

Lecture note on Environment Studies

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Environmental Studies

Unit 1: The Multidisciplinary nature of environmental studies

Definition

The word "environment" is derived from the French word 'environner' means "to encircle or surround".

- It is a composite word for the conditions/surroundings in which organism or group of organism live. It includes both physical & biotic word, in which biological being live, grow, get nourished and develop their natural characteristics.

- The environment consist of both biotic (all the living beings present in the ecosystem) and abiotic (non-living components) substance i.e; consists of air, water, food, sunlight, temperature, electricity etc. Thus environment can be defined in a number of ways, but the common definition is,

"Environment is the sum of all social, economical, physical or chemical factors which constitute the surroundings of men/living organism, who is both creator and moulder of their environment. The environment is constituted by ^{the} interacting systems of physical, biological and cultural elements inter-related in various ways, individually as well as collectively. These elements are

(1) Physical Elements

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

(2) Biological Elements

plants, animals, microorganisms and human beings constitute the biosphere.

(3) Cultural Elements

Economic, social and political elements are essentially manmade features, which constitute the cultural milieu. (surrounding of people)

Scope and Importance

Environmental studies enlighten us about the importance of protection and conservation of our environment. At present, a great number of environment issues have grown in size and complexity day by day, threatening the survival of mankind on earth.

We live in landscapes that have been heavily modified by human beings, in villages, towns or cities. But even those of us who live in cities get our food supply from surrounding villages and these in turn are dependent on natural landscapes such as forests, grasslands, rivers, seashores, for resources such as water for agriculture, fuel wood, fodder and fish. Thus, our daily lives are linked with our surroundings and inevitably affects them.

We use water to drink and for other day-to-day activities. We breathe air, we use resources from which food is made and we depend on the community of living plants and animals which form a web of life, of which we are also a part. Everything around us forms our environment and our lives depend on sustaining its vital systems.

The industrial development and intensive agriculture that provides the goods for our increasingly consumer oriented society uses up large amounts of natural resources such as water, minerals, petroleum products, wood, etc. Non renewable resources, such as minerals and oil are those which will be exhausted in the future if we continue to extract these without a thought for subsequent generations. Renewable resources, such as timber and water, are those which can be used but can be regenerated by natural processes such as regrowth or rainfall. Deforestation leads to floods in the monsoon and dry rivers once the rains are over.

What we should implement is Sustainable Development, it is the organising principle for meeting human needs while at the same time sustaining the ability of natural systems to provide the resources and ecosystem services upon which the economy and society depends. The desirable end result is a society where living conditions and resource use continue to meet human needs without undermining the stability of the natural systems.

The Scope of environmental Studies include :

1. Developing an awareness and Sensitivity to the environment and its related problems.
2. Motivating people for active participation in environmental protection.
3. Developing skills to find solutions to environmental problems.
4. Imbibe ^(absorb) and inculcate ^(fix idea) in others the necessity for conservation of natural resources.

Needs for awareness : ~~about~~ ~~about~~ ~~environmental~~ ~~to~~ ~~aware~~

Increasing population, urbanization and poverty have exerted pressure on the natural resources and led to degradation of the environment. To prevent the environment from further degradation, the Supreme Court has ordered and initiated environmental protection awareness through government and non-government agencies.

Environmental pollution cannot be prevented by laws alone. Public participation is equally important with regards to environmental protection. Environmental Education (EE) is a process of learning by giving an overall perspective of knowledge and awareness of the environment. It sensitizes the society about environmental issues and challenges interested individuals to develop skills and expertise, thereby providing appropriate solutions.

Climate change, loss of biodiversity, declining fisheries, ozone layer depletion, illegal trade of endangered species, destruction of habitats, land degradation, depleting ground water supplies, introduction of alien species, environmental pollution, solid waste disposal, storm water and sewage disposal pose a serious threat to ecosystems in forest, rural, urban and marine ecosystems.

Both formal and informal education on the environment will give the interested individual the knowledge, values, skills and tools needed to face the environmental challenges on a local and global level.

Unit 2: Natural Resources

Renewable and non renewable resources

Natural resources

Things or material of the nature that can be put to some use by human beings for their development, growth, comfort and other necessities are called as natural resources.

Natural Resources

Exhaustible Natural resources Inexhaustible Natural resources

Renewable Natural Resources Non-Renewable Natural resources

Exhaustible Natural Resources :-

* The resources that are consumed from exhausted through continuous use or mis-use.

Ex:- Soil, forest, water, Coal, petroleum, water

Inexhaustible Natural Resources :-

* These are the resources which can not be completely consumed or exhausted even after its continuous use or misuse.

Ex:- Air, Sunlight.

Renewable Natural resources

Resources that can be renewed are called as Renewable natural resources.

Ex:- Soil, water

Non-Renewable Natural resources

Resources that ^{not} can be renewed that called as non-renewable natural resources.

Ex:- Oil, Coal, petroleum

Coal
petroleum (In the absence of air)

process: Destructive. Distillation

Component

Biotic

Abiotic

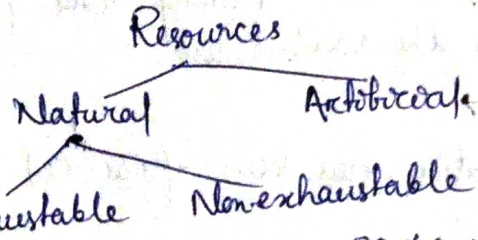
Biotic → It includes all the living things.

Ex:- Human, Tree

Abiotic → It includes all the non-living things. (Ex:- Soil, rock, water)

Forest Resources

33%
Deforestation
Afforestation



Africa has
largest forest area

Forest covered
India - 22%

33% (for ecological balance 33% area should be under forest cover)

Thermal energy (40-45%)

Hydropower

- According to forest survey India has only 22% of its geographical area as forest among which only 11% accounts for dense forest.
- So it is very essential to create forest resources so that we can achieve the desire 33% which is essential to create a perfect balance in the ecosystem.

De-forestation

- The loss of forest resources on the conversion of forest areas into non-forest areas is known as deforestation.
- The causes of deforestation are industrial revolution, technological changes and urbanisation. generally this removal of destruction of significant area of forest cover has resulted with the loss of biodiversity.
- In developing country massive deforestation has assumed alarming proportions and shaped climate and geographies.
- So deforestation may be defined as the loss or continuous degradation of forest habitats due to either natural or human related activity like agriculture or sustainable forestry, fire, mining and petroleum exploration.
- Natural deforestation results in Tsunami, forest fire, volcanic eruption, melting of glaciers and desertification.

Cause of Deforestation :-

Present Causes →

While emphasising market driven forestry practices are often one of the causes of forest degradation.

- The principal human related cause of deforestation are

agricultural live stock · mining · and petroleum exploration which also makes the soil barren.

Pre-history →

Deforestation has been practiced by human for over thousand of year.

Fire is the first tool that allow to modified the landscape after which the agricultural fire become to the prime tool to clear land for crops causing the removal of forest.

Pre-Industrial history →

Industries required sufficient amount of land area with consuming the forest so fast without proper replantation so that it becomes impossible to obtain the required forest cover.

Environmental effects

- Atmospheric pollution
 - Deforestation is one of the major causes of enhance green house effect acid rain.
 - Trees remove carbon dioxide from atmosphere by the process called photosynthesis. Thus making our environment of better place to reside with.
 - Decay and burning of food residues ^{the} much carbon dioxide to the atmosphere.
- (1) Atmospheric condition
 - (2) Wildlife
 - (3) Soil erosion
 - (4) Landslides

Some forest are rich in biodiversity so deforestation can cause the destruction of habitats that supports these biological diversity thus causing shifts and extinction.

- As a result the presence or absence of tree can change the quantity of water on the surface. In the soil or ground water

etc. in the atmosphere this in turn changes erosion rates and the availabilities of water for the ecosystem or human services and also a little impact on flooding.

Soil erosion

Deforestation generally increases the rate of soil erosion by increasing the amount of runoff and reducing the protection of soil.

Precipitation

↓
Interception (Losses due to trees)

↓
Infiltration

↓
Vertical movement of water through soil.

Land slides

- Tree roots bind soil together and ^{keep the} ~~also~~ soil in ~~stability~~ ^{the} place by ~~binding it~~ ^{binding it} with underlining bed ~~rock~~ ^{rock}.
- Tree removals from steep slopes ~~which subside~~ ^{thus increasing} the risk of land slides, which can threaten people near by.

Controlling Deforestation

- (1) Farming
- (2) Forest management
- (3) Afforestation

Farming →

- New methods are being developed to grow more food crops on less fertile land such as hybrid crops and hydroponics.
- Cyclic agriculture increases the fertility of the soil.

Forest Management →

- Attempts to stop or slow deforestation have been attempted from many centuries because it can cause environmental damage causing the society to collapse.
- The process of plantation of new trees or food crops to maintain biodiversity is known as afforestation.

Water Resources

Water satisfy the following needs;

- (1) Water for drinking
- (2) Water for industrial use
- (3) Irrigation
- (4) Hydropower generation
- (5) Inland navigation

(1) Drinking purpose :-

The most important use of water resources is for drinking purpose.

(2) Industrial use :-

Water is use in many industries serving different purpose,

(3) Irrigation :-

Water resources is used for farming.

(4) Hydropower :-

Water resources is the second most sought after resources for the generation of electricity.

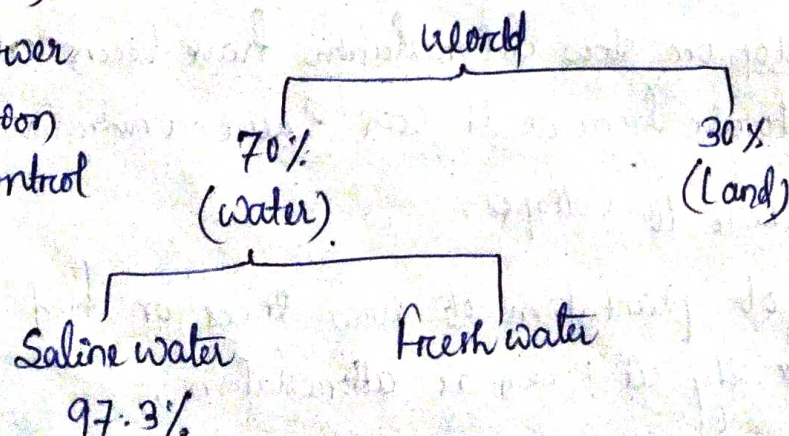
(5) Navigation :-

Water also solves as a medium of transportation termed as water ways.

Benefits of Dams

- (1) Drinking
- (2) Industrial use
- (3) Navigation
- (4) Hydropower
- (5) Irrigation
- (6) Flood control

Hirakud dam
(Major dam)
70% - water



Water bodies

- (1) Sea
- (2) Rivers
- (3) Lakes
- (4) Ponds
- (5) Glaciers
- (6) Well / Spring / streams

Rivers

- (1) Himalayan rivers
- (2) Deccan rivers
- (3) Coastal rivers
- (4) Inland drainage river

Himalayan rivers :-

They receive heavy rainfall in Monsoon months, during rainy season and receive water from melting of ice in glaciers that's why they are perennial river.

