of the habitat, the lower would be the number of species.

**5. Urbanization:** humans building over animals' habitats.

**6. Shortages of water:** not enough water for certain species to survive.

**7. Pollution:** Poisonous gases in the air causing respiratory problems in many species. Plastics, oil and other water contaminants making it difficult for fish and sea birds to thrive in our rivers, lakes and oceans.

## **HABITAT LOSS**

Habitat destruction is damage to an area that certain species live in, to the extent that the species can no longer survive in that area. The causes of habitat destruction can be either man-made or natural in origin. Large scale damage to an area can have obvious implications on the habitat.

**Man-made causes** of habitat destruction include construction of both previously undeveloped areas as well as new construction on the fringe of developed areas. Deforestation for construction can have a huge impact on many different animal species. A wetland area may be filled in to build a structure or road on. A field may be mowed to make the area more aesthetically pleasing, or to purposely discourage the presence of wildlife from a developed area.

**Agriculture** is another man-made cause of habitat destruction. Again, land cut clear of trees or natural grassland mowed to provide farmland can destroy the habitat of mammals, insects, or birds. In addition, efforts to irrigate farmland and provide water for farm animals can impact habitat, either by taking water from an area, or adding water to an area that was previously dry.

**Global warming** is a process that human activity has contributed to. Burning fossil fuels and deforestation have both contributed to increased carbon dioxide in the atmosphere. The increased carbon dioxide in the atmosphere keeps solar heat in the atmosphere. Global warming is an important cause of habitat destruction for polar bears as the sea ice of the Arctic Ocean is melting.

**Fire** is another culprit that can fall under man-made or natural causes of habitat destruction. Human error or intent can result in forest fires. Lightning strikes can also result in serious fires. Either way, the end result can be devastating to species that live in grasslands or forests that are damaged by fire.

**Natural disasters** can be causes of habitat destruction. Examples of natural disasters that can be devastating include earthquakes, floods, and tornadoes. Earthquakes can physically move the land, and may be associated with subsequent tsunamis. Floods can destroy the vegetation and cause erosion of the land. Tornadoes can physically rip trees out of the ground and crush vegetation with debris that is strewn about.

## **POACHING OF WILD LIFE**

**Poaching** is the **illegal hunting**, killing or capturing of animals. People poach because animal products, such as **hide**, **ivory**, horn, teeth and **bone**, are sold to dealers who make clothes, jewelry and other materials from them. The poaching causes various effects, its most direct impact is **extinction**, either globally or within a given **locality**.

Poachers catch Indian **tigers** with **steel** traps. This is against the **law**. After trapping a tiger, they kill it and sell the **body** parts for money. Like the **rhino**, the tiger is a very endangered species. If the killing does not end, they both face extinction (all of that type of animal dies). Extinction means that someday there may be no Indian tigers or rhinos left on **earth**.

## **Effects on poaching wild life**

### **1.Effects on Local Communities**

The extinction of a species can have a negative economic effect on a local community's tourism industry. Furthermore, a tourist boycott due to local poaching is a real threat. A boycott could have a detrimental effect on a community's economy since restaurants, hotels, rentals, and other attractions would suffer.

### **2.Effects on the Environment**

Poaching is also dangerous to the environment. Our ecosystems are sensitive and must be preserved. The economic challenges of a community can lead to poaching, which in turn can lead to endangerment (and in the worst cases, extinction) of different species. We need various species of flora and fauna in our environmental ecosystems so that it can maintain healthy and balanced. The survival of our own species depends on it.

## **Human–wildlife conflict**

It refers to the interaction between **wild animals** and people and the resultant negative impact on people or their resources, or wild animals or their habitat. It occurs when growing human populations overlap with established wildlife territory, creating reduction of resources or life to some people and/or wild animals. The conflict takes many forms ranging from loss of life or injury to humans, and animals both wild and domesticated, to competition for scarce resources to loss and **degradation of habitat**.

## **Effects of conflict**

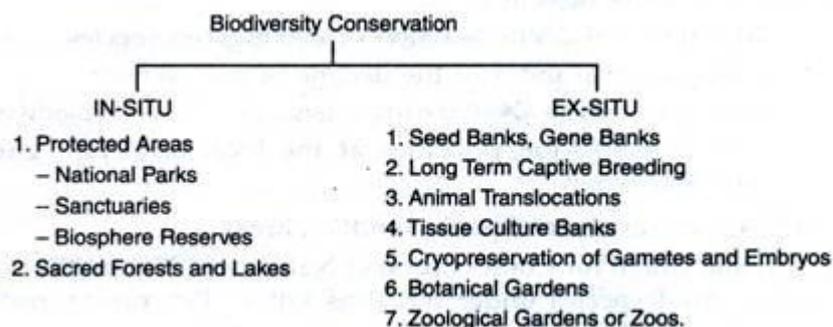
- Injury and loss of life of humans and wildlife
- Crop damage, livestock depredation, predation of managed wildlife stock.
- Damage to human property.
- Destruction of habitat.
- Collapse of wildlife populations and reduction of geographic ranges

Conservation is the protection, preservation, management, or restoration of wildlife and natural resources such as forests and water. Through the conservation of biodiversity and the survival of many species and habitats which are threatened due to human activities can be ensured. There is an urgent need, not only to manage and conserve the biotic wealth, but also restore the degraded ecosystems.

**Types of Conservation:**

**Conservation can broadly be divided into two types:**

1. In-situ conservation
2. Ex-situ conservation



**In-situ Conservation:**

In-situ conservation is on site conservation or the conservation of genetic resources in natural populations of plant or animal species, such as forest genetic resources in natural populations of tree species. It is the process of protecting an endangered plant or animal species in its natural habitat, either by protecting or cleaning up the habitat itself, or by defending the species from predators. It is applied to conservation of agricultural biodiversity in agro forestry by farmers, especially those using unconventional farming practices. In-situ conservation is being done by declaring area as protected area.

**In India following types of natural habitats are being maintained:**

1. National parks
2. Wildlife sanctuaries
3. Biosphere reserves

INDIA has over 600 protected areas, which includes over 90 national parks, over 500 animal sanctuaries and 15 biosphere reserves.

**1. National Parks:**

A national park is an area which is strictly reserved for the betterment of the wildlife and where activities like forestry, grazing on cultivation are not permitted. In these parks, even private ownership rights are not allowed.

Their boundaries are well marked and circumscribed. They are usually small reserves spreading in an area of 100 Sq. km. to 500 sq. km. In national parks, the emphasis is on the preservation of a single plant or animal species.

## **2. Wildlife Sanctuaries:**

A sanctuary is a protected area which is reserved for the conservation of only animals and human activities like harvesting of timber, collecting minor forest products and private ownership rights are allowed as long as they do not interfere with well-being of animals. Boundaries of sanctuaries are not well defined and controlled biotic interference is permitted, e.g., tourist activity.

## **3. Biosphere Reserves:**

It is a special category of protected areas where human population also forms a part of the system. They are large protected area of usually more than 5000 sq.km. A biosphere reserves has 3 parts- core, buffer and transition zone.

1. Core zone is the inner zone; this is undisturbed and legally protected area.
2. Buffer zone lies between the core and transition zone. Some research and educational activities are permitted here.
3. Transition zone is the outermost part of biosphere reserves. Here cropping, forestry, recreation, fishery and other activities are allowed.

### **Advantages of in-situ conservation:**

1. The flora and fauna live in natural habitats without human interference.
2. The life cycles of the organisms and their evolution progresses in a natural way.
3. In-situ conservation provides the required green cover and its associated benefits to our environment.
4. It is less expensive and easy to manage.
5. The interests of the indigenous people are also protected.

### **Ex-Situ Conservation:**

Ex-situ conservation is the preservation of components of biological diversity outside their natural habitats. This involves conservation of genetic resources, as well as wild and cultivated or species, and draws on a diverse body of techniques and facilities. Such strategies include establishment of botanical gardens, zoos, conservation strands and gene, pollen seed, seedling, tissue culture and DNA banks.

#### **i. Seed gene bank:**

These are cold storages where seeds are kept under controlled temperature and humidity for storage and this is easiest way to store the germ plasma of plants at low temperature. Seeds preserved under controlled conditions (minus temperature) remain viable for long durations of time.

#### **ii. Gene bank:**

Genetic variability also is preserved by gene bank under normal growing conditions. These are cold storages where germ plasm are kept under controlled temperature and humidity for storage; this is an important way of preserving the genetic resources.

### **iii. Cryopreservation:**

This is the newest application of technology for preservation of biotic parts. This type of conservation is done at very low temperature (196°C) in liquid nitrogen. The metabolic activities of the organisms are suspended under low temperature, which are later used for research purposes.

### **iv. Tissue culture bank:**

Cryopreservation of disease free meristems is very helpful. Long term culture of excised roots and shoots are maintained. Meristem culture is very popular in plant propagation as it's a virus and disease free method of multiplication.

### **v. Long term captive breeding:**

The method involves capture, maintenance and captive breeding on long term basis of individuals of the endangered species which have lost their habitat permanently or certain highly unfavorable conditions are present in their habitat.

### **vi. Botanical gardens:**

A botanical garden is a place where flowers, fruits and vegetables are grown. The botanical gardens provide beauty and calm environment. Most of them have started keeping exotic plants for educational and research purposes.

### **vii. Zoological Gardens:**

In zoos wild animals are maintained in captivity and conservation of wild animals (rare, endangered species). The oldest zoo, the Schonbrunn zoo which exists today also, was established in VIENNA in 1759.

In India, the 1st zoo came into existence at BARRACKPORE in 1800. In world there are about 800 zoos. Such zoos have about 3000 species of vertebrates. Some zoos have undertaken captive breeding programmes.

### **Advantages of ex-situ preservation:**

1. It is useful for declining population of species.
2. Endangered animals on the verge of extinction are successfully bred.
3. Threatened species are bred in captivity and then released in the natural habitats.
4. Ex-situ centres offer the possibilities of observing wild animals, which is otherwise not possible.
5. It is extremely useful for conducting research and scientific work on different species

### **Difference between *In-situ* and *Ex-situ* conservation**

- *In-situ* conservation is done in the natural habitats of the biodiversity components while *ex-situ* conservation is done outside of their natural habitats.
- *In-situ* conservation is more dynamic, whereas *ex-situ* conservation is more static.
- *In-situ* conservation involves designation, management, and monitoring of target taxa in their natural habitats, whereas *ex-situ* conservation involves sampling, transfer, and storage of target taxa from their natural habitats.
- In *In-situ* conservation, populations remain within the ecosystem involving the process of evolution whereas, in *ex-situ* conservation, they are not involving the natural evolution process.
- *In-situ* conservation is time consuming but more sustainable while *ex-situ* conservation methods are aimed to use in conserving genetic components, in immediate occasions.

## UNIT-5

### **Air Pollution – Causes, effects and control measures**

WHO defines air pollution as the contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere.

It is an atmospheric condition in which certain substances are present in concentrations which can cause undesirable effects on man and his environment. These substances include gases, particulate matter, radioactive substances etc.

### **Sources of Air Pollution**

The sources of air pollution are natural and man-made (anthropogenic).

Man-made causes includes :

#### **Burning-fossil-fuels**

Burning of wood, charcoal and other fossil fuels causes air pollution by the release of carbon dioxide (CO<sub>2</sub>), carbon sulphur dioxide etc.

#### **Emissions-from-automobiles**

Vehicles are a major source of air pollution. The major pollutants released from automobiles, locomotives, aircraft etc., include CO, unburnt hydrocarbons and nitrogen oxide.

#### **Industries**

Factories pollute the air through fossil fuel emissions. These emissions include carbon dioxide, methane, and nitrous oxide. While all of these are naturally-occurring substances, it is the high levels of emissions which are of concern.

## **Agricultural-activities**

Spraying of insecticides and weedicides also cause air pollution. These, when inhaled create severe problems to both animals and man.

## **Wars**

Various forms of explosives used in war pollute the air by releasing poisonous gases. This greatly disturbs the ecology of the area. Nuclear explosions pollute air by radioactive rays.

Natural causes include :

- Volcanic eruption
- Forest fires
- Marsh gas emission
- Deflation of sand and dust
- Micro-organisms such as algae, fungi, bacteria, yeast, moulds, spores are transported by wind to distant places causing air pollution.

## **Effects of air pollution :**

Air pollution has adverse effects on living organisms and materials.