- They are originated from the Himalaya mountains.

Ex:- Ganga, Brahmaputra

Deccan rivers :-

They receive water from rain during monsoon season and remain dry or rainfed during the rest of the season that's why they are called as non-perennial river.

- The rivers are non-navigable because they mainly flow through the hilly regions.

- They are originated from the Deccan plateau.

Ex:- Narmada, Tapi

Coastal rivers :-

They are comparatively small and non-perennial.

Inland drainage river :-

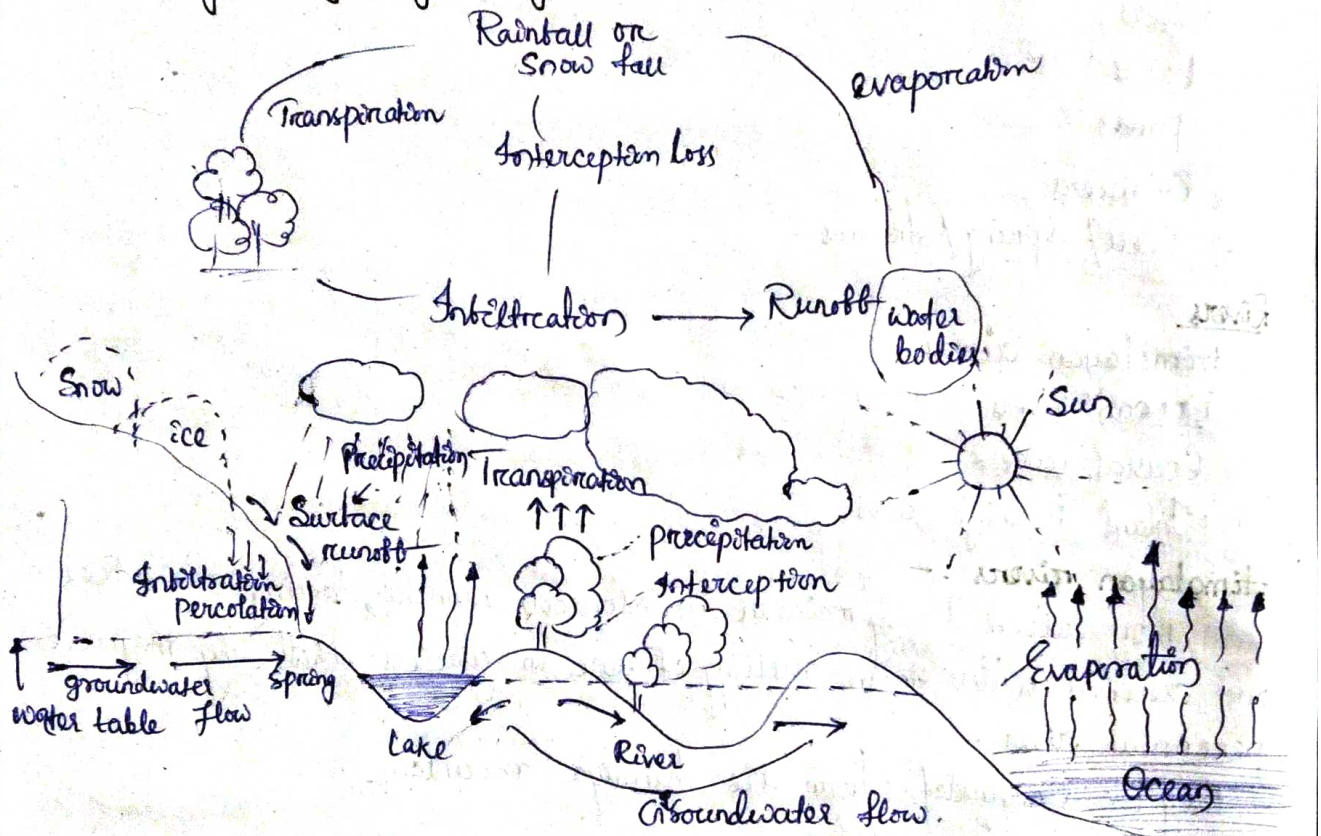
These rivers get into the range of any of the above three types of rivers.

Ex:- Mahanadi

- Monsoon season generally last from may last to October first week almost every part of the country gets rainfall during this period.
- water conflict are arising between Delhi and Haryana; Andhra Pradesh and Chennai.

upstream (Delhi) } downstream (Haryana)

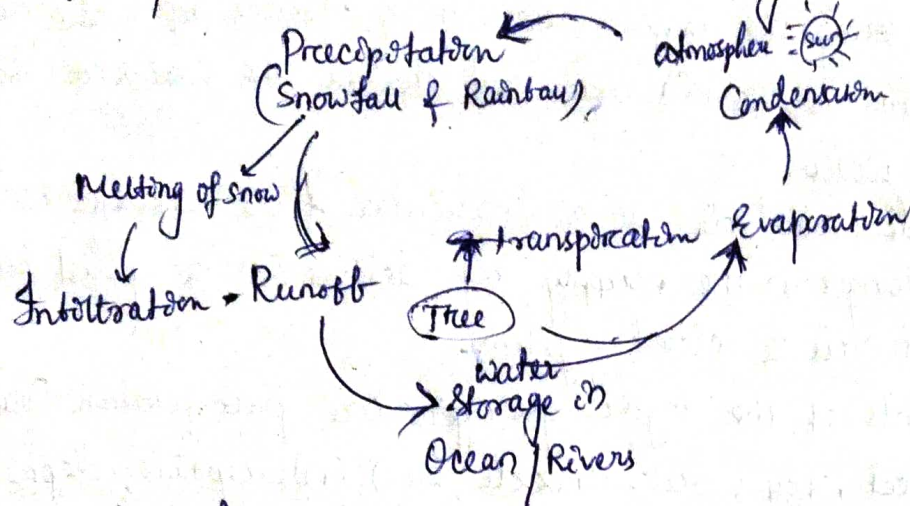
Water Cycle (Hydrological Cycle) :-



(Fig: Hydrological cycle).

- Water occurs in three physical phases; Solid, Liquid and Gas & all of these are found in the nature.
- According to National Research Council (NRC) Hydrologic cycle is defined as the pathway of water as it moves in its various phases to the atmosphere to the earth and through the land to the ocean and then back to the atmosphere and it is a never ending process means it has neither beginning nor an end.
- The hydrologic cycle can be visualized as a series of storages and a set of activities that moves water among the storages.
- Among the ocean are the largest pressure ~~water~~ holding about 97% of the earth's water of the remaining 3% fresh water.

78% is stored as ice and 21% are stored much below the ground and the rivers, trees etc containing the remaining 1%.



(The water cycle)

Source - oceans

Carrier - Atmosphere

User - Land

major system.

- Hydrologic cycle considers the motion loss and recharge of earth's water & connect the atmosphere and the two storages of earth system, the ocean and the land.

The Chipko Movements (Sundarlal Bahuguna)

The forest of India are a critical resources for the subsistence for living of rural people throughout the country especially in hills and mountains because of the direct provision of food fuel.

- The Chipko protectors hugged the tree and thus saved them by putting their body before the tree from the Contractors axe.
- It was started by Sundarlal Bahuguna in 1987.
- We need to study the hydrologic cycle since water is essential for survival of life and is an important input in many economic activities from the use point view, the land phase of the hydrologic cycle is the most important.
- In view of the complexities and extensive coverage, the study of hydrologic cycle is truly interdisciplinary for instance.

Components of hydrologic Cycle :-

The hydrologic cycle can be subdivided into three major systems. The oceans being the major reservoir & source of water the atmosphere functioning as the carrier and deliver the water and the land as the user of water.

The amount of water available at a particular place changes with time because of changes in the supply and deliver on a global basis, the water movement is a closed system.

The major components of the hydrologic cycle are precipitation (rainfall, snowfall, hail, sleet, fog, dew, drizzle, etc.), interception, depression storage, evaporation, transpiration, infiltration, percolation, moisture storage in the unsaturated zone and runoff (surface runoff, interflow and baseflow).

Evaporation of water takes place from the oceans and the land surface mainly due to solar energy. The moisture moves in the atmosphere in the form of water vapour which precipitates on land surface or oceans in the form of rain, snow, hail, sleet etc.

A part of this precipitation is intercepted by vegetation or buildings of the amount reaching the land ~~into~~ surface, a part infiltrates into the soil and the remaining water runs off the land surface to join streams. These streams finally discharge into the ocean. Some of the infiltrated water percolates deep to join groundwater & some comes back to the streams or appears on the surface as Springs.

This immense movement of water is mainly driven by solar energy, the excess of incoming radiation over the outgoing radiation. Therefore, Sun is the prime mover of the hydrologic cycle. The energy for evaporation of water from streams, lakes, ponds, oceans and other open water bodies comes from sun.

A substantial quantity of moisture is added to the atmosphere by transpiration of water from vegetation.

Flood

- Flood is caused by over flowing of the river banks due to heavy rainfall.
- The wetlands are the nature flood control system.
- Due to deforestation in wetland river water comes towards the land area and causes flood.
- This flood can damage crops, kill people and destroy their home so it affects the economy of a particular area.

Drought

- A drought is a period of time when an area or region experiences below-normal precipitation.
- It leads to a period of severe scarcity of water.
- Drought is an unpredictable climate condition which occurs due to failure of one or more monsoons in a particular region.
- Due to drought, farms, industries, urban areas specially gets affected which uses a plenty of water.

Cause :-

- Deforestation is the main cause of drought - when forest come is remove water directly flows into the river without infiltrating into the ground.
- In some areas during monsoon season, adequate amount of water is available. This water are misused by the people and they are not conserving.
- During the non-monsoon period, they face the drought condition.

Water for agriculture & power generation :-

In India, the increasing demand for water in agricultural field and for generating electricity is mostly fulfilled by using the dam projects.

Dam

- Dams are created by storing or conserving large amount of water in a particular area, which can be used later for irrigation, for industrial supply and in urban areas.
- Dams provide year around supply of water for domestic use & provides extra water generating for agricultural.

Disadvantages :-

This Dams Creates several environmental problems like;

- They change the river flow directions & also destroy the wet lands etc.
- It destroy the life of local people and the habitat of wild life.
- The emission of green house gases from reservoir due to rotting of vegetation & carbon airblows pollute the environment.

Case study :-

Sardar Sarovar project - This is a Multi purpose dam project built in the Narmada River valley. It has impacted millions of peoples lives, who have residing in that valley. The farmers who were present in the down stream got benefited but the farmers, fishermen who were living in the valley, have lost their home land & livelihood.