- **Effect on plants**
  - Oxides of nitrogen and fluorides reduce crop yield.
  - Ozone damages cereals, fruits, and cotton crop.
  - Smoke and dust cover the leaf surface and reduce photosynthetic capacity of plants.
  - SO<sub>2</sub> causes chlorosis and also results in the death of cells and tissues.
- **Effect on Human health**
  - SO<sub>3</sub>, CO and NO<sub>2</sub> diffuse into blood stream and reduce oxygen transport. CO damages cardiovascular system. Hydrocarbons and other pollutants act, as carcinogens and lead to different cancers.
  - Ozone has been reported to produce chromosomal aberrations.
  - Cotton dust leads to respiratory disorders e.g. bronchitis and asthma.
- **Effects on Aquatic life**
  - Air pollutants mixing up with rain can cause high acidity (lower pH) in fresh water lakes. This affects aquatic life especially fish. Some of the freshwater lakes have experienced total fish death.
- **Change in Climate**
  - Concentration of various Green House Gases into the atmosphere leads to increase in temperature.

- Thinning of ozone layer would permit more of the harmful ultraviolet rays to reach the earth.
- **Aesthetic loss**
  - Dust and smoke spoils the beauty of nature. Especially the mountain environments, which serve as a great attraction for tourists.
  - Foul odours emitted by industries, automobiles, dirty drains and garbage heaps in cities are a great nuisance.

### Control of Air pollution

Air pollution can be minimized by the following methods:

1. Some gases, which are more soluble in a particular liquid than air, for example, ammonia in water, can be separated by dissolving in it.
2. Particles larger than 50 mm are separated in gravity settling tanks. Using cyclone collectors or electrostatic precipitators separates fine particles.
3. The height of chimneys should be increased to the highest possible level to reduce pollution at the ground level.
4. SO<sub>2</sub> pollution can be controlled by extracting sulphur from the fuel before use.
5. Pollution control laws should be enforced strictly.
6. Trees should be planted on the roadside, riverbanks, parks and open places as they keep the environment fresh.
7. Population growth, which is the main cause of pollution should be checked.
8. Nuclear explosions should be restricted.

### Water Pollution – Causes, effects and Control measures

Water pollution can be defined as alteration in physical, chemical or biological characteristics of water making it unsuitable for designated use in its natural state.

#### Sources of Water Pollution

- **Domestic sewage**  
This includes household's wastes like food wastes, synthetic detergents used for washing clothes and cleaning bathrooms and latrines and water based paints.
- **Industrial effluents**  
Industrial wastes containing toxic chemicals, acids, alkalis, metallic salts, phenols, cyanides, ammonia, radioactive substances, etc. are discharged in the adjoining rivers and streams through flush lines of factories.
- **Agricultural source**  
Agrochemicals like fertilizers (containing nitrates and phosphates) and

pesticides (insecticides, fungicides, herbicides etc.) washed by rain-water and surface run-off pollute water.

- **Thermal pollution**

Waste heat from industrial discharges increases the temperature of water bodies and affects distribution and survival of sensitive species.

- **Pathogenic organisms**

Sewage and domestic waste from houses introduces pathogenic organisms viz., protozoa, worms-eggs and bacteria into water. This contaminated water if consumed causes jaundice, typhoid, dysentery, cholera, tuberculosis etc.

- **Mineral oils**

Oil from oil spills and washing of automobiles finds way into river water through sewers.

### Effect of water pollution

- Pesticides in drinking water ultimately reach humans and are known to cause various health problems.
- Industrial effluents containing iron, free chlorine, phenol, manganese, oils, hydrocarbons, ammonia, algae and microorganisms impair the taste and odour of water.
- The nitrates and phosphates dissolved in water accelerate the growth of microorganisms, which consume much of the dissolved oxygen depriving fish and other aquatic life (Eutrophication).
- Nitrate when present in excess in drinking water causes blue baby syndrome.
- Excess of fluoride in drinking water causes defects in teeth and bones called fluorosis.
- Some heavy metals like lead, mercury and cadmium cause various types of diseases like – Minamata, Itai Itai etc.
- Soap, detergents and, alkalis result in foam formation, which in turn affects aquatic life.

### Control of Water Pollution

- Domestic sewage and industrial wastes should be treated before discharging them into drains.
- In towns where sewage facilities are not available, septic tanks should be made in the houses.
- Use of pesticides, insecticides and fertilizers should be done judiciously. Rapid biodegradable substitutes for pesticides should be employed.
- Separate ponds and tanks to be used for cattle and animals.

- Prevent run-off of manure. Divert such run-off to basin for settlement. The nutrient rich water can be used as fertilizer in the fields.

### Soil Pollution – Causes, effects and control measures

**Soil pollution** is defined as the presence of toxic chemicals (pollutants or contaminants) in soil, in high enough concentrations to pose a risk to human health and the ecosystem.

### Sources of soil pollution

- Pesticides are used to kill pests that damage crops. These pesticides ultimately reach the soil and persist there for a long time. Residues of these pesticides in the soils have long term effects especially under the temperate conditions.
- Industrial wastes also contain some organic and inorganic compounds that are refractory and non-biodegradable.
- Soil also receives excreta from animals and humans. The sewage sludge contains many pathogenic organisms, bacteria, viruses and intestinal worms which cause pollution in the soil.
- Thermal power plants generate a large quantity of 'Fly ash'. Huge quantities of these wastes are dumped on soils, thus contaminating them.
- Many radio active substances like Uranium, radium, caesium etc. are discharged from industries as wastes. These elements reach the soil and persist there for a long time and keep on emitting radiations.

### Effects of Soil Pollution

- Chemicals and pesticides affect the structure and fertility of soil by killing the soil microorganisms.
- Pesticides are absorbed by the plants and then transferred to other organism. Hence, they affected food chains and food webs.
- Pathogens present in the wastes and excreta contaminate the soil and vegetable crops causing diseases in man and domesticated animals.
- Radioisotopes which attach with the clay become a source of radiations in the environment.

### Control of Soil Pollution

- Effluents should be properly treated before discharging them on the soil.
- Solid wastes should be properly collected and disposed off by appropriate method.
- Metals should be recovered from scrap and disposed materials.
- Materials like paper, glass and plastics can be recycled.
- Use of pesticides can be reduced by adopting biological control of pests.

- Use of cattle dung and agricultural wastes in biogas plants should be encouraged.

### Write a short note on salination of soil.

Soil salinity is the salt content in the soil; the process of increasing the salt content is known as salinization.

It takes place in two ways:

- accumulation of salts dissolved in irrigation water on the soil surface due to intensive farming and poor drainage, and
- deposition of salts as white crust during summer months drawn by capillary action from the lower surface to the top surface.

The consequences of salinity are

- detrimental effects on plant growth and yield
- damage to infrastructure (roads, bricks, corrosion of pipes and cables)
- reduction of water quality for users, sedimentation problems
- soil erosion ultimately, when crops are too strongly affected by the amounts of salts.

Salinity of soil can be checked by adopting these methods :

- Drainage is the primary method of controlling soil salinity. Once good drainage is assured, the soil can be irrigated with clean water.
- Run-off should be avoided to prevent erosion.
- Adopting proper irrigation techniques.

### Marine Pollution – Causes, effects and control measures

Marine pollution can be defined as the introduction of substances to the marine environment directly or indirectly by man resulting in adverse effects such as hazards to human health, obstruction of marine activities and lowering the quality of sea water.

#### Sources of marine pollution

The main sources of marine pollution are

- Rivers, which bring pollutants from their drainage basins
- Catchment area i.e. coastline where human settlements in the form of hotels, industry, agricultural practices have been established
- Oil drilling and shipment.

#### Effects of marine pollution

- The pollutants in sea may become dispersed by turbulence and ocean currents and finally becomes a part of food chain.
- Hydrocarbons and benzpyrene gets accumulated in food chain and consumption of such fish by man may cause cancer.

- Bioaccumulation in food chain also result in loss of species diversity.
- Oil pollution causes damage to marine fauna and flora including algae, fish, birds, and invertebrates.
- Detergents used to clean up the spill are also harmful to marine life.

### Control of marine pollution

- Toxic pollutants from industries and sewage treatment plants should not be discharged in coastal waters.
- Run off from non-point sources should be prevented to reach coastal areas.
- Sewer overflows should be prevented by having separate sewer and rain water pipes.
- Dumping of toxic, hazardous wastes and sewage sludge should be banned.
- Developmental activities on coastal areas should be minimized.
- Oil and grease from service stations should be processed for reuse.
- Oil ballast should not be dumped into sea.
- Ecologically sensitive coastal areas should be protected by not allowing drilling.

### Noise Pollution – Causes, effects and control measures

**Noise pollution** or **noise disturbance** is the disturbing or excessive noise that may harm the activity or balance of human or animal life. A decibel value greater than 80 decibels causes noise pollution. Noise becomes troublesome above 140 decibels.

### Sources of noise pollution

The major sources of noise are :

- various modes of transportation (like air, road, rail-transportation)
- industrial operations
- construction activities
- celebrations (social/religious functions, elections etc)
- electric home appliances.

### Effects of noise pollution

Noise causes the following effects :

- **Interferes with man's communication:** In a noisy area communication is severely affected.
- **Hearing damage:** Noise can cause temporary or permanent hearing loss. It depends on intensity and duration of sound level. Auditory sensitivity is reduced with noise level of over 90 dB in the mid high frequency for more than a few minutes.

- **Physiological and Psychological changes:** Continuous exposure to noise affects the functioning of various systems of the body. It may result in hypertension, insomnia (sleeplessness), gastro-intestinal and digestive disorders, blood pressure changes, behavioural changes, emotional changes etc.

### Control of Noise pollution

Following methods can control noise pollution:

- Limited use of loudspeakers and amplifiers.
- Exercising control over noise producing vehicles.
- Industrial workers should be provided with ear plugs.
- Delocalisation of noisy industries far away from dwelling units
- Plants and trees having broad leaves should be planted all around the hospitals, libraries and schools and colleges.
- Through Law: Legislation can ensure that sound production is minimized at various social functions. Unnecessary horn blowing should be restricted especially in vehicle-congested areas.

### Thermal Pollution – Causes, effects and control measures

Thermal pollution is defined as the degradation of water quality by any process that changes ambient water temperature.

#### Causes of Thermal pollution

**1. Water used as coolant & ejected back into water bodies** – Mainly, the water that is used as coolant and transferred back to natural water bodies is the chief reason for thermal pollution. This kind of activity is mostly done by production; manufacturing and power plants. These plants use water to cool down their machines and eject back the hot water into water bodies. Thus, the natural water goes through a sudden rise in temperature.

**2. Release of cold water** – Just as we mentioned before, many industries liberate very cool water from their reservoirs. This water when mixed up with warm water rivers, lakes or ponds creates a disbalance in the flora and fauna of affected water bodies.

**3. Growing industrial activities** – It gives a repenting feeling to know that thermal pollutants are increasing day by day because of the growing industrial activities. Therefore, thermal pollution is also growing each day.

**4. Chemical pollutants discharged into water** – There are copious factories that discharge their chemical waste directly into natural water bodies. This does not only causes thermal pollution but also makes the water poisonous.

**5.Livestock waste mixed into water** – This is another major cause of thermal pollution. Many industries dispose their livestock waste into water without analyzing upon the hazardous consequences of this act.

**6.Water discharged from urban areas** – Many urban areas like parking places, roads, etc., deposit rain water and discharge the heated water back into water bodies. The heated water disturbs the normal temperature of natural water bodies.

**7.Human waste, household & personal care products** – These products go into sewage water which pollutes the water in ponds, seas and other water bodies.

**8.Deforestation & soil erosion** – Soil erosion makes natural water bodies to rise beyond their normal level. Thus, they get more exposed to sunlight. Hence, the temperature of water rises. Forests absorb much of sun rays and save water bodies from getting too much heat. However, deforestation disturbs this cycle and provides augmented temperature of water.

**9.Natural Geo-thermal activities** – Natural geothermal activities can stimulate lava and can cause a rise in water temperature, making way for thermal pollution.

**10.Unawareness among people** – Growing thermal pollution is also the result of unawareness among people. Even after knowing the hazardous effects of thermal pollution on environment, there are abundant industries which are continuously using ways that encourage this pollution.

### **Effects of Thermal pollution**

**1.Thermal shock resulting in rise in temperature of water bodies** – When industries and factories dispose the water, used as coolant, back into water bodies the temperature suddenly raises to an abnormal level. The sudden and abnormal temperature level acts as a thermal shock for aquatic life,

**2.Depleted level of oxygen in natural water** – When warm water discharged by industries enters the natural water bodies, they get heated up. The warm water causes an unusual growth of plants and expansion of algae. The algae expansion in water reduces the level of oxygen in water.