Mineral resources

- A mineral is a naturally occurring substance with definite chemical composition and identifiable physical property.
- This minerals are form over a period of millions of years in the earth's crust.
- The process of extracting minerals & ores from the earth's interior is known as mining.
- An Ore is a mineral or combination of minerals available in impure form, from which useful substance can be extracted.

Ex:- Bauxite is an ore of Aluminium mineral.

Mining → prospecting → Searching for minerals
→ Exploration → Assessing the size, shape, location & economic value
→ Development
→ Exploitation

Mining is done through four stages:

Development → preparation or setup of the access so that minerals can be extracted.

Exploitation → extraction of the minerals from the mine

→ At present days many sophisticated instrument like GIS (Geographical Information System) are used to survey & study the minerals present in earth.

→ There are two types of mines available;

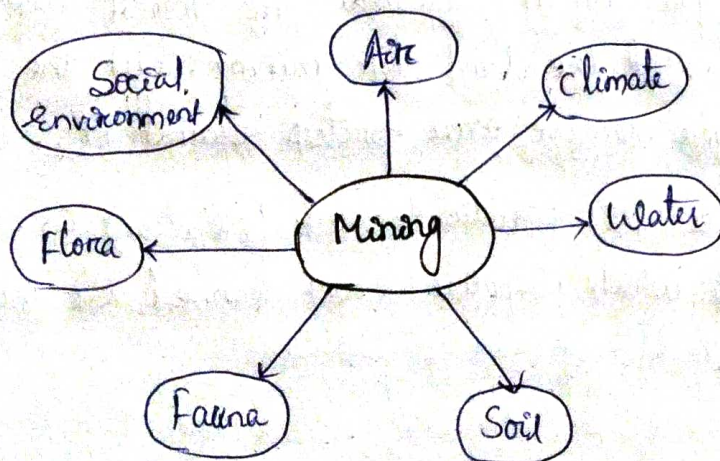
(1) Surface mines (open-cast)

(2) Underground mines (deep mines)

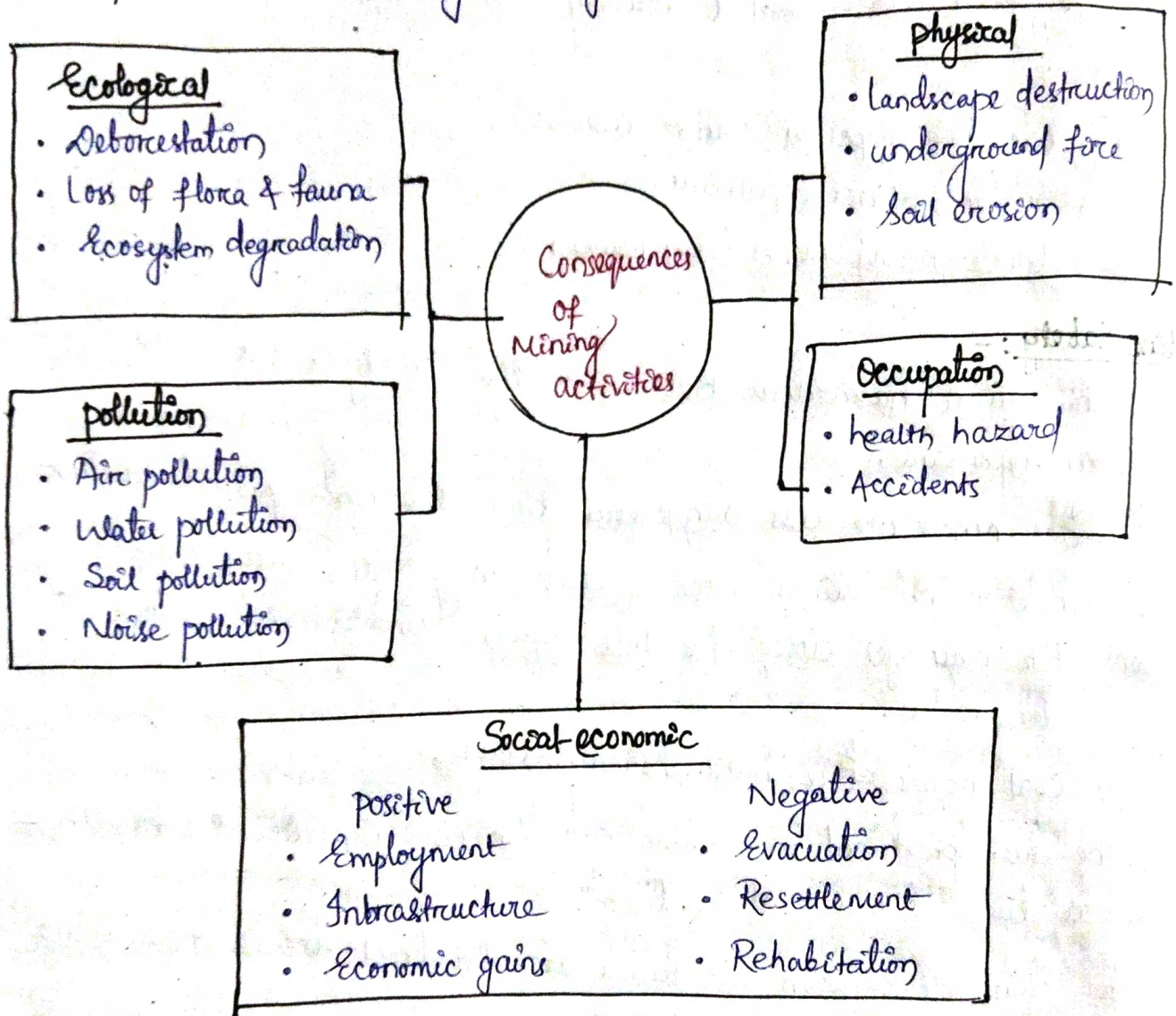
Mine Safety:-

- Mining is a hazardous process, so the safety of the mine occurs is very important.
- Surface mines are less dangerous than the underground mines.
- In underground mines, rock & roof may fall, flood may occur, ventilator may get closed for this reason, underground mines are very dangerous.
- In coal mines fire hazard may occur.
- The dust produced in mining operation is injurious to health & cause a lung disease "Black lung".
- In dynamite explosion, the fumes are produced which are also very dangerous for the mine workers.

Environmental Effects:-



- Mining operations are considered as one of the major source of environmental pollution, since it affects the air, water, forest, wild species and the social environment.
- The extraction of minerals from the lithosphere has many side effects such as it pollutes the water & near by land. The industry develop due to this mining, damage the near by environment.



Case study :-

- Sariska Tiger Reserve, Rajasthan.
- This tiger reserve present in Rajasthan. The Forest department of Rajasthan have leased the land for mining, but the local people of Sariska tiger reserve area protest against it. They also ~~had~~ filed a PIL (Public Interest Litigation) in Supreme Court as a result of which Supreme court banned the mining in the reserve area.

Food Resources

- Food which is necessary for all living organism generally consist of proteins, Carbohydrate, enzymes, minerals etc.
- Today our food entirely depends on agriculture, animal husbandry and fishing.
- In ~~whole~~ throughout the Country, food production has increased by almost 50% in past few years, it is not sufficient as the population is also growing in the same rate.
- Since the land and water resources are limited therefore it is required to increase the productivity and some steps should be taken to reduce the population growth.
- Due to this intensive agriculture ~~to~~ to increase the productivity, we gradually damage the environment, some of which are listed as below;

Overgrazing

- Can occur where over grazing a particular area like; grassland is under continuous grazing.
 - Due to this overgrazing, plant leaf areas are reduced, so sunlight directly heats the ground and gradually that area becomes dry.
 - Overgrazing also increases soil erosion, due to this fertility of the soil decreases.
 - Due to overgrazing the plants become weak and its root length reduces day by day for which infiltration of surface water to the underground is blocked.
 - Overgrazing can be reduce by rotational grazing which means a particular area is left after grazing it so that again the plant can grow in that area.
 - Also different types of grass or fodders can be harvested to fulfilled the demand of animal food.
- (i) Effects of modern agriculture
 - (ii) Damage to soil
 - (iii) Contamination of water
 - (iv) Fertilizer
 - (v) pesticides

(i) Effects of Modern Agriculture →

To increase the productivity in agriculture sector, many techniques are used which has negative consequences on the environment.

- The impact of modern agriculture technique on the environment are describe below;

(ii) Damage to Soil →

Due to intensive agriculture, it causes soil erosion in the farm land. Due to erosion, the surface soil get remove which generally contains the organic matter, plant nutrients etc. So fertility of the soil, it decrease due to erosion of surface soil.

(iii) Contamination of water →

- At farming various things like manure fertilizer, pesticides are used.
- Surface runoff carry all these things into the streams, lakes, reservoirs etc. and contaminate the water bodies.
- These things can also infiltrate to the ground contaminate the ground water.

(iv) Fertilizers →

- When the nutrients are lost from the soil, then farmers use fertilizers to increase the productivity, generally 3 major nutrients are applied to the farm i.e; Nitrogen, phosphorus & potassium.
- Nitrogen is readily lost as it is soluble in water & contaminate the ground water. This nitrogen mixed water is not acceptable for drinking.
- phosphorus is not readily soluble in water and present highly with the soil particle. This phosphorus mixed soil when get eroded. It goes into the water bodies. When it may cause excessive growth of aquatic plants. Due to this the lakes reservoir become ~~not~~ choked with offensive odour may come out.
- Potassium is not hazardous for the environment.
- pesticides are readily used in farms to get rid of different types of pests and insects which may damage the crops.
- These pesticides are poisonous, chemicals which can contaminate the water and kill the aquatic animals. These pesticides can also harm for human beings if it is consumed with the crops/foods.

(v) Pesticides →

- One drawback to this is that pesticides generally kill not only the pest of concern, but also a wide range of other organisms, including beneficial insects and other ^{pest} predators.
- Once the effect of the pesticide wears off, the pest species is likely to recover more rapidly than its predators because of differences in the available food supply.
- The increasing pesticide use is the development of resistance in pest species. The individual pests that survive pesticide applications continue to breed, gradually producing a population with greater tolerance to the chemicals control pest populations.
- Accumulate in animal tissues, causing water contamination, fish kills, and decline of some bird population.

Waterlogging

- Another problem associated with excessive irrigation on poorly demand soils is waterlogging.
- The irrigation water eventually raises the water table in the ground, the upper level of the ground water found beneath.
- The raised water table results in the soils becoming waterlogged. When soils are waterlogged, air spaces in the soil are filled with water, and plant roots essentially suffocate lack oxygen. Waterlogging also damages soil structure.

Salinity

Crop production is limited because of salinity or alkalinity or both. Three classes of saline & alkali soils are recognized. They are;

(1) Saline Soils →

- Exchangeable sodium percentage is less than 15 and the pH is less than 8.5.
- The soluble salts mainly consist of chlorides and sulphates of sodium, calcium & magnesium. Because of the ^{white} incrustation due to salts, the saline soil is also called white alkali.

(2) Non-saline Alkali or Sodic Soils →

- Alkali soils have an exchangeable sodium percentage of more than 15 and a pH greater than 8.5.