**3.Contamination of water** – Thermal pollution also results in contamination of water because various chemicals and other wastes get mixed up with the water that is disposed off back to rivers, ponds, lakes, etc., by various factories. If this contamination of water keeps on increasing, humans can suffer from shortage of water.

**4.Reduced solubility of oxygen** – Reduced solubility of oxygen in water bodies is another disappointing effect of thermal pollution. This less solubility of oxygen in water mainly affects the metabolism of water animal.

**5. Adverse effect on water plants** – Change in temperature levels is extremely harmful for the aquatic plants. These plants cannot cope up with the sudden alteration in water temperature. Hence, more and more aquatic plants are depleting each day because of thermal pollution

**6. Adverse effects on water animals** – The whole marine life gets disturbed because of thermal pollution. The contaminated water makes the natural water poisonous and has an adverse effect on animals living in it. Also, the reduced level of oxygen makes it difficult for water animals to survive.

**7. Effect on population of water animals** – When the temperature in natural water bodies gets disturbed because of thermal pollution, the cycle of animal population gets disturbed too. For example, sometimes the fish start laying eggs too soon and sometime they do it too late. The whole productivity of river gets disturbed too.

**8. Unexpected Migration of Water Animals** – When water animals find it difficult to survive in the changed water because of thermal pollution, they start for an unexpected migration, making way for a disturbed ecosystem.

### **Control of Thermal pollution**

The following methods can be employed for control of thermal pollution:

**1. Use less electricity** – All of us know that power plants are the main reasons behind growing thermal pollution. This is so because power plants use water as a cooling agent for cooling down their machines. This used water, which is much higher in temperature, is discharged back into the rivers, seas or lakes. We can make a significant contribution in controlling thermal pollution by consuming less electricity,. The use of less electricity will lead to less workload on power plants and these plants will not have to use their machines too much, meaning controlled use of water as coolant.

**2. Use of Better Technologies** – Science has gifted us with plentiful inventions, discoveries, techniques and knowledge. Incorporating good techniques ensure a good lifestyle for human race. Use of better technologies is strongly recommended for solving the problem of thermal pollution.

**3. Holding back the water for good** – If factories or plants cannot stop using water as a coolant, there is another option available for them. After using the water as coolant, they should store that water somewhere else for a temporary period. Instead of discharging back the heated water into water bodies, the temporarily collected heated water can be used for various other purposes too. Storing the heated water for a particular time will help in bringing back the high temperature of water to a normal level.

**4. Plantation of more trees upon the banks of rivers, seas & other water bodies** – This is also a good way to control thermal pollution. The trees around sources of water

help in absorbing the harsh sun rays and prevent them from falling directly upon the water. This helps in prevention of heating of water bodies. Planting more trees also helps in controlling the problem of soil erosion

**5.Artificial Lakes** – Industries, factories or plants which are serious about storing and reusing the heated water, used as coolant, can work out on artificial lakes. These are artificial lakes where the heated water can be stored easily. These lakes are very helpful for normalizing the temperature of hot water. This way, the hot water will not be disposed back to the lakes, rivers, etc., and will be used in other suitable tasks.

**6.Recycling used water** – Smart people always find intelligent solutions for even the most difficult of problems. If people start working upon the ideas of recycling the used water in plants and factories, the problem of thermal pollution will definitely be lessened to a significant extent.

**7.Spreading awareness among people** – Environment can be made better with a united effort. Making more and more people aware about the problem of thermal pollution will be very beneficial in the long run. Groups of people can initiate a discussion with different plants and industries. These groups can discuss the

### **Nuclear Hazards – Causes, effects and control measures**

Nuclear hazard can be defined as the Risk or danger to human health or the environment posed by radiation emanating from the atomic nuclei of a given substance, or the possibility of an uncontrolled explosion originating from a fusion or fission reaction of atomic nuclei.

### **Sources of Nuclear Hazards :**

The sources of radioactivity are both natural and man-made.

#### **The natural sources include:**

- Cosmic rays from outer space. The quantity depends on altitude and latitude; it is more at higher latitudes and high altitudes.
- Emissions from radioactive materials from the Earth's crust.

#### **Man-made sources include:**

- Mining and processing of radioactive ores.
- Use of radioactive material in nuclear power plants.
- Use of radioactive isotopes in medical, industrial and research applications.
- Use of radioactive materials in nuclear weapons.

### **Effects of Nuclear Hazards**

Ionization radiations can affect living organisms by causing harmful changes in the body cells and also changes at genetic level.

- **Genetic damage** is caused by radiations, which induce mutations in the DNA, thereby affecting genes and chromosomes. The damage is often seen in the offsprings and may be transmitted upto several generations.
- **Somatic damage** includes burns, miscarriages, eye cataract and cancer of bone, thyroid, breast, lungs and skin.

### **Control of Nuclear Hazards**

Following measures can help in controlling the radioactive pollution:

- Workers in nuclear plants should be provided with nuclear gadgets and safety measures against accidents.
- Leakage of radioactive elements from nuclear reactors, laboratories, transport, careless handling and use of radioactive fuels should be checked.
- There should be regular monitoring and quantitative analysis through frequent sampling in the risk areas.
- Preventive measures should be followed so that background radiation levels do not exceed the permissible limits.
- Waste disposal must be careful, efficient and effective.

## **Solid waste management - sources, effects and methods of disposal**

### **Solid waste management**

Rapid population growth and urbanization in developing countries has led to people generating enormous quantities of solid waste and consequent environmental degradation. The waste is normally disposed in open dumps creating nuisance and environmental degradation. Solid wastes cause a major risk to public health and the environment. Management of solid wastes is important in order to minimize the adverse effects posed by their indiscriminate disposal.

**Types of solid wastes:** Depending on the nature of origin, solid wastes are classified into

1. URBAN OR MUNICIPAL WASTES
2. INDUSTRIAL WASTES and
3. HAZARDOUS WASTES

### **SOURCES OF URBAN WASTES**

**Urban wastes include the following wastes:**

**Domestic wastes** containing a variety of materials thrown out from homes

Ex: Food waste, Cloth, Waste paper, Glass bottles, Polythene bags, Waste metals, etc.

**Commercial wastes:** It includes wastes coming out from shops, markets, hotels, offices, institutions, etc.

Ex: Waste paper, packaging material, cans, bottle, polythene bags, etc.

**Construction wastes:** It includes wastes of construction materials.

Ex: Wood, Concrete, Debris, etc.

**Biomedical wastes:** It includes mostly waste organic materials

Ex: Anatomical wastes, Infectious wastes, etc.

### **Classification of urban wastes**

Urban wastes are classified into:

**Bio-degradable wastes** - Those wastes that can be degraded by micro organisms are called bio-degradable wastes

Ex: Food, vegetables, tea leaves, dry leaves, etc.

**Non-biodegradable wastes:** Urban solid waste materials that cannot be degraded by micro organisms are called non-biodegradable wastes.

Ex: Polythene bags, scrap materials, glass bottles, etc.

### **SOURCES OF INDUSTRIAL WASTES**

The main source of industrial wastes are chemical industries, metal and mineral processing industries.

Ex: Nuclear plants: It generated radioactive wastes

Thermal power plants: It produces fly ash in large quantities

Chemical Industries: It produces large quantities of hazardous and toxic materials.

Other industries: Other industries produce packing materials, rubbish, organic wastes, acid, alkali, scrap metals, rubber, plastic, paper, glass, wood, oils, paints, dyes, etc.

### **EFFECT OF IMPROPER SOLID WASTE MANAGEMENT**

1. Due to improper disposal of municipal solid waste on the roads and immediate surroundings, biodegradable materials undergo decomposition producing foul smell and become a breeding ground for disease vectors.
2. Industrial solid wastes are the source for toxic metals and hazardous wastes that affect soil characteristics and productivity of soils when they are dumped on the soil  
Toxic substances may percolate into the ground and contaminate the groundwater.
3. Burning of industrial or domestic wastes (cans, pesticides, plastics, radioactive materials and batteries) produce furans, dioxins and polychlorinated biphenyls that are harmful to human beings.
4. Contaminates water and air, resulting into diseases and dysentery in Human beings.
5. Mosquitoes breed in the stagnant water, blocked due to waste choked in the drains.
6. Decomposition of solid waste spreads obnoxious odour in the air, thus polluting it.
7. Burning of waste, especially plastic adds up obnoxious fumes in the air.
8. Garbage dumps and decomposed waste helps many harmful species to breed in them.
9. The infected water supply also leads to large scale epidemics.

### **STEPS INVOLVED IN SOLID WASTE MANAGEMENT:**

Two important steps involved in solid waste management are:

## **Reduce, Reuse and Recycle of Raw Materials**

### **Discarding wastes**

**Reduce** - If usage of raw materials is reduced, the generation of waste also gets reduced

**Reuse** - Refillable containers that are discarded after use can be reused

Rubber rings can be made from discarded tubes and this reduces waste generation during manufacture of rubber bands.

**Recycle**- Recycling is the reprocessing of discarded materials into new useful products

Ex: Old aluminium cans and glass bottles are melted and recast into new cans and bottles, Preparation of cellulose insulation from paper, Preparation of automobile body and construction material from steel cans

This method (**Reduce, Reuse & Recycle**), i.e, **3R's** help save money, energy, raw materials and reduces pollution.

### **DISCARDING WASTES:**

The following methods are adopted for discarding wastes:

1.Landfill, 2.Incineration and 3.Composting

**LANDFILL:** Solid wastes are placed in a sanitary landfill in which alternate layers of 80 cm thick refuse is covered with selected earth-fill of 20 cm thickness. After 2-3 years solid waste volume shrinks by 25-30% and land is used for parks, roads and small buildings.

This is the most common and cheapest method of waste disposal and is mostly employed in Indian cities.

### **Advantages:**

- 1.It is simple and economical.
- 2.Segregation of wastes is not required.
- 3.Landfilled areas can be reclaimed and used for other purposes.
- 4.Converts low-lying, marshy waste-land into useful areas.
- 5.Natural resources are returned to soil and recycled.

### **Disadvantages:**

- 1.Large area is required.
- 2.Land availability is away from the town, transportation costs are high.
- 3.Leads to bad odour if landfill is not properly managed.
- 4.Land filled areas will be sources of mosquitoes and flies requiring application of insecticides and pesticides at regular intervals.
- 5.Causes fire hazard due to formation of methane in wet weather.

### **INCINERATION:**

It is a hygienic way of disposing solid waste. It is suitable if waste contains more hazardous material and organic content. It is a thermal process and very effective for detoxification of all combustible pathogens. It is expensive when compared to

composting or land-filling.

In this method municipal solid wastes are burnt in a furnace called incinerator.

Combustible substances such as rubbish, garbage, dead organisms and non-combustible matter such as glass, porcelain and metals are separated before feeding to incinerators.

The non-combustible materials can be left out for recycling and reuse. The leftover ashes and clinkers may account for about 10 to 20% which need further disposal by sanitary landfill or some other means.

The heat produced in the incinerator during burning of refuse is used in the form of steam power for generation of electricity through turbines. Municipal solid waste is generally wet and has a high calorific value. Therefore, it has to be dried first before burning.

Waste is dried in a pre-heater from where it is taken to a large incinerating furnace called "destructor" which can incinerate about 100 to 150 tonnes per hour. Temperature normally maintained in a combustion chamber is about 700 C which may be increased to 1000 C when electricity is to be generated.

#### **ADVANTAGES**

Residue is only 20-25% of the original and can be used as clinker after treatment

Requires very little space

Cost of transportation is not high if the incinerator is located within city limits

Safest from hygienic point of view

An incinerator plant of 3000 tonnes per day capacity can generate 3MW of power.

#### **DISADVANTAGES**

1.Its capital and operating cost is high

2.Operation needs skilled personnel

3.Formation of smoke, dust and ashes needs further disposal and that may cause air pollution.

#### **COMPOSTING**

It is another popular method practiced in many cities in our country. In this method, bulk organic waste is converted into fertilizer by biological action.

Separated compostible waste is dumped in underground trenches in layers of 1.5m and finally covered with earth of 20cm and left for decomposition. Sometimes, actinomycetes are introduced for active decomposition. Within 2 to 3 days biological action starts.

Organic matter is destroyed by actinomycetes and lot of heat is liberated increasing the temperature of compost by 75C and the refuse is finally converted into powdery brown coloured odourless mass called humus that has a fertilizing value and can be used in agriculture. Humus contains lot of Nitrogen essential for plant growth apart from phosphates and other minerals.

#### **ADVANTAGES**

Manure added to soil increases water retention and ion-exchange capacity of soil.

This method can be used to treat several industrial solid wastes.

Manure can be sold thereby reducing cost of disposing wastes

Recycling can be done

### **DISADVANTAGES**

Non-consumables have to be disposed separately

The technology has not caught-up with the farmers and hence does not have an assured market

### **Role of individual in prevention of pollution**

- Individuals should minimize wastage of resources such as electricity. Every unit of electricity saved is equivalent unit of electricity produced as it not only saves the fuel that would be used to produce that electricity, but also help to prevent pollution that is accompanied by burning of that fuel. Therefore, person should always switch off appliances when not in use.
- Individuals should prefer walking or use cycles instead of using motor vehicles, especially when distances to be travelled are small.
- Individuals can make considerable contribution by using mass transport (buses, trains, etc) instead of using personal vehicles.
- When going to workplace, colleagues from nearby localities should pool vehicles instead of going in individual personal vehicles.
- Taking personal vehicles for periodic pollution checks at centres approved by authorities.
- Individuals should reuse items whenever possible.
- Products that are made of recycled material should be given preference.
- Use gunny bags made of jute instead of plastic bags.
- Take part in environment conservation drives such as tree planting drives.
- Use water resources efficiently.
- Use renewable resources by installing equipment such as solar heaters and using solar cookers.
- Dispose potentially harmful products such as cells, batteries, pesticide containers, etc properly.
- Use of refrigerators should be minimised wherever possible as they are main source of CFC, which is responsible for Ozone layer depletion.
- Follow and promote family planning, as more population means more resources utilized and more resources utilized imply more pollution.
- Avoid making noise producing activities such as listening to loud music.

- Use handkerchiefs instead of paper tissues.
- Organize drives to clean streets and clean drains with help of other people of locality.
- Spread awareness and inspire other people to prevent pollution. Individuals should be encouraged to acquire information and innovations from world over and implement them locally.

## **DISASTER MANAGEMENT**

Disaster management is a collective term encompassing all aspects of planning for and responding to emergencies and disasters, including both pre- and post-event activities. It refers to the management of both the risk and the consequences of an event. The actions taken by an organization in response to unexpected events that are adversely affecting people or resources and threatening the continued operation of the organization.”

Disasters are mainly of 2 types,

1. Natural disasters. Example – earthquakes, floods, landslides, Floods etc.
2. Man made disasters. Example – war, bomb blasts, chemical leaks, etc.

### ***Goals of disaster management***

- Proactive plans to mitigate various business risks
- Minimizing loss via more effective preparedness and response <sup>[1]</sup><sub>[SEP]</sub>
- Creating more effective and durable recovery

### **Taking Earthquake Precautions**

There is no effective warning system for earthquakes, which makes preliminary precautions even more critical. At the same time, knowing how to behave when a quake strikes and what to do after the event is just as important to staying safe.

### **Before an Earthquake**

There are many things families and individuals can do to prepare for an earthquake, including the following:

- Install latches on cupboard doors to prevent them from opening during a quake.
- Use non-skid shelf liners for kitchen and bathroom cupboards, medicine cabinets, and closet shelves.
- Store heavy items or glassware in lower cabinets so they do not become dangerous projectiles.
- Update home insurance policies to adequately cover building costs, possession replacement, and injury deductibles.
- Secure large appliances such as refrigerators, water heaters, air conditioners, and other bulky items with straps, bolts, and other stabilizing methods.
- Be sure both old and new buildings meet earthquake construction requirements.

- Do not put heavy artwork, mirrors, or shelves over beds.
- Firmly secure bookcases, artwork, mounted televisions and other objects to withstand as much shaking as possible.
- Take clear photos of valuables as a record for insurance purposes.
- Prepare an earthquake emergency kit with non-perishable food, bottled water, copies of important documents (birth certificates, prescriptions, insurance papers, etc.), flashlights, first aid materials, blankets, spare glasses, and other essential items and store it where it will be easily accessible in case of a quake.
- Keep cell phones charged and replace emergency kit supplies as necessary to keep them usable.
- Plan alternative commuting routes in case an earthquake damages roads.
- Set up a family meeting location in a safe area.
- Teach all family members basic first aid, how to behave during a quake, and what to do after a quake.

### **During an Earthquake**

Earthquakes can last just a few seconds or as long as several minutes, and knowing how to react during the quake can help prevent injuries:

- Immediately seek a safe location such as in a doorway (if you live in an old, adobe house that is not reinforced), beneath a table or desk, or along an interior wall away from windows or hazardous objects.
- Cover the back of your head and your eyes to minimize injury from flying debris.
- Do not take elevators during an earthquake.
- If cooking, turn off heating elements immediately.
- If outdoors, stay in open areas away from buildings, power lines, trees, and other potential hazards.
- If driving, stop quickly but safely and stay in the vehicle. Do not stop near power lines, bridges, overpasses, or other potentially dangerous locations.
- Stay calm and brace yourself to keep your balance, sitting if possible.

### **After an Earthquake**

Quick thinking after an earthquake hits can minimize immediate dangers. Proper earthquake safety precautions after a tremor include the following:

- Be prepared for aftershocks, which may be stronger than the initial jolt.
- Tend injuries immediately and summon emergency assistance if necessary.
- Check for structural damage, but do not enter a building that shows damage or has visible cracks in the walls or foundation.
- Wear shoes at all times to avoid stepping on broken glass.

- Turn off gas, [electricity](#), and water if damage is suspected or if advised to do so by authorities.
- Be cautious opening cabinets, cupboards, and closets in case items may be poised to fall.
- Keep phone lines clear for emergency use.
- Be patient: It may take hours or days to restore all services depending on the severity of the quake.

#### **BEFORE A FLOOD**

- Avoid building in a [floodplain](#).
- Construct barriers (levees, beams, floodwalls) to stop floodwater from entering your home.
- Seal walls in basements with waterproofing compounds to avoid seepage.
- If a flood is likely in your area, listen to the radio or television for information.
- Know the difference between a flood watch and a flood warning. A watch means flooding is possible. A warning means flooding is occurring or will occur soon.

#### **WHEN A FLOOD IS IMMINENT**

- Be prepared! Pack a bag with important items in case you need to evacuate. Don't forget to include needed medications.
- If advised to evacuate your home, do so immediately.
- If there is any possibility of a [flash flood](#), move immediately to higher ground.
- If possible, bring in outdoor furniture and move essential items to an upper floor.
- Turn off utilities at the main switches or valves if instructed to do so. Disconnect electrical appliances.

#### **DURING A FLOOD**

- Do not walk through moving water. As little as 6 inches (15 centimeters) of moving water can make you fall.
- If you have to walk in water, wherever possible, walk where the water is not moving. Use a stick to check the firmness of the ground in front of you.
- Do not drive into flooded areas. If floodwaters rise around your car, abandon the car and move to higher ground if you can do so safely.
- Do not touch electrical equipment if you are wet or standing in water.

#### **AFTER A FLOOD**

- Listen for news reports to learn whether the community's water supply is safe to drink.
- Avoid floodwaters; water may be contaminated by oil, gasoline, or raw sewage. Water may also be electrically charged from
- Avoid moving water.

- Be aware of areas where floodwaters have receded. Roads may have weakened and could collapse under the weight of a car.
- Stay away from downed power lines, and report them to the power company.
- Return home only when authorities indicate it is safe.
- Stay out of any building if it is surrounded by floodwaters.
- Service damaged septic tanks, cesspools, pits, and leaching systems as soon as possible. Damaged sewage systems are serious health hazards.
- Clean and disinfect everything that got wet. Mud left from floodwater can contain sewage and chemicals.

### **Safety Precautions and Timely Actions to Reduce Damage:**

#### **Cyclone is 24 hours away:**

- i. Fill water buckets and cover them.
- ii. Top up your car's fuel tank.
- iii. Ensure you have fresh batteries for your radio.
- iv. Make sure you have adequate supplies of prescribed medicines.
- v. Stock up on non perishable food items if required.
- vi. Ensure your neighbours are aware of the issued warning.

#### **Cyclone is 16 hours away:**

##### **ADVERTISEMENTS:**

- ii. Ensure your children are home.
- ii. Gather tools that will be needed for emergency repairs, e.g. hammer, nails, rope, and tarpaulins.
- iii. If you live in a caravan, identify a solid structure to which you can move if required.

#### **Cyclone is 9 hours away:**

- i. Prepare the safest part of your house (usually the bathroom) and place emergency stores there.
- ii. Account for and lock up your pets.
- iii. Gather protective gear and place in shelter.

#### **When the Cyclone has passed:**

- i. Listen to the media for regular updates.
- ii. Do not make unnecessary demands on the emergency services.
- iii. Do not touch wet switches, and beware of fallen power lines, treat them as if they are live.
- iv. Stay at home resist the urge to go sightseeing. The water surge caused by your vehicle can send flood water into people's homes.

## UNIT-6

### **FROM UNSUSTAINABLE TO SUSTAINABLE DEVELOPMENT:-**

Sustainable development is defined as “meeting the needs of the present without compromising the ability of the future generation to meet their own needs”. Our natural resources are just dividing due to over exploitation. If growth continues in the same way, very soon we will be facing a doom’s day. These are the key aspects for sustainable development.

(a) Inter-generational equity:- This emphasizes that we should minimize adverse impacts on resources and environment for future generations. i.e., we should hand over a safe, healthy & resourceful environment to our future generation. This can be possible only if we stop over exploitation of resources, reduce waste discharge and emissions & maintain ecological balance.

(b) Intra-generational equity:- This emphasizes that the development process should seek to minimize the wealth gap within and between nations. The technology should address the problems of the developing countries, producing drought-tolerant varieties for uncertain climates, vaccines for infectious diseases, clean fuels for domestic and industrial use. This type of technological development will support economic growth of the poor and help in narrowing the wealth gap and lead to sustainability.

### **MEASURES FOR SUSTAINABLE DEVELOPMENT:-**

A. USING APPROPRIATE TECHNOLOGY:- It is one which is locally adaptable, eco-friendly, resource-efficient and culturally suitable. Indigenous technologies are more useful, cost-effective and sustainable. Nature is often taken as a model, using the natural conditions of that region as its components. This concept is known as design with nature. The technology should use less of resources and should produce minimum waste.

B. REDUCE, REUSE, RECYCLE APPROACH:- The 3-R approach advocating of resource using them again and again instead of passing it on to the waste stream and recycling the materials goes a long way in achieving the goal of sustainability. It reduces pressure on our resources as well as reduces waste generation and pollution.

### **URBAN PROBLEMS RELATED TO ENERGY**

1. Cities are the major centres of economic growth, trade, education, innovations & employments.
2. A big majority of human population lived in rural areas & their economic activities centred around agriculture, cattle rearing, fishing, hunting or some cottage industry.
3. 50% of the world population in urban area & there is movement of rural folk to cities in search for employment.

4. So, urban growth is so fast than it is becoming difficult to accommodate all the industrial commercial and residential facilities with in a limited municipal boundary spreading of the cities into the sub-urban or rural areas

5. In developing countries urban(growth) population is very fast and in most of the cases it is un-contractible and un planned growth.

6. In contrast, to the rural set up urban set up Is densely populated, consumers a lot of energy and material and generators a lot of waste.

Energy requirement of urban population are much higher than that of rural ones b/c urban people have a higher standard life and there life style demand more energy inputs in every sphere of life. These includes:

- a. Residential and commercial lighting.
- b. Transportation means including auto mobiles and public transport for moving from residency to work place.
- c. Modern lifestyle using large number of electrical gadgets in everyday life.
- d. Industrial plans using a big proportion of energy.
- e. A large amount of waste generation which has to be disposed properly using energy based techniques.
- f. Control and prevention air and water pollution which need energy dependent technologies. Due to high population density and high energy demanding activities the urban problem and related to energy or much more magnified as compared to rural population

### **Water conservation**

Now a days water is a very major factor for the society. So for that water conservation is necessary for the future use. So it is the responsibility of each and every human being to store the water. The following are control measure for water conservation which is very necessary:-

- Turn Off the Water tap after each activity.
- Minimize Use of Kitchen Sink Garbage Disposal Units
- When Washing Dishes by Hand, Don't Leave the Water Running for Rinsing
- Don't Let the Faucet Run While You Clean Vegetables
- Check Faucets and Pipes for Leaks
- Use Your Water Meter to Check for Hidden Water Leaks
- Reuse Wastewater Where Possible
- Use Clothes Washer for Only Full Loads
- Consider a High Efficiency Washing Machine
- Check Your Toilets for Leaks

- Don't Run the Hose pipe While Washing Car

## **Rainwater harvesting**

It is the process of collecting rainwater and putting it to good use. There are different ways in which this task can be accomplished.