- Such soils have low infiltration rate and the physical condition is unfavourable. Because of high alkalinity, resulting from Sodium Carbonate. Hence, the term black alkali is frequently used to designate the non-saline alkali soil.

(3) Saline Alkali Soils →

- This group of soils is both saline and alkali. Also the exchangeable sodium percentage is greater than 15.
- The pH, however, is likely to be less than 8.5.
- The soil salinity or alkalinity or both have many adverse effects.
 1. Causing low yields of crops or crop failure in extreme cases.
 2. The limiting of the choice of crops, because some crops are sensitive to salinity or alkalinity or to both.

Causes of Salinity:-

- i) During the periods of higher than average rainfall, the soluble salts are leached from the more permeable high lying areas to the low-lying areas, where, if the drainage is restricted, salts accumulate on the surface as water evaporates.
- ii) In the coastal areas, the ingress of sea water induces salinity in the soil.

Reclamation :-

- i) The salts need to be leached below the root zone and not allowed to come up.
- ii) The commonly used amendment is Gypsum.
- iii) The number and frequency of leaching, the quantity of gypsum to be added and the techniques involved vary from region to region, depending upon the clay minerals of the soils, the intensity of the problem.

Energy Resources

→ Energy is needed by all living organisms and degradation for biochemical reactions of their cells. It is a power which is needed in one form or other for work done.

→ Before, most of the power available to human society was limited to solar energy trapped by green plants which produced organic matter.

→ The fire was the first form of known energy used for cooking, heating purpose.

Growing Energy Needs :-

For every activity to be performed required energy in the form of heat, light, electricity and even food.

Energy Sources (Renewable & Non-Renewable Sources of Energy) :-

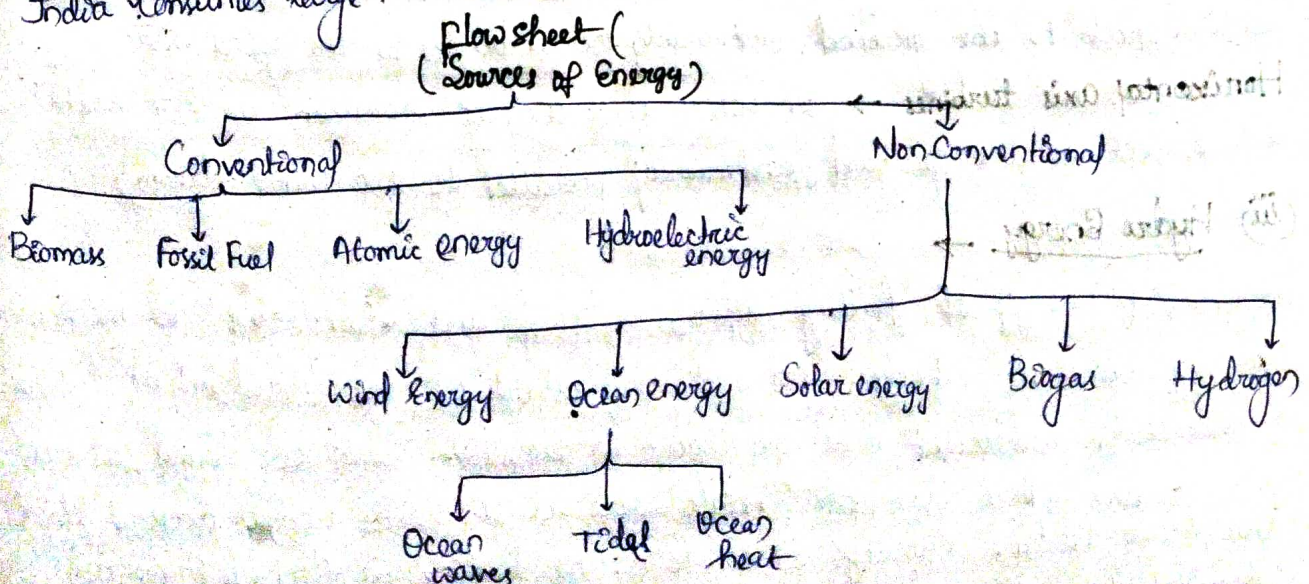
There are following 2 types of energy sources to meet the requirement.

1. Renewable or Non-conventional or inexhaustible energy sources

- These sources are continuously replenished by natural processes.
- For example; solar energy, wind energy, bio energy, hydropower etc.

2. Non-renewable or Conventional or exhaustible energy sources

- Examples of this are coal, petroleum, natural gas and nuclear power. These are traditional sources available to us.
- In addition to commercial fuels, coal, oil, natural gas and power, India consumes large.



(i) Solar Energy →

- Solar energy is the most readily available and free source of energy since prehistoric times in a most primitive manner.
- Solar thermal energy is used for cooking, heating, drying, timber seasoning, distillation, electricity generation, cooling, refrigeration, cold storage etc.
- Solar photovoltaic uses sun's heat to produce electricity for lighting home & building, running motors, pumps, electric appliances, lighting streets, village electrification, powering of remote telecommunication & railway signals etc.
- Solar cooker is a device which uses solar energy for cooking, saving fuel to a large extent. It can only supplement the cooking fuel & not replace it totally.
- In solar water pumping system, the pump is driven by motor run by solar electricity instead of conventional electricity drawn from utility grid.
- It converts the solar energy into electricity, which is used for running the motor pump set.

(ii) Wind Energy →

- Wind energy is basically utilizing wind power to produce electricity.
- The kinetic energy of the wind is converted into electric energy.
- Different examples of wind energy technology are vertical axis wind turbines & horizontal axis wind turbines.

Vertical-axis wind turbines → In which the axis of rotation is vertical with respect to the ground. (and roughly perpendicular to the wind stream).

Horizontal axis turbines → In which the axis of rotation is horizontal with respect to the ground. (and roughly parallel to the wind stream).

(iii) Hydro Energy →

- potential energy of falling water, captured and converted to mechanical energy by water wheels, powered the start of the industrial revolution.
- wherever sufficient head or change in elevation could be found, rivers and streams were dammed & mills were built. Water under pressure flows through a turbine causing it to spin. The turbine is connected to a generator which produces electricity.

(iv) Bio Energy →

- Biomass is a renewable energy resources derived from the Carbonaceous waste of various human and natural activities.
- It is derived from numerous sources including the by-products from the wood industry, agricultural crops, raw materials from the forest, household wastes etc.

Application :-

Bio energy is being used for Cooking, mechanical applications, pumping power generation.

(v) Hydrogen Energy →

- Hydrogen is a clean fuel and energy storage medium for various applications. Hydrogen can be produced by biological conversions of various organic effluents like distillery, starch etc.
- Hydrogen contained in a metal hydrides can be used in vehicles.

(vi) Tidal & Ocean Energy →

Tidal energy :-

- Tidal electricity generation involves the construction of a barrage across an estuary to block the incoming & outgoing tide.
- The head of the water is then used to drive turbines to generate electricity from elevated water in the basin as in hydroelectric dam.

Ocean energy :-

- Ocean energy draws on the energy of ocean waves tides or the thermal energy stored in the ocean.
- The Ocean energy contains two types of energy i.e; thermal energy from the Sun's heat and mechanical energy from the tides and waves.

(vii) Geothermal Energy →

- Geothermal energy is based on the Core of the earth which is very hot & it is possible to make use of this geothermal energy.
- There are areas containing volcanic, hot springs, geysers & methane; under the water in the oceans & sea.
- Geothermal energy which is derived from high temperature geothermal fluids, which can be utilized for power generation & thermal applications like greenhouse cultivation, heating & cooking.

(viii) Chemical Sources of Energy →

- Fuel cells electrochemically produce direct current (DC) electricity through a reaction between hydrogen & oxygen. Such cells are electrochemical devices that convert the chemical energy of a fuel directly and very efficiently into electricity (DC) & heat, thus doing away with combustion.
- The most suitable fuel for such cells is hydrogen or a mixture of compounds containing hydrogen.
- A fuel cell consists of an electrolyte sandwiched between two electrodes. Oxygen passes over one electrode & hydrogen over the other, & they react electrochemically to generate electricity, water and heat.

Conventional or Non-Renewable Energy Sources

In early days wood was used as fuel in rural areas, Coal, oil and natural gas are also non-renewable energy sources.

1. Coal →

The Coal reserves are non-cooking coal, the most being coking coal. Coal reserves are unevenly distributed in the country, with the bulk reserves located in the eastern states of Bihar, West Bengal & Odisha.

2. Petroleum and Natural gas →

Exploration Licensing policy has been demonstrated by recent findings of natural gas in deep waters.

3. Nuclear power →

- The Nuclear power programme in India is based on natural uranium & indigenous thorium reserves.
- Atomic power plant based on boiling water reactor (BWR) technology with assistance from USA. This power station is currently under operation and supplies.

4. Hydropower →

The total potential for hydropower in India, based on river system, was assessed at load factor and economic potential.

Land Resources

- Top layer of the land is called as soil, which is renewable resource and essential for survival of life through it is a life support system but when it is over used it causes environmental problems.
- Soil is defined as a thin layer of earth crust which serves as a natural medium for the growth of plant. It is formed by weathering of rocks and decomposition of organic matters.
- Soil differs from parent materials in physical, chemical and biological properties.
- There are various types of soils, like
 - Black Cotton soil
 - Laterite soil
 - Red Soil (Odisha)
 - Alluvial Soil.

Classification of Soil

- (1) Alluvial Soil → These soils are formed by transportation due to water found in Ganga, Brahmaputra.
- (2) Black Soil → These soils vary depth from shallow to deep. This soil is mostly found in Maharashtra.
- (3) Red soils → Red soil is a type of soil that typically develops in warm, temperate, and humid climates and comprise approximately 13% of Earth's soils. These soils are found in Odisha, Madhya Pradesh, Bihar etc.
- (4) Laterite Soil → Laterite is both a soil and a rock type rich in iron and aluminium and is commonly considered to have formed in hot and wet tropical areas.
- (5) Desert Soil → The most predominant component of this soil is quartz.
- (6) Problem Soil → These are the soils due to land and soil characteristics are not suitable economically for cultivation of crops without proper reclamation.
- (7) Acid soil → These are the soil having $\text{pH} < 7$.

Soil Erosion

Soil erosion means removal of matter from the surface of the soil by the agencies such as running water, wind or gravity. Since the upper layer of the soils are rich in plant nutrients and thus feeding ground of plant roots, the process of soil erosion involves a definite loss of valuable plant nutrients and if it becomes sufficiently intense may lead to complete destruction of the soil hampering the plant growth.

Different type of soil erosion are;

- (1) Geologic Erosion
- (2) ~~At~~ Streambank Erosion
- (3) Wind erosion
- (4) Water erosion
- (5) Landslides erosion

Land degradation

~~→ Agricultural production has not~~

→ Land degradation is a process in which the value of the biophysical environment is affected by a combination of human-induced processes acting upon the land.