Rainwater harvesting refers to the trapping and storing of rainwater so that it can be used at a later time when the need arises. As the rain falls, water is directed to a suitable collection point.

It can also mean collecting rainwater before it infiltrates into the ground and becomes underground water. Harvesting mainly entails gathering something from its natural source.

## **Methods of Rainwater Harvesting**

There are many ways in which rainwater can be harvested. Some of these methods are. These are the common methods of rainwater harvesting:

**1. Surface Water Collection Systems:** Surface water is simply water that accumulates on the ground's surface. When rainwater falls on the surface of the earth, it usually flows down slopes as it moves towards a point of depression where the moving water can collect. Surface water collection systems enable the collection of ground surface rainwater before it flows to other locations. Examples of such systems include rivers, ponds, and wells.

**2. Rooftop system:** These can also be used to harvest rainwater. They can be used to direct rainwater that falls on the roof of a building into containers or tanks. These tanks are usually elevated so that when the tap is opened, water flows at a high pressure. This method of rainwater harvesting is good because the accumulated water is mostly clean and usually requires no further treatment to make it fit for human use.

**3. Dams:** These are barriers that are designed to trap water. Rainwater can accumulate directly in them or drainage systems can be created to direct water into them. Water collected in dams is mostly used for irrigation purposes or treated and then distributed for domestic use.

**4. Underground Tanks:** These are also ideal for collecting rainwater. They are constructed by digging into the ground and creating a space which is then cemented to reduce water infiltration. The top is also sealed and water is obtained through pipes directed into the tank. To get water out, pumps are used.

**5. Water Collection Reservoirs:** Water collected through this method is not really clean and may be contaminated. However, it can still be used for crop irrigation.

**6. Barrage:** A barrage is a dam that has several openings which can be closed or opened to control the quantity of water that passes through it. It is usually large and can be used to collect a lot of water.

**7. Trenches:** This is another great way to harvest rainwater for irrigation. When it rains, the water is directed to the farm using trenches. It is one of the traditional methods of rainwater harvesting that is still very much in use today.

**8. Rain Barrels:** These are also used for rainwater harvesting. They are specifically designed for this purpose and can be purchased from retail stores. Rain barrels are used for harvesting rainwater that falls on rooftops.

### **Advantages of Rainwater Harvesting**

**1. Water For Domestic Use:** Rainwater harvesting is beneficial because it provides a source of water for domestic use. The collected water can be used for house cleaning purposes, washing laundry and for cooking. When treated, rainwater is good for drinking. It is an easy way of obtaining water for use in the home.

**2. Water For Industrial Use:** Industries can also harvest rainwater for use in some of their processes. Rainwater meant for industrial use is normally harvested in large scale. Such companies can construct their own dams or have underground tanks to store rainwater.

**3. Cost Effective:** We basically harvest rainwater for free because it is naturally occurring. If you store enough water during the rainy season, you may never have to pay for water services again because you'll have enough supply to last you through the summer. This saves you money by cutting down your monthly expenditure on water bills.

**4. Mitigates/Reduces The Impacts of Floods:** Harvesting rainwater plays a key role in mitigating or reducing the impacts of floods. When rainwater is directed to farms through trenches or collected in dams, its movement is controlled.

**5. Building and Construction:** Collected rainwater can be used for building and construction. The process of building a house requires a lot of water. Harvesting rainwater would thus avail water for this activity.

**6. Helps In Preventing Water Pollution:** Rainwater flowing on the ground surface can carry with it a lot of impurities and toxic substances. When it drains into water bodies, it pollutes them because of these impurities. Harvesting rainwater, therefore, prevents pollution of water bodies.

**7. Irrigation:** Rainwater is good for farming because once harvested, it can be used for irrigation especially during the summer. One can, therefore, have a thriving farm and realize a bumper harvest.

**8. Saves Potable Water:** Instead of using clean and treated water for other purposes such as washing and in the toilet, rainwater can be used. This saves potable water which would

### **Disadvantages of Harvesting Rainwater**

**1. Additional Expenditure:** Treating rainwater to make it fit for human consumption will see you incurring additional expenses. This would not happen when you use water supplied to you by the local council because it's already treated.

**2. Huge Efforts and Resources Required:** Constructing a dam or an underground tank is no mean feat. Before you begin harvesting rainwater, you'll have spent a considerable amount of resources. There are other cheap means but then you'll not collect a reasonable amount of water.

**3. Dependent On Rainfall:** You can't harvest rainwater when it does not rain. This process is therefore solely dependent on the availability of rain which can sometimes be very unreliable. What then happens when the dry spell is prolonged and you don't have an alternative source of water?

**4. Limited Storage:** Even if it rains for three months straight, you cannot harvest all that water even if you wanted to. This is because there is limited storage to keep the rainwater.

**5. Risk of Contamination:** If not preserved with care, rainwater can be contaminated. This can cause several health problems especially when the water is used without first being treated. Waterborne diseases are so many and treating them is very costly.

**6. Cleaning and Maintenance:** The storage facilities have to be occasionally cleaned and maintained. Cleaning an underground water tank is not easy and maintaining a dam is very expensive. This makes the thought of harvesting rainwater unattractive.

**7. Roof Tops That Contain Chemicals:** Some rooftops contain chemicals and impurities that mix with the rainwater. When consumed, this water can affect human health by causing illnesses and other health conditions.

### **WATERSHED MANAGEMENT**

Watershed is defined as a geo-hydrological unit draining to a common point by a system of drains. All lands on earth are part of one watershed or other. Watershed is thus the land and water area, which contributes runoff to a common point.

A watershed is an area of land and water bounded by a drainage divide within which the surface runoff collects and flows out of the watershed through a single outlet into a larger river ( or ) lake. Watershed technology is used in Rain fed areas.

Watershed management implies an effective conservation of soil and water resources for sustainable production with minimum non point resources (NPS) pollutant losses. It

involves management of land surface and vegetation so as to conserve the soil and water for immediate and long term benefits to the farmers, community and society as a whole.

Catchment area is the water collecting area. "All the areas from which water flows out into a river or water pool".

### **TYPES OF WATERSHED**

Watersheds is classified depending upon the size, drainage, shape and land use pattern.

Macro watershed (> 50,000 Hect)

Sub-watershed (10,000 to 50,000 Hect)

Milli-watershed (1000 to 10000 Hect)

Micro watershed (100 to 1000 Hect)

Mini watershed (1-100 Hect)

### **Objectives of watershed management**

The different objectives of watershed management programmes are:

1. To control damaging runoff and degradation and thereby conservation of soil and water.
2. To manage and utilize the runoff water for useful purpose.
3. To protect, conserve and improve the land of watershed for more efficient and sustained production.
4. To protect and enhance the water resource originating in the watershed.
5. To check soil erosion and to reduce the effect of sediment yield on the watershed.
6. To rehabilitate the deteriorating lands.
7. To moderate the floods peaks at down stream areas.
8. To increase infiltration of rainwater.
9. To improve and increase the production of timbers, fodder and wild life resource.
10. To enhance the ground water recharge, wherever applicable.

### **Resettlement and Rehabilitation of People: Problems and Concerns!**

It is a well-known fact that both natural and human made disasters force people to move out of their land. For example. Tsunami in South Asia in December 2004, Latur and Gujarat earthquake, the Orissa super-cyclone and scores of floods and droughts in other parts of our country have rendered thousands of people homeless and jobless. Disasters, like the Bhopal gas tragedy in Union carbide factory, derailment of trains, are examples of human made disaster.

### **Control Measure**

Firstly, strategies should be made for rehabilitation of thus displaced people are in the first place by way of preventive action. For instance, care is taken to build earthquake proof houses, gather advance information about cyclones and arrange for timely evacu-

ation, build appropriate bunds in flood prone areas, maintain bridges that take regular up and down passing of trains/ road transport vehicles on them in order to avert likely disasters.

Secondly, advance preparation on the part of administration and local communities are made to face the consequences of sudden calamities. For both these remedial steps, the primary necessity is that of building awareness among the people in general and among administrative personnel in particular.

Thirdly, advance planning should be made in the cases of natural and human made calamities is however quite limited and in comparison the Govt. we can certainly plan better in the cases of development projects which are planned in advance.

Fourthly the Govt. has developed many development projects to take care of people those who are affected by natural calamities. But the problem is that the in-charge should pay little attention to the processes of resettlement and rehabilitation of displaced people.

Fifthly, there are some institutional measure have been taken by the government by way of constituting committees at various levels. They exist on paper and their immediate response to the actual events is yet to come in any significant manner.

Finally, It is the responsibility of each human being and Govt. that they Should take some initiative relief measure for the disaster victim through resettlement and rehabilitation.

### **Environmental ethics: issue and possible solutions**

- **Resource consumption patterns and the need for equitable utilization:** It deals with how we utilize and distribute resources. There is a difference between the individuals, communities and countries in usage of resources. The educated urban people consumes much larger quantities of resources and energy than the traditional rural individual. This unequal distribution of wealth and access to land and its resources is a serious environmental concern. An equitable sharing of resources forms the basis of sustainable development for urban, rural communities.
- **Equity-disparity in the northern and southern countries:** It is concerned with who owns resources and how they are distributed. People living in the economically-advanced nations use greater amounts of resources and energy per individual and also waste more resources. This is at the cost poor people who are resource-dependent and live in developing nations.
- **Urban-rural equity issues:** The common property of rural communities has increasingly been used to supply the needs of the urban and industrial sectors. As

the rural sector supplies food and a part of the energy needs (mainly fuel wood) to most towns and cities in India, the common lands of the rural sector are being depleted of their resources.

- **The need for gender equity:** All over India, especially in the rural sector, women work longer hours than men. They are involved in collection and sale of fuel wood, collection of fodder, fruits, medicinal products, trekking several kilometres to fetch potable water, cooking meals in smoky unhealthy atmosphere etc. On an average they spend 10-12 hrs a day of very hard work, every day of the year. Unfortunately, it is the men who play a decisive role in managing the village common and their resources while women have not been given an equal opportunity to develop and improve their status which is due to a lower access to education and health care than that of men. This has deep implications for the rate of utilization of natural resources and their conservation.
- **Preserving resources for future generations:** This ethical issue must be considered when we use resources unsustainably. If we overuse and misuse resources and energy from fossil fuels, our future generations will find survival very difficult.

**The rights of animals:** The plants and animals that share the Earth with us too have a right to live and share the Earth's resources and living space. We have no right to push a species that has taken millions of years to evolve towards extinction. Cruelty to animals is a crime that must be regarded seriously and action must be taken against offenders.

- **The ethical basis of environment education and awareness:** . The Supreme Court of our country has ordered that every young individual at school and college level be exposed to a course on environment.
- **The conservation ethic and traditional value systems of India:** During olden days, people have always valued mountains, rivers, forests, trees and several animals. Thus, much of nature was venerated and protected. Certain species of trees have been protected as they are valued for their fruit or flowers. Traditions held the animals/species as an important aspect of nature were the basis of local life-support systems and were integral to bring about a harmonious life.

## **CLIMATE CHANGE**

The United Nations Framework Convention on Climate Change (UNFCCC) defines it as a change of climate that is attributed directly or indirectly to human activity, altering the composition of the global atmosphere.

Human activity includes the pollution that arises from industrial activity and other sources that produce greenhouse gases. These gases, such as carbon dioxide, have the ability to absorb the spectrum of infrared light and contribute to the warming of our atmosphere. Once produced, these gases can remain trapped in the atmosphere for tens or hundreds of years.

## Global warming

Global warming is defined as the increase in the temperature on earth's surface due to various reasons. The reasons include both by human and natural but the major contribution towards the global warming is from human and his activities. The natural causes include volcanic eruptions and other natural hazards. Due to volcanic eruption there is a production large amount of heat and this heat will transmitted to the atmosphere and there will be a increase in the atmospheric temperature. The other reasons are the activities of human that lead to the global warming. They are listed below:

### **Exhaust from vehicles**

The exhaust from vehicles are mainly compounds of carbon including carbon dioxide, carbon monoxide etc. The incomplete or partial combustion of fossil fuel will release more harmful gases to the atmosphere and these gases increase heat in the atmosphere this also results in the global warming.

### **Exhaust from jet plane and other commercial planes**

The exhaust from the jet planes directly enter to the atmosphere because they are flying in the high altitudes which is near to the ozone layer. These exhausts are by-product of burned fossil fuel.

### **Exhaust from industries**

Many industries exhaust their exhaust gas directly to the atmosphere these gasses are very harmful and capable of producing holes in the ozone layer. These gasses include sulfur dioxide, carbon monoxide, carbon dioxide etc.