→ In India, the green revolution brought about technology break through which led to the use of the short duration high yielding varieties of crops helping intense use of land. Thus increasing the area under irrigation and enhancing the use of fertilizers and pesticides.

→ Due to this process the quality of land is degrading significantly which is called as land degradation.

Land slides

→ A land slide is a sudden collapse of a large mass of soil/side, there are different type of land slides occurs on earth, rock etc.

→ Landslides occurs on;

- on steep slopes
- where landslides have occurred before
- drainage problem.

Factors Causing landslides:-

- (1) Due to sudden down hill movement on earth, which is caused due to rain.
- (2) Excessive rainfall or snow melt
- (3) Mining, underground excavation.
- (4) Earthquakes, volcanic eruptions
- (5) Changes in groundwater

Effects:-

- (1) Damage of houses, loss of public properties
- (2) No Communication of road and rail.
- (3) Fatality to living beings

Desertification :-

- Desertification is a process by which the productive potential of arid or semi-arid rains falls thus decreasing the productivity.
- It leads to Conversion of an irrigated crop land into desert.
- It is characterized by loss of vegetation cover, depletion of ground water and soil erosion.
- The Causes of desertification are
 - 1) Deforestation
 - 2) Mining activity
 - 3) Quarrying activities (extraction of rock from rock bed).
 - 4) Natural disasters

b) Role of individual in Conservation of natural resources

Conservation of energy:

- Switch off light, fan and other appliances when not in use
- Use solar heater for cooking
- Dry the cloth in the sunlight instead of driers.
- Use always pressure Cookers
- Instead of using AC and Cooler, grow trees near the house to get cool breeze.

Conservation of forest:

- Use non timber product
- plant more trees
- Girassing must be Controlled
- Minimise the use of paper and fuel.
- Avoid the Construction of dam, road in the forest areas.

Conservation of Water:

- Use minimum water for all domestic purposes.
- Check the water leaks in pipes and repair them properly.
- Use drip irrigation
- Rain water harvesting system should be installed in all the houses.
- Continuous running of water taps should be avoided.

Conservation of Food resources:

- Cook required amount of food
- Don't waste the food, give it to some one before spoiling.
- Don't store large amount of food grains and protect them from damaging insects.

Conservation of Soil:

- In the irrigation process, using strong blow of water should be avoided.
- Soil erosion can be prevented by sprinkling irrigation.
- Use organic manure/compost to maintain soil fertility.

c) Equitable use of resources for Sustainable Life styles

Sustainable development → Development of healthy environment without damaging natural resources.

Unsustainable development → Degradation of the environment due to over utilisation of natural resources.

Life style in more developed Countries:

- 22% of world population, 88% of its' natural resources and 85% of total global income.
- Consumption is more and pollution is more.

Life style in less developed Countries → 78% of world population, 12% of its' natural resources and 15% of total global income.

- Consumption is less and pollution is less.

Causes of unsustainability → Main Cause - difference between More Developed Countries (MDCs) and Less Developed Countries (LDCs).

Sustainable life style → MDCs should have to reduce the utilisation of natural resources, that should have to be diverted to LDCs. This will reduce the gap between MDCs and LDCs, leads to sustainable development of the entire world.

Unit: 3 Systems

Ecosystem

For the basic requirement each living organism has to depend and also interact with non-biotic or non-living and living or biotic component of the environment.

* The scientific study of the interaction with their physical environment and with each other is called as "ECOLOGY".

- Ecosystem is defined as a community of organisms interacting with one another and the environment in which they live.

Function and Types of Ecosystem

Functioning of the ecosystem is self-regulating and self-sustaining. This depends upon flow of energy, cycling of materials etc. Depending upon the species, diversity and the manner in which they are organised, ecosystems are following types;

① Permanent and Natural Ecosystem :-

These operate under natural conditions without any interference (even by human being). These are further classified into 2 types;

- (1) Terrestrial ecosystem
- (2) Aquatic ecosystem

(1) Terrestrial ecosystem → Terrestrial ecosystem operates on land hence forest, desert and grassland are ecosystems included in this type.

Ex:- Forest, Desert, grassland etc.

(2) Aquatic ecosystem → This type of ecosystem operates in water. It is divided into 2 types;

(1) Fresh water ecosystem

(2) Marine water ecosystem

(1) Fresh water eco-system → It usually consists of fresh water bodies.
Ex - River, Lake, pond.

(2) Marine water ecosystem → This ecosystem is basically consists of 'Salty' water. It is also called as large ecosystem.
Ex - Ocean, Sea.

(2) Temporary and Natural Ecosystem :-

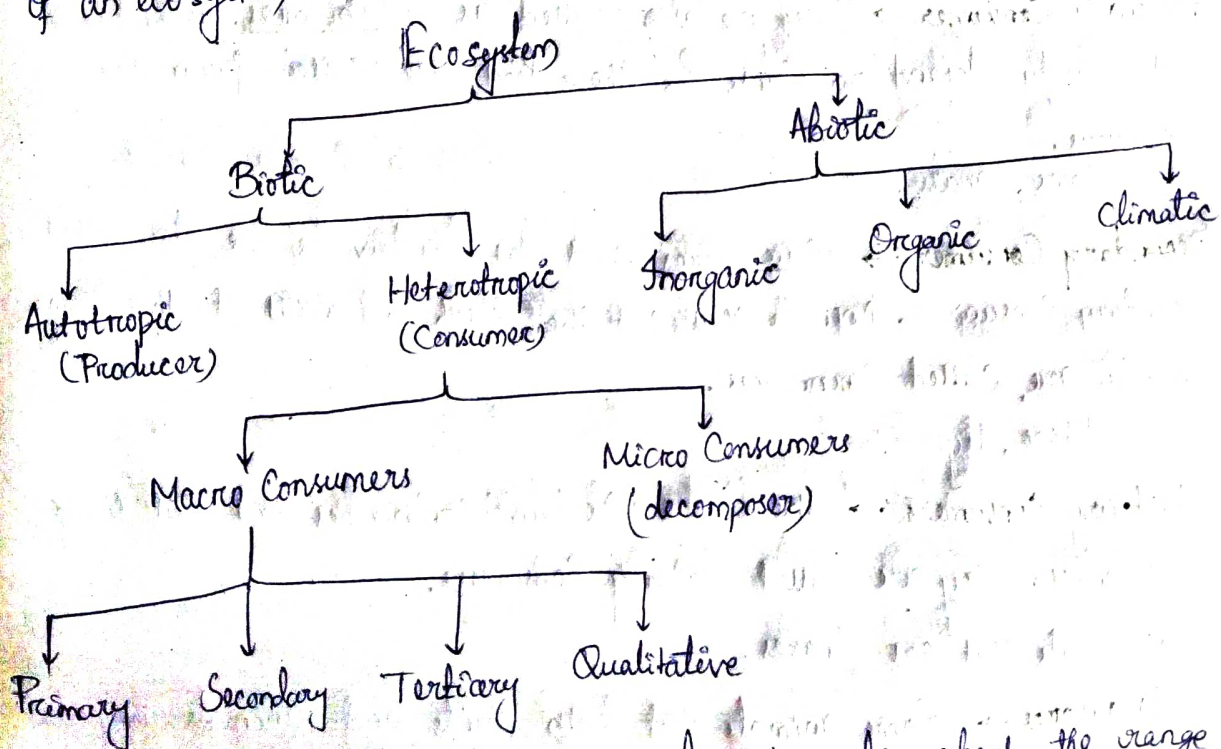
These are short lived but operate under natural condition.
Ex - pond

(3) Artificial or Anthropogenic Ecosystem :-

These eco-systems are man made.
Ex - Fish aquarium, Fishery tanks, Croplands etc.

Structure of an Eco-System

Biological Communities and Abiotic Compounds constitute the structure of an ecosystem.



The structure of ecosystem provides information about the range of climatic conditions that prevail in the area composition and organisation of biological communities & abiotic components.

Biotic

These are basically consists of living organisms.
ex:- plants, animals, micro-organisms.

Autotrophic Components

These components are basically includes plants, it is also called as producers.

Heterotrophic Components

- These are basically consists of all the living bodies except plant
- It is also called as consumers.
- Ex:- All animals, Human beings, micro-organisms etc.

Producers

All green plants are called as producers. They are also called as convertors. They are the living members of ecosystem that utilise sunlight as the primary source to produce different types of foods which using photo-synthesis process.

Consumers

The consumers are derive the food directly or indirectly from the producer. The food is then digested (broken into simple substances) which are metabolized in the consumers body and released the waste product to the environment.

Primary Consumer → They are also called as herbivores. Animals that mainly depend on plants for their food are called primary consumers.

Ex:- Cows, goats.

Secondary Consumer → Carnivores that eat herbivores are also called Secondary consumers. Animals that eat the flesh and meat of other living animals are called Carnivores.

Ex:- Lions, tigers.

Tertiary Consumers → There are certain carnivores that eat other carnivores. They are called tertiary consumers.

Ex:- Owls that eat snakes.

Omnivores → Some animals eat both plants and animals. They are called omnivores.

Ex:- human beings, monkeys, bears.

Decomposers

Some organisms derive their nutrition by breaking down dead and decaying material. They are also referred to as the cleaners of the environment. These organisms are called decomposers.

Abiotic Structure

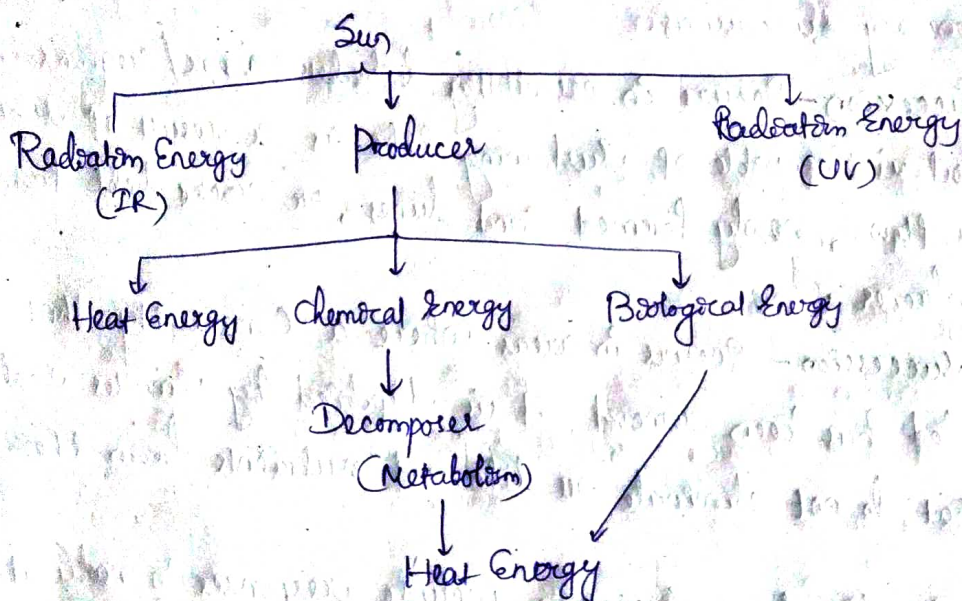
The physical and chemical components of an ecosystem consist of abiotic structures.