### **Exhaust from various power plants mainly non conventional**

Non conventional power plants are power plants use non conventional power source such as fossil fuel, coal etc for their energy source. These power plants emits a lot of gasses to the atmosphere which is very harmful to the ozone layer.

### **Green house gasses**

Carbon dioxide, methane, water vapour, nitrous oxide, etc are collectively called green house gas. Water vapour are released when the surface water bodies become hot and the water evaporates to the atmosphere. The methane is formed from the dead and decay of organic materials.

## **Gasses released from mines**

Gasses released from mines also make a good contribution to the ozone depletion. Many greenhouse gases are released from the mines which are released to the atmosphere and make serious damage on the Ozone layer.

## **Effects of global warming**

### **1. Rise in sea level world wide**

Scientists predict an increase in sea levels worldwide due to the melting of two massive ice sheets in Antarctica and Greenland, especially on the East coast of the U.S. However, many nations around the world will experience the effects of rising sea levels, which could displace millions of people.

### **2. Severe storms**

The severity of storms such as hurricanes and cyclones is increasing and it may destroy the population and the habitat of the animals.

### **3. Massive crop failures due to climate change.**

*“Climate change is expected to have the most severe impact on water supplies. Shortages in future are likely to threaten food production, reduce sanitation, hinder economic development and damage ecosystems.”*

### **4. Widespread extinction of species**

*“Climate change now represents at least as great a threat to the number of species surviving on Earth as habitat-destruction and modification”*

### **5. Disappearance of coral reefs**

Due to prolonged rise in sea temperature causes severe danger for ocean ecosystems, and many other species in the oceans rely on coral reefs for their survival.

## **Remedial measures**

1. Plant maximum number of trees as they release oxygen and absorb CO<sub>2</sub> present in the atmosphere. In this way a tree balances the temperature of air and reduces the amount of CO<sub>2</sub> present in air.
2. Vehicles release many harmful gases in the air. Hence try to drive those cars which run on gas or electricity. If possible minimize the use of personal vehicles and travel by public transport. This way we can also control the problem of pollution.
3. Use fans more than air conditioners to use less energy. Hot air released from an air conditioner is one of the major factors behind global warming.
4. Avoid to use water heaters or use that on a temperature lesser than 120 F.
5. Instead of dryers take an advantage of sun light to dry wet cloths.
6. Unplug all the electrical appliances if they are not in use.
7. For less amount of carbon emission we can also use renewable energy like wind power

which generate negligible amount of harmful gases.

8. Use recyclable materials instead of disposable materials. This is good to control on waste.

## **ACID RAIN**

Acid rain means the presence of excessive acids in rain water. Thermal power plants, industries and vehicles release nitrous oxide and sulphur dioxide into the atmosphere by burning of coal and oil. When these gases react with water vapour in the atmosphere, they form acids and descend on Earth as "acid rain" through rain water.

### **Causes of Acid Rain**

Both natural and man-made sources are known to play a role in the formation of acid rain. But, it is mainly caused by combustion of fossil fuels which results in emissions of sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>).

#### **1. Natural Sources**

The major natural causal agent for acid rain is volcanic emissions. Volcanoes emit acid producing gases to create higher than normal amounts of acid rain or any other form of precipitation such as fog and snow to an extent of affecting vegetation cover and health of residents within the surrounding.

#### **Man-made sources**

Human activities leading to chemical gas emissions such as sulphur and nitrogen are the primary contributors to acid rain. The activities include air pollution sources emitting sulphur and nitrogen gases like factories, power generations facilities, and automobiles. In particular, use of coal for electrical power generation is the biggest contributor to gaseous emissions leading to acid rain. Automobiles and factories also release high scores of gaseous emissions on daily basis into the air, especially in highly industrialized areas and urban regions with large numbers of car traffic.

### **Effects of Acid Rain**

Acid rain has significant effects on the world environment and public health.

- **Effect on Aquatic Environment:** Acid rain puts affect on aquatic environment. The aquatic plants and animals need a particular pH level of about 4.8 to survive. If the pH level falls below that the conditions become hostile for the survival of aquatic life.
- **Effect on Forests:** It makes trees vulnerable to disease, extreme weather, and insects by destroying their leaves, damaging the bark and arresting their growth.
- **Effect on Soil:** Acid rain highly impacts on soil chemistry and biology. It means, soil microbes and biological activity as well as soil chemical

compositions such as soil pH are damaged or reversed due to the effects of acid rain.

- **Vegetation Cover and Plantations:** The damaging effects of acid rain on soil and high levels of dry depositions have endlessly damaged high altitude forests and vegetation cover since they are mostly encircled by acidic fogs and clouds.
- **Effect on Architecture and Buildings:** Acid rain on buildings, especially those constructed with limestone are affected severely. Modern buildings, cars, airplanes, steel bridges and pipes are all affected by acid rain. Irreplaceable damage can be caused to the old heritage buildings.
- **Effect on Public Health:** When in atmosphere, sulphur dioxide and nitrogen oxide gases and their particulate matter derivatives like sulphates and nitrates, degrades visibility and can cause accidents, leading to injuries, deaths and other health problems.

## **Solutions to Acid Rain**

### **1 Alternative Energy Sources**

Besides fossil fuels, there is a wide range of alternative energy sources that can generate electrical power. These include wind energy, geothermal energy, solar energy, hydropower, and nuclear power.

### **2 Individual, National/State, and International Actions**

Millions of people directly and indirectly contribute to SO<sub>2</sub> and NO<sub>x</sub> emissions.

Mitigation of this challenge requires individuals to be more informed about energy conservation and ways of reducing emissions such as: turning off lights or electrical appliances when not using them; use public transport; use energy efficient electrical appliances; and use of hybrid vehicles.

## **OZONE LAYER DEPLETION**

There are different layers of the atmosphere. The earth's atmosphere is composed of many layers, each playing a significant role. The first layer stretching approximately 10 kilometers upwards from the earth's surface is known as the troposphere. A lot of human activities such as gas balloons, mountain climbing, and small aircraft flights take place within this region.

The stratosphere is the next layer above the troposphere stretching approximately 15 to 60 kilometers. The ozone layer sits in the lower region of the stratosphere from about 20-30 kilometers above the surface of the earth. The thickness of the ozone layer is about 3 to 5 mm, but it pretty much fluctuates depending on the season and geography.

Ozone layer is a deep layer in earth's atmosphere that contain ozone which is a naturally occurring molecule containing three oxygen atoms. These ozone molecules form a gaseous layer in the Earth's upper atmosphere called stratosphere. This lower region of stratosphere containing relatively higher concentration of ozone is called Ozonosphere. The Ozonosphere is found 15-35 km (9 to 22 miles) above the surface of the earth.

### **CAUSES OF OZONE LAYER DEPLETION**

**Natural causes of depletion of ozone layer:** Ozone layer has been found to be affected by certain natural phenomena such as Sun-spots and stratospheric winds. But this has been found to cause not more than 1-2% depletion of the ozone layer and the effects are also thought to be only temporary. It is also believed that the major volcanic eruptions has also contributed towards ozone depletion.

**Man-made causes of depletion of ozone layer:** The main cause for the depletion of ozone is determined as excessive release of chlorine and bromine from man-made compounds such as chlorofluorocarbons (CFCs). CFCs (chlorofluorocarbons), halons, CH<sub>3</sub>CCl<sub>3</sub> (Methyl chloroform), CCl<sub>4</sub> (Carbon tetrachloride), HCFCs (hydro-chlorofluorocarbons), hydro-bromofluorocarbons and methyl bromide are found to have direct impact on the depletion of the ozone layer.

### **Serious Effects of Ozone Depletion**

#### **1. Damage to human health**

If the ozone layer is depleted, it means humans will be overly exposed to strong UV light. Overexposure to strong UV light causes skin cancer, cataracts, sunburns, weakening of immune system and quick aging.

#### **2. Devastation to environment**

Many crops species are vulnerable to strong UV light and overexposure may well lead to minimal growth, photosynthesis and flowering. Some of the crop species vulnerable to UV light include barley, wheat, corn, oats, rice, broccoli, tomatoes, cauliflower just to name a few. Forests equally also effected by ozone depletion.

#### **3. Threat to marine life**

Certain marine life, especially planktons, is greatly impacted by exposure to strong ultraviolet rays. In the aquatic food chain, planktons appear high up. If planktons decrease in number due to ozone layer destruction, the marine food chain would be disrupted in many ways. Also, overexposure of sun rays could reduce the fortunes of fishers.

#### **4. Effect on animals**

In domesticated animals, too much Ultraviolet radiation could also lead to skin and eye cancer.

## **5.Impacts certain materials**

Materials like plastics, wood, fabrics, rubber are massively degraded by too much ultraviolet radiation.

### **Solutions to Ozone Depletion**

- Desist from using pesticides

Pesticides are the concentration of many chemicals materials and causes for ozone layer depletion. So it is advised to use alternative eco-friendly chemicals instead of pesticides.

- Discourage driving of private vehicles

The easiest technique to minimize ozone depletion is to limit the number of vehicles on the road. These vehicles emit a lot of greenhouse gases that eventually form smog, which is the main cause of the depletion of ozone layer.

- Utilize environmentally friendly cleaning products

Most household cleaning products are loaded with harsh chemicals that find way to the atmosphere, eventually contributing to degradation of the ozone layer. Use natural and environmentally friendly cleaning products to arrest this situation.

- Nitrous oxide, which is a known harmful chemical that can destroy the ozone layer. Nitrous oxide is still in use today. Governments must take action now and outlaw nitrous oxide use to reduce the rate of ozone depletion.

## **NUCLEAR ACCIDENTS AND HOLOCAUST**

A nuclear and radiation accident is defined by the International Atomic agency as an “event that has led to significant consequences to people, the environment or the facility”. Examples include lethal effects to individuals, large radioactivity release to the environment, or “reactor core melt.”

The prime example of a “major nuclear accident” is one in which a reactor core is damaged and significant amounts of radiation are released, such as in the Chernobyl Disaster in 1986. The impact of nuclear accidents has been a topic of debate practically since the first nuclear reactors were constructed. It has also been a key factor in public concern about nuclear facilities.

**Two of the major nuclear accidents are as follows:**

### **(i) Chernobyl Nuclear Disaster:**

26th of April 1986 witnessed one of the world’s worst Nuclear Disaster ever in Chernobyl. Chernobyl is approximately 80 miles (which is 120 kilometers) north of the capital city of the Ukraine, Kiev. The accident took lives of 30 people immediately and vast evacuation of 135000 people within 20 mile radius of the power plant was carried out after the accident.

**Causes of the Accident:**

There was not one cause of this accident, there were several which all contributed to it. This accident happened while testing an RBMK reactor. A chain reaction occurred in the reactor and got out of control, causing explosions and a huge fireball which blew off the heavy concrete and steel lid on the reactor.

**These are the causes:**

1. Design fault in RBMK reactor
2. A violation, of procedures
3. Breakdown of communication
4. Lack of a 'Safety Culture' in the power plant

**Consequences of the Accident:**

***1. Environmental consequences:***

The radioactive fallout caused radioactive material to deposit itself over large areas of ground. It has had an effect over most of the northern hemisphere in one way or another. In some local ecosystems within a 6 mile (10 km) radius of the power plant the radiation is lethally high especially in small mammals such as mice and coniferous trees. Luckily within 4 years of the accident nature began to restore itself, but genetically these plants may be scarred for life.

***2. Health effects:***

Firstly, there was a huge increase in Thyroid Cancer in Ukrainian children (from birth to 15 years old). From 1981-1985 there was an average of 4-6 patients per million but between 1986 and 1997 this increased to an average of 45 patients per million.

It was also established that 64% of Thyroid Cancer patients lived in the most contaminated areas of the Ukraine (Kiev province, Kiev city, provinces of Rovno, Zhitomir, Cherkassy and Chernigov).

***3. Psychological consequences:***

There has been an increase in psychological disorders such as anxiety, depression, helplessness and other disorders which lead to mental stress. These disorders are not a consequence of radiation, but a consequence from the stress of evacuation, the lack of information given after the accident and the stress of knowing that their health and their children's health could be affected.

***4. Economic, political and social consequences:***

The worst contaminated areas were economically, socially and politically declining as the birth rate had decreased and emigration numbers had substantially risen which had caused a shortage in labour force. These areas could not evolve industrially or agriculturally because of strict rules that were introduced because the area was too contaminated.

## **(ii) Fukushima Daiichi Nuclear Disaster:**

The Fukushima Daiichi nuclear disaster was a series of equipment failures, nuclear meltdowns, and releases of radioactive materials at the Fukushima I Nuclear Power Plant, following the Tohoku earthquake and tsunami on 11 March, 2011. It is the largest nuclear disaster since the Chernobyl disaster of 1986.