It includes 2 things;

(1) Materials / Chemical factor → Materials like mineral, atmospheric gas, other inorganic salts. They also include some organic material such as decay products, Carbohydrates, Aminoacids etc.

(2) Energy / physical factor → Annual rainfall, wind latitude, temperature changes etc. are also some physical factors which have a strong influence on ecosystem.

Energy flow in the Ecosystem



Energy is needed for every biological activity, solar energy is transformed into chemical energy by a process of photosynthesis.

The energy stored in plant tissue is then transferred into chemical and heat form during metabolic activities. In the biological process, the energy flows from sun to plants and then to all heterotrophic organisms like animals, man i.e.; from producers to consumers. 1% of the total sunlight falling on the green plants is utilized in photosynthesis. There is no 100% flow of energy from producers to consumers. Some is always lost to environment because of this energy.

can not be recycled in an ecosystem. It can flow unidirectional or oneway.

Energy flow follows the laws of thermodynamics. Energy flow is based on two different laws of thermodynamics;

i) First law of thermodynamics →

It states that energy can neither be created nor destroyed. Here also, the source of energy, i.e., solar energy, can neither be created nor destroyed. It can only be transferred from one system to another as from one form to another form.

ii) Second law of thermodynamics →

In the second law, it is stated that during the transformation, a portion of the energy is dissipated into the surroundings as heat energy.

Ecological Succession

The process by which the structure of a biological community evolves over time. There are two different types of succession are there; ① primary succession and

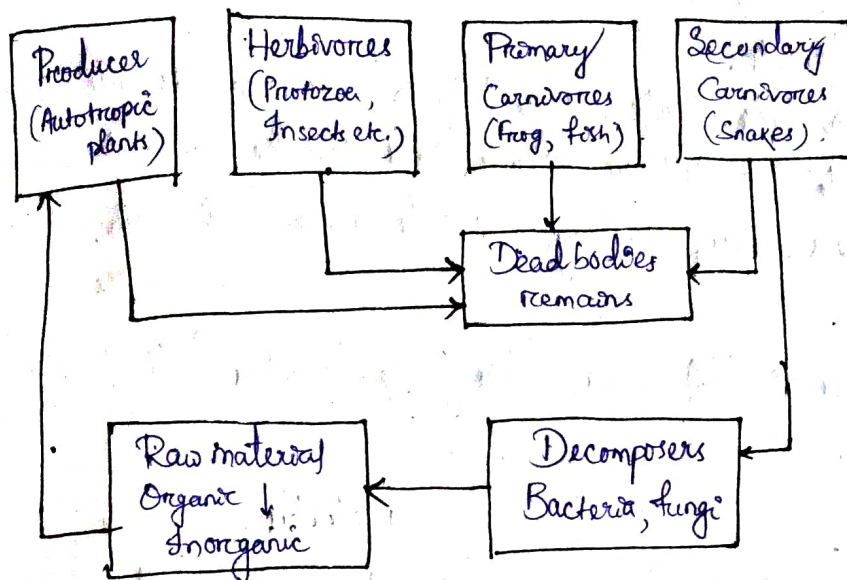
② Secondary succession

① Primary Succession - Occurs in essentially lifeless areas/regions in which the soil is incapable of sustaining life as a result of such factors as lava flows, newly formed sand dunes, or rocks left from a retreating glacier.

② Secondary succession - Occurs in areas where a community that previously existed has been removed; it is typified by smaller-scale disturbances that do not eliminate all life and nutrients from the environment.

Common types of secondary succession include responses to natural disturbances such as fire, flood, and severe winds and to human-caused disturbances such as logging and agriculture.

Food chains



Food chain is defined as the process of energy transfer from producer by a series of organisms with repeated eating. It is a simple and easy process. It increases the instability of an ecosystem.

A food chain refers to the order of events in an ecosystem, where one living organism eats another organism, and later that organism is consumed by another larger organism. The flow of nutrients and energy from one organism to another at different trophic levels forms a food chain.

The food chain consists of four major parts, namely: The sun, producers, consumers, decomposers.

- The sun is the initial source of energy, which provides energy for everything on the planet.

- The producers in a food chain include all autotrophs such as phytoplankton, cyanobacteria, algae, and green plants. This is the first stage in a food chain. The producers utilize the energy from the sun to make food. Producers are also known as autotrophs as they make their own food.

- Consumers are all organisms that are dependent on plants or other organisms for food. It includes herbivores and carnivores, which are known as primary consumers and secondary consumers. The second trophic level includes organisms that eat producers. Therefore, primary consumers or herbivores are organisms in the second trophic level.

- Decomposers are organisms that get energy from dead or waste organic material. This is the last stage in a food chain.

Decomposers are an integral part of a food chain, as they convert organic waste materials into inorganic materials, which enriches the soil on land with nutrients. Decomposers complete a life cycle. They help in recycling the nutrient, as they provide nutrients to soil or oceans, that can be utilised by autotrophs or producers. Thus, starting a whole new food chain.

Types of food chain

There are two types of food chains, namely the detritus food chain and the grazing food chain.

Grazing

→ This type of food chain starts from green plants & ends to carnivores through herbivores.

→ The energy level is high at each trophic level.

→ The energy transfer is linearly from one trophic level to another trophic level.

• Other examples of food chains are;

(1) Food chain in a forest

plants → Deer → Tiger

The producers in a forest ecosystem are plants & trees. The Deer feeds on plants and a carnivore such as tiger feeds on a deer.

(2) Food chain in a grass land

Grass → Grasshopper → Frog → Snake → Eagle

In a grassland ecosystem, grass produces its own food from sunlight. A grasshopper feeds on grass & a frog feeds on a grasshopper. Thereafter, in the chain, a snake feeds on a frog and an eagle feeds on a snake.

(3) Food chain in a pond.

Algae → Small fishes → Large fishes → Fish eating Birds

The producers in the pond ecosystem can be algae or aquatic plants which are consumed by small insects or small fishes. These small insects or fishes are food for large fishes. Thereafter, fish-eating birds or animals will consume large fish forming a chain.

Detritus

→ Its food chain starts from organic materials & ends large carnivores.

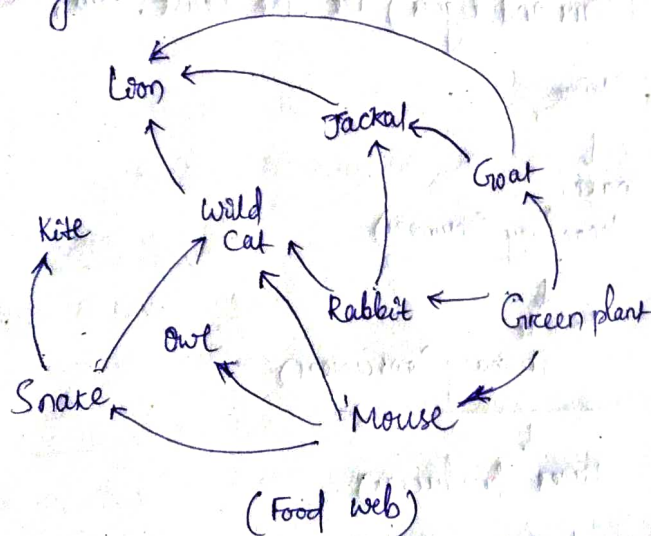
→ The energy level is low.

→ The energy transfer is not linearly from one trophic level to another trophic level.

Food Webs

Food web is defined as "A network of food chains where different types of organisms are connected at different trophic levels, so that there are a number of options of eating and being eaten at each trophic level."

- In the ecosystem, a number of food chains operate simultaneously. These food chains are inter-linked with one another to form a food web.
- For example, a plant may be food for any herbivore or Carnivore such as human beings.
- A herbivore again becomes food for Carnivore or is directly eaten by the top Carnivore. For example, a mouse feeding on food grains becomes food for a snake which is eaten by a hawk.
- The mouse can be directly eaten by a hawk. In this way, the inter-related complex food chain forms a food web. A food web constitutes a number of alternative paths for energy flow and provides greater stability to the ecosystem.

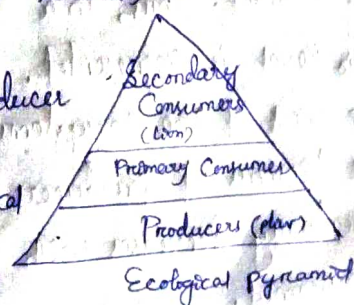


Ecological pyramids

Ecological pyramid is the graphical representation of the trophic structure (the position of organisms in the food chain) and function at successive trophic levels.

The base of the pyramid consists of the food producer level. The successive levels make the tier, with the top Carnivores forming the apex. These ecological pyramids are of 3 types;

- ① pyramid of numbers
- ② pyramid of biomass
- ③ pyramid of energy

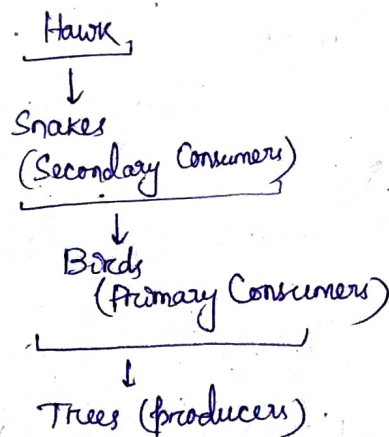


① Pyramid of numbers

This pyramid deals with the relationship between the number of primary producers and consumers (herbivores and carnivores) of different orders. Depending on the nature of the food chain, in the present ecosystem, the pyramid of numbers may be upright or inverted.

For example, in a grassland ecosystem, the number of grasses (producers) is always high followed by primary consumers (herbivores like rabbits and grasshoppers) that are less, the secondary consumers (carnivores like snakes and lizards) that are lesser and finally the top carnivores, like hawks, which are the least in number.

- In the forest ecosystem, the producers are big trees on the fruits of which birds and other primary herbivores depend. Thus, the number of primary consumers (birds & monkeys) are always greater than the number of producers (big fruit-bearing trees).
- Again the number of secondary consumers (carnivores such as snakes and lizards) are less than primary consumers and obviously the number of top (tertiary) carnivores (lions and tigers) are the least. Thus, the shape of the pyramid looks;



(Pyramid of numbers (forest ecosystem))

② Pyramid of biomass

The individual in each trophic level is weighed instead of being counted. Thus, in a pyramid of biomass the total weight of each trophic level is represented.

For most of the ecosystems on land (for example, forest and grassland), the biomass of producers is large (the base of the pyramid) and it gradually decreases with each successive layer resulting in an upright pyramid.