The plant comprises six separate boiling water reactors originally designed by General Electric (GE), and maintained by the Tokyo Electric Power Company (TEPCO). At the time of the quake, Reactor 4 had been de-fuelled while 5 and 6 were in cold shutdown for planned maintenance. The remaining reactors shut down automatically after the earthquake, and emergency generators came online to control electronics and coolant systems. The tsunami resulted in flooding of the rooms containing the emergency generators. Consequently those generators ceased working, causing eventual power loss to the pumps that circulate coolant water in the reactor. The pumps then stopped working, causing the reactors to overheat due to the high decay heat that normally continues for a short time, even after a nuclear reactor shut down.

## **WILDLIFE PROTECTION ACT (1972) OF INDIA!**

The Wildlife Act was passed in 1972 to protect the wildlife and their habitats. The habitat destruction due to agriculture, industries, urbanisation and other human activities had led to the erosion of the country's wildlife.

### **The major activities and provisions in the act can be summed up as follows:**

1. It defines the wildlife related terminology.
2. Enactment of an All India Wildlife Protection Act (1972).
3. It provides for the appointment of wildlife advisory Board, Wildlife warden, their powers, duties etc.
4. Becoming a party to the Convention of International Trade in Endangered Species of Fauna and Flora (CITES, 1976).
5. Launching a "national component of UNESCO's 'Man and Biosphere Programme' (1971).
6. Under the Act, comprehensive listing of endangered wildlife species was done for the first time and prohibition of hunting of the endangered species was mentioned.
7. Protection to some endangered plants.
8. The Act provides for setting up of National Parks, Wildlife Sanctuaries etc.
9. The Act provides for the constitution of Central Zoo Authority.
10. There is provision for trade and commerce in some wildlife species with license for sale, possession, transfer etc.
11. The act imposes a ban on the trade or commerce in scheduled animals.

12. It provides for legal powers to officers and punishment to offenders.

It provides for captive breeding programme for endangered species. Several Conservation Projects for individual endangered species like Lion (1972), Tiger (1973), Crocodile (1974) and Brown antlered Deer (1981) were stated under this Act. The Act is adopted by all states in India except J & K, which has its own Act.

Some of the major drawbacks of the Act include mild penalty to offenders, illegal wildlife trade in J & K, personal ownership certificate for animal articles like tiger and leopard skins, no coverage of foreign endangered wildlife, pitiable condition of wildlife in mobile zoos and little emphasis on protection of plant genetic resources.

### **ENVIRONMENTAL POLLUTION ACT--1986**

This Act has been brought into force from November, 1986. Its salient features are:

(a) Conferring powers on the Central Government to:

- (i) Take all necessary measures for **protecting** quality of **environment**,
  - (ii) Co-ordinate actions of States, officers and other authorities under this Act,
  - (iii) Plan and execute a nationwide programme for prevention, control and abatement of environmental pollution,
  - (iv) Lay down standards for discharge of environmental pollutants,
  - (v) Empower any person to enter, inspect, take samples and test,
  - (vi) Establish or recognise environmental laboratories,
  - (vii) Appoint or recognise government analysts, (viii) lay down standards for quality of environment,
  - (ix) Restrict areas in which any industries, operations or processes may not be carried out subject to certain safeguards,
  - (x) Lay down safeguards for prevention of accidents and take remedial measures in case of such accidents,
  - (xi) Lay down procedures and safeguards for handling hazardous substances,
  - (xii) Constitute an authority for exercising powers,
  - (xiii) Issue directions to any person, officer or authority including the power to direct closure, prohibition or regulation of any industry, operation or process,
  - (xiv) Require any person, officer or authority to furnish any prescribed information and
  - (xv) Delegate powers to any officer of a state or authority;
- (b) It confers powers on persons to complain to courts regarding any violation of the provisions of the Act, after a notice of 60 days to the prescribed authorities;
- (c) The Act makes it obligatory for the person in charge of a place to inform the prescribed authorities regarding any accidental discharge of any pollutant in excess of prescribed standards.

The concerned authorities, on receipt of such information, shall take remedial measures to prevent or mitigate pollution caused by such accidents and expenses incurred by the authorities in respect of remedial measures are recoverable with interest from the polluter;

(d) It prescribes stringent penalties for violation of the provisions of the Act; and

(e) Jurisdiction of civil courts is barred under the Act.

A comprehensive Environment (Protection) Act came into being in 1986 to remedy the lacunae noticed in the earlier laws and to serve as a single legislation on the subject.

The Air (Prevention and Control of Pollution) Act, 1981 and the Water (Prevention and Control of Pollution) Act, 1974 were amended to bring their provisions at par with those of The Environment (Protection) Act, 1986 and to give more powers to the implementing agencies.

### **AIR PREVENTION AND CONTROL OF POLLUTION ACT (1981) OF INDIA!**

It makes provisions, interlaid, for Central and State Boards, power to declare pollution control areas, restrictions on certain industrial units, authority of the Boards to limit emission of air pollutants, power of entry, inspection, taking samples and analysis, penalties, offences by companies and Government and cognizance of offences etc..

The Act specifically empowers State Government to designate air pollution areas and to prescribe the type of fuel to be used in these designated areas. According to this Act, no person can operate certain types of industries including the asbestos, cement, fertilizer and petroleum industries without consent of the State Board.

The Government passed this Act in 1981 to clean up our air by controlling pollution. It states that sources of air pollution such as industry, vehicles, power plants, etc., are not permitted to release particulate matter, lead, carbon monoxide, sulfur dioxide, nitrogen oxide, volatile organic compounds (VOCs) or other toxic substances beyond a prescribed level. To ensure this, Pollution Control Boards (PCBs) have been set up by Government to measure pollution levels in the atmosphere and at certain sources by testing the air.

The particulate matter and gases that are released by industry and by cars, buses and two wheelers is measured by using air-sampling equipment. However, the most important aspect is for people themselves to appreciate the dangers of air pollution and reduce their own potential as polluters by seeing that their own vehicles or the industry they work in reduces levels of emissions. This Act is created to take appropriate steps for the preservation of the natural resources of the Earth which among other things includes the preservation of high quality air and ensures controlling the level of air pollution.

#### **The main objectives of the Act are as follows:**

(a) To provide for the prevention, control and abatement of air pollution.

(b) To provide for the establishment of central and State Boards with a view to implement the Act.

(c) To confer on the Boards the powers to implement the provisions of the Act and assign to the Boards functions relating to pollution.

### **Powers and Functions of the Boards:**

#### ***Central Pollution Board:***

The main function of the Central Board is to implement legislation created to improve the quality of air and to prevent and control air pollution in the country.

The Board advises the Central Government on matters concerning the improvement of air quality and also coordinates activities, provides technical assistance and guidance to State Boards and lays down standards for the quality of air. It collects and disseminates information in respect of matters relating to air pollution and performs functions as prescribed in the Act.

#### ***State Pollution Control Boards:***

The State Boards have the power to advise the State Government on any matter concerning the prevention and control of air pollution. They have the right to inspect at all reasonable times any control equipment, industrial plant, or manufacturing process and give orders to take the necessary steps to control pollution. They are expected to inspect air pollution control areas at intervals or whenever necessary. They are empowered to provide standards for emissions to be laid down for different industrial plants with regard to quantity and composition of emission of air pollutants into the atmosphere. A State Board may establish or recognize a laboratory to perform this function. The State Governments have been given powers to declare air pollution control areas after consulting with the State Board and also give instructions to ensure standards of emission from automobiles and restriction on use of certain industrial plants.

**Penalties:** The persons managing industry are to be penalized if they produce emissions of air pollutants in excess of the standards laid down by the State Board. The Board also makes applications to the court for restraining persons causing air pollution.

### **WATER PREVENTION AND CONTROL OF POLLUTION ACT, 1974**

This act aims to prevent and control water pollution and to maintain/restore of water by establishing central and state pollution control board to monitor and enforce the regulations. The Central Pollution Control Board, and State Pollution Control Boards composition, terms and conditions of service of members are defined in Sections 3-12 of water (prevention and control of pollution) act, 1974. The Board advises the government on any matter concerning the prevention and control of water pollution. It coordinates the

activities and provides technical assistance and guidance. This policy sets the standards and penalties for non-compliance for polluting bodies.

The Government has power to restrict any unit, and to take samples of effluents and get them analysed in Central or State laboratories. Whoever fails to comply with any provision of this Act is punishable with imprisonment, fine or with both.

The Central Board may perform all or any of the following functions, namely,-

- advise the Central Government on any matter concerning the prevention and control of water pollution;
- co-ordinate the activities of the State Boards and resolve disputes among them;
- provide technical assistance and guidance to the State Boards, carry out and sponsor investigations and research relating to problems of water pollution and prevention, control or abatement of water pollution;
- plan and organise the training of persons engaged or to be engaged in programmes for the prevention, control or abatement of water pollution on such terms and conditions as the Central Board may specify;
- organise through mass media a comprehensive programme regarding the prevention and control of water pollution;
- collect, compile and publish technical and statistical data relating to water pollution and the measures devised for its effective prevention and control and prepare manuals, codes or guides relating to treatment and disposal of sewage and trade effluents and disseminate information connected therewith;
- lay down, modify or annul, in consultation with the State Government concerned, the standards for a stream or well;
- plan and execute a nation-wide programme for the prevention, control or abatement of water pollution;
- perform such other functions as may be prescribed.

## **WASTE LAND RECLAMATION**

Waste land reclamation refers to the process of making land useful by restoring it from wetlands, seas, lakes, deserts or mines, through drainage or irrigation. It also refers to the restoration of land that is damaged by natural phenomena, such as erosion, or impaired by industrial and urban processes. In other words Reclamation of waste land means re-claiming it or to use it for productive purposes.

### ***1. Afforestation:***

It means growing the forest over cultivable wasteland.

## **2. Reforestation:**

Growing the forest again over the lands where they were existing and was destroyed due to fires, overgrazing, and excessive cutting. Reforestation checks water logging, floods, soil erosion and increase productivity of land.

## **3. Providing surface cover:**

The easiest way to protect the land surface from soil erosion is of leave crop residue on the land after harvesting.

## **4. Mulching:**

Here also protective cover of organic matter and plants like stalks, cotton stalks, tobacco stalks etc. are used which reduce evaporation, help in retaining soil moisture and reduce soil erosion.

## **5. Changing Ground Topography on Downhill's:**

Running water erodes the hill soil and carries the soil along with it. This can be minimized by following alternation in ground topography:

### **(a) Strip farming:**

Different kinds of crops are planted in alternate strip along the contour.

### **(b) Terracing:**

In this arrangement, the earth is shaped in the form of levelled terraces to hold soil and water. The terrace edges are planted with such plant species which anchor the soil.

### **(c) Contour ploughing:**

In this arrangement, the ploughing of land is done across the hill and not in up and down style.

## **6. Leaching:**

In salt affected land, the salinity can be minimized by leaching them with more water.

## **7. Changing agricultural practices:**

Like mixed cropping, crop rotation and cropping of plants are adopted to improve soil fertility.

## **8. Ecological Succession:**

This refers to the natural development or redevelopment of an ecosystem which help in reclaiming the minerally deficient soil of wasteland.

## **Public Awareness**

1. Government should organize Environmental Education campaign programmes for children, youth, men and women. The state government should establish appropriate funding mechanisms for raising public awareness of environmental education.
2. Government officials can make significant contributions to improve public awareness of environmental education.

3. NGOs (at national and community levels) should initiate and help by awareness campaigns to save environment.
4. Ban the littering of polythene cannot be successful until the public understands the environmental implications of the same.
5. Proper methods of disposal and its treatment should be applied otherwise they can be the causes of chronic diseases. When sewage is applied continuously on a part of land, the pores or voids of the soil are clogged and free circulation of air is prevented.
6. Humans are responsible for depletion of the natural resources; degradation of the vital life-supporting systems (like air, water, soil, etc.); ecological imbalance; deteriorated environment, etc. By exercising following actions, humans can protect global environment for sustainable development:
  - i. Preserve forest cover: Humans should minimize cutting of trees and using timber for aesthetic pleasure such as decoration of drawing rooms.
  - ii. Preserve natural resources: Human should not extract unnecessarily and exhaustively the natural resources such as mineral resources, water resources, etc.
  - iii. Conserve energy: Human should not harness too much energy from burning of fossil fuels.
  - iv. Maintain ecological balance: Human should exploit synergy between green revolution and industrial evolution by compulsory growing green belts around industrial areas, maintaining wild life sanctuaries and national parks.
  - v. Practice green technology: Everyone from a farmer in the village to a policy planner in the government should use green technology that incorporates: treatment of air emissions, treatment of waste waters, waste reduction, waste or emission management, use of non-conventional, renewable energy resources like solar energy on priority, etc.