Carnivore
(Tiger)

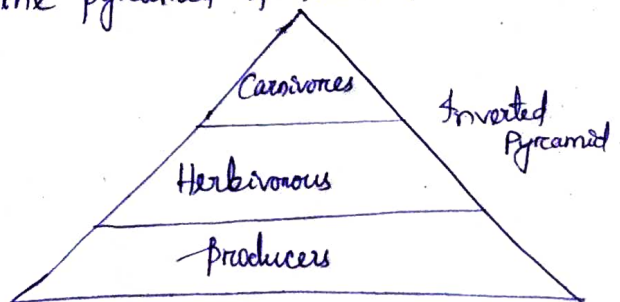
↓
Herbivore
(Deer)

↓
Producers (plant)

(Pyramid of biomass)

- In the case of a pond ecosystem, the producers are tiny phytoplanktons which grow and reproduce rapidly. These phytoplanktons are consumed as fast as they reproduce (only herbivores).

- In this case, the biomass of the consumer at any instant is more than the producer biomass. Thus, in case of a pond or any aquatic ecosystem, the pyramid of biomass has an inverted shape;



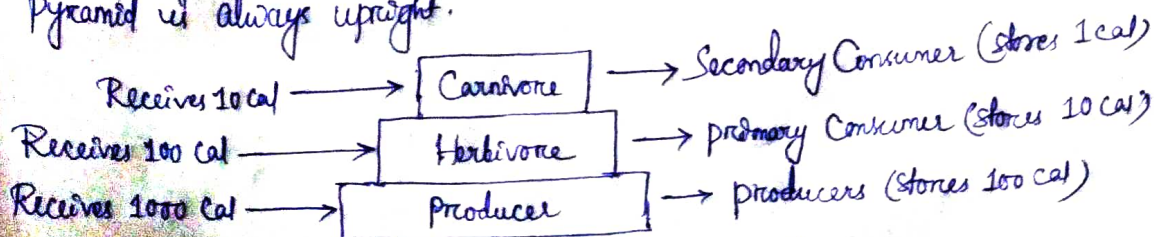
(Pyramid of Biomass of an Aquatic Ecosystem)

③ Pyramid of energy

- The pyramid of energy actually depicts the rate at which the food mass is passed through the food chain.

- It is based on the actual amount of energy that individuals take in, how much is burnt up in the metabolism, how much remains in the waste products and how much they store in the body tissue, this is a reflection of the laws of thermodynamics. Thus, the energy pyramid gives the best picture of the overall nature of the ecosystem.

- The actual amount of energy content in successive trophic levels from the producer to various consumers decreases. Hence, the shape of energy pyramid is always upright.



(Pyramid of energy in an ecosystem)

→ For example, a forest ecosystem receives 1000 calories of sunlight in a day of which about 100 calories are stored in the plant. When any herbivore (primary consumer) such as a deer or a goat eats the plant, it receives 100 calories.

→ But after its expenditure, its own metabolism lets it store 10 calories of energy. Thus, any Carnivore (secondary consumer) eating the above herbivore will receive 10 calories. It can store 1 calorie of energy after its expenditure for metabolism.

Forest and Grassland ecosystem

Types of forest ecosystem

- A forest ecosystem is the one in which a tall & dense trees grow that support many animals and birds.
- The forest as an ecosystem contains interacting biological communities (vegetation) and faunal communities which together interact with the physical environment resulting in an integrated structure. It is always the vegetation which forms the base of the food chain.
- Depending upon the climatic conditions, forests can be classified into the following types;
 - Tropical rain forests
 - Tropical deciduous forests
 - Tropical shrub forests
 - Temperature rain forests
 - Temperature deciduous forests

Features of forest ecosystem

- Forest ecosystem characterized by warm temperature and adequate rainfall, which make the generation of number of ponds, lakes, etc.
- The forest maintains climate and rainfall. The forest support many wild animals and protect biodiversity.
- The soil is rich in organic matter and nutrients, which support the growth of trees. Since the penetration of light is so poor, the conversion of organic matter into nutrient is very fast.

Structure and function of forest ecosystem

Abiotic Component

All inorganic, Organic (litters, debris) substances present in the environment and minerals present in the forest constitute the abiotic components. Mainly the amount of sunlight depend on the stratification condition of the trees.

Biotic Component

The biotic component consists of all living components of the environment which constitute,

- Producers
- Consumers
- Decomposers

Producers →

The vegetation of the forest is the producer. The term vegetation includes big trees, medium sized bush & small herbaceous plants.

- All vegetation contains chlorophyll and performs photosynthesis. The herbaceous vegetation contains maximum green photosynthetic tissues, produces the maximum & being annual, it also decomposes very fast.
- Thus, herbaceous vegetation contributes to the nutrient cycling and boosts the production in forests.

Consumers →

Primary Consumer

Insects like ants, beetles, flies, spiders, birds and other herbivores such as deer, squirrels, shrews, mongooses & elephants graze over the

primary producer and convert it into secondary production.

Thus, herbivores are the links between the primary producer and the Carnivores.

Secondary Consumer

Carnivorous animals such as snakes, birds, foxes and jackal which are the predators of herbivores come under this category.

These animals regulate the population size of herbivores & thereby their grazing activity. In this way, the base of the food chain is maintained.

Tertiary Consumers

These are top carnivores, such as lions, tigers & hawks that feed on secondary consumers. Thus, there exists a complete balance between different groups of animals and plants and the forest ecosystem is naturally conserved.

When there is a loss of this balance (biodiversity), the destruction of the forest begins.

Decomposers →

- These organisms remain confined to the soil of the forest floor and have the capacity to degrade all dead plants, herbivore and carnivore tissue to release nutrients into the soil.
- These nutrients are again used by the producer. A wide variety of microorganisms such as fungi, bacteria, mites, nematodes, protozoa and earthworms are present in the forest soil to perform the role of decomposers.
- The rate of decomposition is more rapid in tropical and subtropical forests than in a temperate one. Thus, decomposers act as scavengers of the forest, have links with all groups of plants and animals and help in recycling the nutrients.

Types of grassland ecosystem

- Grassland occupies about 20% of earth's surface. In addition to grass, some scattered trees and shrubs are also present in grasslands.
- Limited grazing helps to improve the net primary production of the grasslands. But over grazing leads to degradation of these grasslands to desertification.
- Depending upon the climate conditions grassland can be classified into 3 types;

- (1) Tropical grasslands
- (2) Temperate grasslands
- (3) Polar grasslands

Features of grassland ecosystem

- Grassland ecosystem is a plain land occupied by grasses.
- Soil is very rich in nutrients and organic matter.
- Since, it has tall grass, it is ideal place for grazing animals.
- It is characterized by low or uneven rainfall.

Aquatic ecosystem

Types of aquatic ecosystem

About 70 percent of the earth's total surface is under the aquatic ecosystem. An aquatic ecosystem can be freshwater, marine or estuarine ecosystem. Thus, a wide variety of species are found in the aquatic ecosystem.

Fresh water ecosystem

A freshwater ecosystem is of two types;

(1) Lotic ecosystem

(2) Lentic ecosystem

Lotic

Having flowing water. For example, freshwater streams, springs, rivulets, brooks, rivers and so on.

Lentic

Having stagnant or still water, for example, ponds, swamps, bogs and lakes besides others. Lentic water bodies usually start from narrow springs and waterfalls and tend to broaden and become deep and slow moving. Lentic water bodies include ponds, swamps, and lakes. Being a still water system they vary widely in chemical, physical and biological characteristics.

The Components of an aquatic system may be classified into two types;

(1) Abiotic Component

(2) Biotic Component

Abiotic Component → It includes Carbon dioxide, oxygen, calcium, nitrogen, phosphorus, amino acids and water.

Biotic Component → Producers → The autotrophic green plants and some photosynthetic bacteria for the radiant energy with the help of nutrients obtained from the mud of the pond.

Consumers → **Primary Consumers** - Herbivores like 100 plankton and small invertebrates such as Copepods feed on the producers.

Secondary Consumers - Small carnivores like small fishes feed on primary consumers.

Tertiary Consumers - Large fishes that feed on the small fishes are the tertiary consumers.

Decomposers → Finally, bacteria & fungi present at the base of the pond decompose the organisms & help in the release and recycling of nutrients.

Marine (Ocean) ecosystem

→ Three-fourths of the earth's surface is covered by oceans with an average salinity of 35 parts per thousand (ppt). The concentration of nutrients in the marine (ocean) ecosystem is low.

→ However, a marine ecosystem can be divided into littoral, neritic, pelagic and benthic zones.

→ The shoreline between the land & the open sea is termed as littoral zone. Waves & tides have the maximum effect in this zone.

→ Organisms of the pelagic zone are present below the light penetration zone and totally depend on the rain of detritus of upper regions for their nutrition.

→ In deeper water, many animals have poor vision, fishes are bioluminescent some deep water fishes have a light-producing organ.

→ The floor of the ocean constitutes the benthic zone. It stretches from the edge of the continental shelf to the deepest ocean trenches. Organisms present here are heterotrophic.

Estuarine ecosystem

→ Coastal bays, river mouths & tidal marshes form estuaries. Here, fresh water from the rivers mixes with the ocean water.

→ The degree of salinity depends upon the amount of freshwater flow and tidal inflow.

→ Estuaries are more productive than adjacent rivers or oceans due to the high concentration of the nutrients received from land as well as the sea. Rooted plants are supported in shallow water of lesser salinity than the sea.

→ Organisms present in estuaries are those which are capable of tolerating fluctuation in the salinity of water.

→ Estuaries contain producers, such as seaweed, marsh grasses, benthic algae & phytoplanktons. They are also used as nurseries by deep water fishes to bring up their younger ones.

Chapter-4 Biodiversity and its Conservation

Biodiversity

It is defined as the degree of variety in nature with regards/with respect to the biological species. It refers to the variation of life on earth the no. of plants, animals and other organism that exist is known as biodiversity.

What is genetics

It is the study of ~~genes~~ genes variation in living organism

What is species

It is the basic unit of biological classification. It is defined as the largest group of organism where two individuals ~~each~~ are capable of reproducing of off-spring

Type of Biodiversity:



Genetic Biodiversity

① It gives genetic variation with a population in one species

② There are two main reason for the difference betⁿ the individual one is the variations engines and second one is the influence of environment due to combination of both the genetic biodiversity takes place.

Species Biodiversity:

① This refers to the variety of species within a particular region reason. It depends as much on genetic diversity as well as on environmental condition.

② A good climate reason is a better support for species diversity.

Ecosystem Biodiversity

① This is the no. of species in a community of organism maintaining both genetic & species diversity for the proper function of an ecosystem

*) Biological classification in India

① Biological geography is related to ecology & ecosystem of a region in India, the biogeography zone are broadly divided into ~~10~~ ten categories.

① Trans Himalayan zone

② Himalayan zone

③ Desert zone

④ Semiarid zone

⑤ Western ghat zone

⑥ Deccan zone

⑦ Gangetic zone

⑧ Northeast zone

⑨ Coastal zone

~~⑩ Island zone~~

⑩ Island present near shore line.