## UNIT 7

### HUMAN POPULATION AND THE ENVIRONMENT

#### **Population growth, variation among nations**

Our global human population, 6 billion at present, will cross the 7 billion mark by 2019. The needs of this huge number of human beings cannot be supported by the Earth's natural resources, without degrading the quality of human life. In the near future, fossil fuel from oil fields will run dry. It will be impossible to meet the demands for food from existing agro systems. Pastures will be overgrazed by domestic animals and industrial growth will create ever-greater problems due to pollution of soil, water and air. Seas will not have enough fish. Larger ozone holes will develop due to the discharge of industrial chemicals into the atmosphere, which will affect human health.

Global warming due to industrial gases will lead to a rise in sea levels and flood all low-lying areas, submerging coastal agriculture as well as towns and cities. Water 'famines' due to the depletion of fresh water, will create unrest and eventually make countries go to war. The control over regional biological diversity, which is vital for producing new medicinal and industrial products, will lead to grave economic conflicts between biotechnologically advanced nations and the bio rich countries.

Degradation of ecosystems will lead to extinction of thousands of species, disturbing natural ecosystems of great value. These are only some of the environmental problems related to an increasing human population and more intensive use of resources that we are likely to face in future. These effects can be averted by creating a mass environmental awareness movement that will bring about a change in people's way of life. In some countries, food shortage has become a permanent feature. Two of every three children in South Africa are underweight. In other regions famines due to drought have become more frequent.

Present development strategies have not been able to successfully address these problems related to hunger and malnutrition. On the other hand, only 15% of the world's population in the developed world is earning 79% of income! Thus the disparity in the extent of per capita resources that are used by people who live in a 'developed' country as against those who live in a 'developing' country is extremely large. Similarly, the disparity between the rich and the poor in India is also growing. The increasing pressures on resources place great demands on the in-built buffering action of nature

that has a certain ability to maintain a balance in our environment. The world population is growing by more than 90 million per year, of which 93% is in developing countries. This will essentially prevent their further economic 'development'.

In the past, population growth was a gradual phenomenon and the Earth's ability to replenish resources was capable of adjusting to this increase. In the recent past, the escalation in growth of human numbers has become a major cause of our environmental problems. Present projections show that if our population growth is controlled, it will still grow to 7.27 billion by 2015. However, if no action is taken it will become a staggering 7.92 billion. Human population growth increased from: 1 to 2 billion, in 123 years. 2 to 3 billion, in 33 years. 3 to 4 billion, in 14 years. 4 to 5 billion, in 13 years. 5 to 6 billion, in 11 years. It is not the census figures alone that need to be stressed, but an appreciation of the impact on natural resources of the rapid escalation in the rate of increase of human population in the recent past. The extent of this depletion is further increased by affluent societies that consume per capita more energy and resources, than less fortunate people. This is of great relevance for developing a new ethic for a more equitable distribution of resources. In the first half of the 1900s human numbers were growing rapidly in most developing countries such as India and China. In some African countries the growth was also significant. In contrast, in the developed world population growth had slowed down.

### **Population explosion – family welfare program**

In response to our phenomenal population growth, India seriously took up an effective Family Planning Program which was renamed the Family Welfare Program. Slogans such as 'Hum do hamare do' indicated that each family should not have more than two children. It however has taken several decades to become effective. At the global level by the year 2000, 600 million, or 57% of women in the reproductive age group, were using some method of contraception. However the use of contraceptive measures is higher in developed countries – 68%, and lower in developing countries - 55%.

Female sterilization is the most popular method of contraception used in developing countries at present. This is followed by the use of oral contraceptive pills and, intrauterine devices for women, and the use of condoms for men. India and China have been using permanent sterilization more effectively than many other countries in

the developing world. The best decision for the method used by a couple depends on a choice that they make for themselves. This must be based on good advice from doctors or trained social workers who can suggest the full range of methods available for them to choose from. Informing the public about the various contraceptive measures that are available is of primary importance. This must be done actively by Government Agencies such as Health and Family Welfare, as well as Education and Extension workers.

It is of great importance for policy makers and elected representatives of the people – Ministers, MPs, MLAs at Central and State levels – to understand the great and urgent need to support Family Welfare. The media must keep people informed about the need to limit family size and the ill effects of a growing population on the world's resources. The decision to limit family size depends on a couple's background and education. This is related to Government Policy, the effectiveness of Family Welfare Programs, the educational level, and information levels in mass communication. Free access to Family Welfare information provided through the Health Care System, is in some cases unfortunately counteracted by cultural attitudes.

#### **Environment and human Health**

Environmental pollution is one of the serious problems faced by the people in the country, especially in urban areas, which not only experiences a rapid growth of population due to high fertility, low mortality and increasing rural-urban migration, but also industrialization which is accompanied by growing number of vehicles.

In India, the rapid increase of human numbers combines with desperate poverty to deplete and pollute local resource bases on which the livelihood of present and future generations depends. Population impacts on the environment primarily through the use of natural-resources and production of wastes and is associated with environmental stresses like biodiversity, air and water pollution and increased pressure on arable land. India is the world's sixth largest and second fastest growing producer of greenhouse gases.

The lack of services such as water supply, sanitation, drainage of store water, treatment and disposal of waste water, management of solid and hazardous wastes, supply of safe food, water and housing are all unable to keep pace with urban growth. All these in turn lead to an increase in the pollution levels. Also the unplanned location of industries in urban and sub-

urban areas followed by traffic congestion, poor housing, poor drainage and garbage accumulation causes serious pollution problems. However, all these factors together not only lead to deteriorating environmental conditions but also have adverse effects on the health of people. The peoples in environment polluted areas are infected by pollution related diseases. Due to air pollution the incidence of respiratory to increase and water pollution triggers the number of patients suffering from acute water borne diseases. Hence it have been the main areas of concern for demographers, ecologists, planners and policy makers over the recent past.

## **HUMAN RIGHTS**

**1.Marriage and Family.** Every grown-up has the right to marry and have a family if they want to. Men and women have the same rights when they are married, and when they are separated.

**2. The Right to Your Own Things.** Everyone has the right to own things or share them. Nobody should take our things from us without a good reason.

**3. Freedom of Thought.** We all have the right to believe in what we want to believe, to have a religion, or to change it if we want.

**4. Freedom of Expression.** We all have the right to make up our own minds, to think what we like, to say what we think, and to share our ideas with other people.

**5. The Right to Public Assembly.** We all have the right to meet our friends and to work together in peace to defend our rights. Nobody can make us join a group if we don't want to.

**6. The Right to Democracy.** We all have the right to take part in the government of our country. Every grown-up should be allowed to choose their own leaders.

**7. Social Security.** We all have the right to affordable housing, medicine, education, and childcare, enough money to live on and medical help if we are ill or old.

**8. Workers' Rights.** Every grown-up has the right to do a job, to a fair wage for their work, and to join a trade union.

**9. The Right to Play.** We all have the right to rest from work and to relax.

**10. Food and Shelter for All.** We all have the right to a good life. Mothers and children, people who are old, unemployed or disabled, and all people have the right to be cared for.

**11. The Right to Education.** Education is a right. Primary school should be free. We should learn about the United Nations and how to get on with others. Our parents can choose what we learn.

**12. Copyright.** Copyright is a special law that protects one's own artistic creations and

writings; others cannot make copies without permission. We all have the right to our own way of life and to enjoy the good things that art, science and learning bring.

**13. A Fair and Free World.** There must be proper order so we can all enjoy rights and freedoms in our own country and all over the world.

**14. Responsibility.** We have a duty to other people, and we should protect their rights and freedoms.

**15. No One Can Take Away Your Human Rights.**

### **VALUE EDUCATION**

The very purpose and main function of education is the development of an all round and well-balanced personality of the students, and also to develop all dimensions of the human intellect so that our children can help make our nation more democratic, cohesive, socially responsible, culturally rich and intellectually competitive nation.

#### ***Objectives of Value-Education:***

Traditionally the objectives of value-education were based on religion and philosophy. There was no secular value-education; but in today's modern world, this has been taken as very much essential. The objectives are given below :-

1. Full development of child's personality in its physical, mental, emotional and spiritual aspects,
2. Inculcation of good manners and of responsible and cooperative citizenship.
3. Developing respect for the dignity of individual and society.
4. Inculcation of a spirit of patriotism and national integration.
5. Developing a democratic way of thinking and living.
6. Developing tolerance towards and understanding of different religious faiths.
7. Developing sense of brotherhood at social, national and international levels.
8. Helping pupils to have faith in themselves and in some supernatural power that, is supposed to control this universe and human life.
9. Enabling pupils to make decisions on the basis of sound moral principles
10. Evolving the evaluation criteria on value-education.
11. Suggesting measures for better utilisation of value-education.
12. Finding out the interests of pupils in relation to different aspects and activities of value-education.
13. Clarifying the meaning and concept of value-education.

#### **Role of Information Technology in Environment and Human Health!**

Information technology has tremendous potential in the field of environment education and health as in any other field like business, economics, politics or culture.

Development of internet facilities, Geographic Information System (GIS) and information through satellites has generated a wealth of up-to-date information on various aspects of environment and health.

A number of software have been developed for environment and health studies which are user friendly and can help an early learner in knowing and understanding the subject.

#### **Database on Environment System:**

Database is the collection of interrelated data on various subjects. It is usually in computerized form and can be retrieved whenever required. In the computer the information of database can be very quickly retrieved. The comprehensive database includes wildlife database, conservation database, forest cover database etc. database is also available for diseases like HIV/AIDS, Malaria, Fluorosis, etc.

#### **(a) National Management Information System (NMIS):**

NMIS of the Department of Science and Technology has compiled a database on Research and Development Projects along with information about research scientists and personnel involved.

#### **(b) Environmental Information System (ENVIS):**

The Ministry of Environment and Forests, Government of India has created an information System called Environmental Information System (ENVIS). With its headquarters in Delhi, it functions in 25 different centres all over the country. The ENVIS centres work for generating a network of database in areas like pollution control, clean technologies, remote sensing, coastal ecology, biodiversity, western Ghats and eastern environmental management, media related to environment, renewable energy, desertification, mangroves, wildlife, Himalayan ecology, mining etc.

#### **(c) Remote Sensing and Geographical Information System (GIS):**

Satellite imageries provide us actual information about various physical and biological resources and also to some extent about their state of degradation in a digital form through remote sensing. Satellite imageries provide us actual information about various physical and biological resources and also to some extent about their state of degradation in a digital form through remote sensing. We are able to gather digital information on environment aspects like water logging, desertification, deforestation, urban sprawl, river and canal network, mineral and energy reserves and so on.

***(d) Geographical Information System (GIS):***

GIS has proved to be a very effective tool in environmental management. GIS is a technique of superimposing various thematic maps using digital data on a large number of inter-related or inter dependent aspects. Several useful soft-wares have been developed for working in the field of GIS.

Different thematic maps containing digital information on a number of aspects like water resources, industrial growth, human settlements, road network, soil type, forest land, crop land or grassland etc. are superimposed in a layered form in computer using software. Such information of polluted zones, degraded lands or diseased cropland etc. can be made based on GIS. They also provide information of atmospheric phenomena, like approach of monsoon, ozone layer depletion many new reserves of oil; minerals etc. with the remote sensing and GIS play a key role in resource mapping, environmental conservation, management, planning and environmental impact assessment. It also helps in identifying several disease infested areas which are prone to some vector-borne diseases like malaria s etc. based upon mapping of such areas. They also provide information of atmospheric phenomena

***(e) The World Wide Web:***

With resources material on every aspect, class-room activities, and digital files of photos, power-point lecture presentations, animations, web-exercises and quiz has proved to be extremely useful both for the students and the teachers of environmental studies.

**The role of online learning centre website has the following features:**

***(a) Student-friendly features:***

These include practice quiz, how to study tips, hyperlinks on every topics with detailed information, web exercises, case studies, environmental maps, key-terms, career information, current articles, and interactive encyclopaedia and how to contact your elected officials.

***(b) Teacher-friendly features:***

These include in addition to above supplement resources charts, additional case studies, answers to web exercises, solutions to critical thinking, questions, editing facility to add or delete questions and create multiple version of same test etc. Information technology is expanding rapidly with increasing applications and new avenues are being opened with effective role in education, management and planning in the field of environment and health.