Need for Conservation

① Continuous increase in population causes an increasing demand for natural resources, the shortage of the resources and the rising cost effects the economic structure of different countries negatively.

② Conservation may be concern with complete care of some near species where there is no alternative at all, in our own interest to conserve our plant animal, there must be a global realization should be needed.

③ Conservation has three specific objectives;

① To maintain essential ecological process & life support system

② To preserve biological diversity.

③ To ensure that any utilisation of species and ecosystem should be limited.

⑫ Conservation of biodiversity is broadly divided into two categories

- ① In situ conservation
- ② Ex situ conservation

In situ conservation

~~Cons~~ This is the conservation of genetic resources through their maintenance within natural or even human ecosystem in which they occur.

⑭ This is an ideal ecosystem for genetic resources conservation therefore this is related to natural conditions.

Ex situ conservation

This conservation outside their habitats by creating simple population in genetic resource centre like zoo, botanical garden.

⑮ In ex situ conservation plants are more readily maintain than animals.

Values of Biodiversity

It has different types of values including;

- ① Consumptive
- ② Productive
- ③ Social
- ④ Ethical
- ⑤ Aesthetic
- ⑥ Option

Consumptive

Developing open assigning to goods such as fuel, wood that are locally consumed and not act national & international level. for example: wood, meat, fruits etc.

Productive

Assigning to the products that are harvested from the wild animal & trees and sold in commercial market both are national & international level. For example: bamboos, grasses, essential oil.

3 Social values

Goods & services provided by the ecosystem to the society includes the social values of biodiversity

- ① Provision of food, fuel, & fiber
- ② Purification of air & water
- ③ Generation of soil fertility including nutrient cycling
- ④ Maintenance of genetic ~~resources~~ resources
- ~~⑤ Maintenance of genetic resources~~
- ⑥ Provision of different types of medicine and herb

4 Aesthetic

Aesthetic word is scientifically defined as the study of sensory and emotional value.

- ⑤ Aesthetic value of biodiversity is the pure enjoyment that offers to human being by the biodiversity being closed to nature gives us enjoyment. Nature gives inspiration for creative work also.
- ⑥ It promotes ecotourism etc. also generates revenue by designing zoological park, botanical garden, national park etc.

5 Ethical values

Ethical or recreational value is also one type of indirect value to the biodiversity.

- ⑦ Ethical value is one of the value which derive from human ethical consideration to the particular biodiversity or ecosystem.

6 Option value

It concern with the value of a species and its potential to provide economic benefit to human society in present or future.

For example:- Medicinal plants which upon get used for finding & developing of new medicines.

BIODIVERSITY AT GLOBAL, NATIONAL, LOCAL LEVEL

Biodiversity is the measure of the variety of earth's animal, plant and microbial species; of genetic differences within species; and of the ecosystems that support the species. Out of an estimated 30 million species on earth, only one-sixth has been identified and authenticated in the past 200 years.

There are at present 1.8 million species known and documented by scientists in the world. However, scientists have estimated that the number of species of plants and animals on earth could vary from 1.5 to 20 billion! Thus the majority of species are yet to be discovered.

Biodiversity is the measure of the variety of earth's animal, plant and microbial species; of genetic differences within species; and of the ecosystems that support the species. Out of an estimated 30 million species on earth, only one-sixth has been identified and authenticated in the past 200 years.

An estimated biodiversity covers 400,000 higher plants. Most of the world's bio-rich nations are in the South, which are the developing nations. In contrast, the majority of the countries capable of exploiting biodiversity are Northern nations, in the economically developed world.

These nations however have low levels of biodiversity. Thus the developed world has come to support the concept that biodiversity must be considered to be a 'global resource'. However, if biodiversity should form a 'common property resource' to be shared by all nations, there is no reason to exclude oil, or uranium, or even intellectual and technological expertise as global assets.

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 insects 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.

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, 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

Due to human population and its impact on ecosystem 1000 of species become ~~exten~~ extinct every year. It is studied that 99% of all species that are existed previously are now extinct.

(1) Habitat Loss

~~(2) Threatening of Wildlife~~

(2) Poaching of Wildlife

(3) Man-wildlife conflict

~~(4) Habitat loss~~

It is due to human activity and other disturbances due to human, this is ~~pa~~ specially true for wildlife with which suffer due to habitat loss & habitat fragmentation.

(i) Habitat loss in installments leads to habitat fragmentation

(ii) Due to pollution & presence of toxic pollutants our fresh water ~~ss~~ resources support from pollution so that aquatic birds, ~~pe~~ fishes, faces different type of diseases which directly affects the food chain.

Dt - 10/01/2024

(2) Poaching of wild life

Poaching is another thread to wild life from early period hunters, ~~threasters~~ are the measure ~~threasters~~ to a no. of species where they collected ~~for~~ ^{to} home, task including herbal products & sale it to different countries for million of dollars.

(i) The cost of this animal part are very high for example:- Bangle tiger part cost for about one lakh dollar where a single orchid flower cost for about 5000 dollar.

(ii) These are some example by which we can understand the situation of threading wild life products, which is a very easy way to make profit.

(iii) It is advisable that do not purchase or ~~by~~ buy the parts and products made from wild animal.

✓ Man-wild life conflict :

(i) This is applicable for both man & wild animal due to habitat loss animals comes out of the forest & destroy the crop land & that is become a huge danger to human-being.

(ii) There are so many cases of conflict between human & wild life & In this case the forest department could not provide any co-operation for the wild life conservation from affected people.

(iii) For example :- Tiger, leopard, chittas & elephant etc
~~Social issues of the environment~~

(iv) Appropriate technology: The technology should use less resources & produce minimum waste. That should be ecofriendly, efficient & locally adopted.

(v) To utilise Resources as per carrying capacity of the environment: If the carrying capacity of a system crosses environmental, degradation will start & continue up to ~~the~~ nonreturn level.

UNIT-5

ENVIRONMENTAL POLLUTION

Definition causes, effects and control measures

AIR POLLUTION

Definition

Air pollution can be defined as the presence of toxic chemicals or compounds (including those of biological origin) in the air, at levels that pose a health risk. In an even broader sense, air pollution means the presence of chemicals or compounds in the air which are usually not present and which lower the quality of the air or cause detrimental changes to the quality of life (such as the damaging of the ozone layer or causing global warming).

Causes

1. The burning of fossil fuels

Sulphur dioxide emitted from the combustion of fossil fuels like coal, petroleum and other factory combustibles are one the major cause of air pollution. Pollution emitting from vehicles including trucks, jeeps, cars, trains, airplanes cause an immense amount of pollution.

2. Agricultural activities

Ammonia is a very common byproduct from agriculture-related activities and is one of the most hazardous gases in the atmosphere. Use of insecticides, pesticides, and fertilizers in agricultural activities has grown quite a lot. They emit harmful chemicals into the air and can also cause water pollution.

3. Exhaust from factories and industries

Manufacturing industries release a large amount of carbon monoxide, hydrocarbons, organic compounds, and chemicals into the air thereby depleting the quality of air. Manufacturing industries can be found at every corner of the earth and there is no area that has not been affected by it. Petroleum refineries also release hydrocarbons and various other chemicals that pollute the air and also cause land pollution.

4. Mining operations

Mining is a process wherein minerals below the earth are extracted using large equipment. During the process dust and chemicals are released in the air causing massive air pollution. This is one of the reasons which is responsible for the deteriorating health conditions of workers and nearby residents.

5. Indoor air pollution

Household cleaning products, painting supplies emit toxic chemicals in the air and cause air pollution. Suspended particulate matter popular by its acronym SPM, is another cause of pollution. Referring to the particles afloat in the air, SPM is usually caused by dust, combustion etc.

Effects

1. Respiratory and heart problems

The effects of air pollution are alarming. They are known to create several respiratory and heart conditions along with Cancer, among other threats to the body. Several million are known to have died due to direct or indirect effects of Air pollution. Children in areas exposed to air pollutants are said to commonly suffer from pneumonia and asthma.

2. Global warming

Another direct effect is the immediate alterations that the world is witnessing due to global warming. With increased temperatures worldwide, increase in sea levels and melting of ice from colder regions and icebergs, displacement and loss of habitat have already signaled an impending disaster if actions for preservation and normalization aren't undertaken soon.

3. Acid rain

Harmful gases like nitrogen oxides and sulphur oxides are released into the atmosphere during the burning of fossil fuels. When it rains, the water droplets combine with these air pollutants, becomes acidic and then falls on the ground in the form of acid rain. Acid rain can cause great damage to human, animals, and crops.

4. Eutrophication

Eutrophication is a condition where a high amount of nitrogen present in some pollutants gets developed on sea's surface and turns itself into algae and adversely affect fish, plants and animal species. The green coloured algae that are present on lakes and ponds is due to the presence of this chemical only.

5. Effect on wildlife

Just like humans, animals also face some devastating effects of air pollution. Toxic chemicals present in the air can force wildlife species to move to a new place and change their habitat. The toxic pollutants deposit over the surface of the water can also affect sea animals.

6. Depletion of the ozone layer

Ozone exists in the Earth's stratosphere and is responsible for protecting humans from harmful ultraviolet (UV) rays. Earth's ozone layer is depleting due to the presence of chlorofluorocarbons, hydrochlorofluorocarbons in the atmosphere. As the ozone layer will go thin, it will emit harmful rays back on earth and can cause skin and eye related problems. UV rays also have the capability to affect crops.

Control measures

1. Use public mode of transportation

Encourage people to use more and more public modes of transportation to reduce pollution. Also, try to make use of carpooling.

2. Conserve energy

Switch off fans and lights when you are going out. A large number of fossil fuels are burnt to produce electricity. You can save the environment from degradation by reducing the number of fossil fuels to be burned. to make use of carpooling.

3. Understand the concept of Reduce, Reuse and Recycle

Do not throw away items that are of no use to you. In-fact reuse them for some other purpose.

4. Emphasis on clean energy resources

Clean energy technologies like solar, wind and geothermal are on high these days. Governments of various countries have been providing grants to consumers who are interested in installing solar panels for their home. This will go a long way to curb air pollution.

5. Use energy efficient devices

CFL lights consume less electricity as against their counterparts. They live longer, consume less electricity, lower electricity bills and also help you to reduce pollution by consuming less energy.

WATER POLLUTION

Definition

Water pollution is the contamination of water bodies (like oceans, seas, lakes, rivers, aquifers, and groundwater) usually caused due to human activities. Water pollution is any change in the physical, chemical or biological properties of water that will have a detrimental consequence of any living organism.

Causes

1. Natural Sources

Naturally occurring substances found in the soils and rocks can be dissolved in water causing contamination. These substances are sulphates, iron, radionuclides, fluorides, manganese, chlorides and arsenic.

2. Septic Systems

Across the world, septic systems are the main cause of pollution of underground water. The pollutants are out flow from privies, septic tanks and the cesspools.

3. Hazardous waste Disposal

Hazardous wastes such as photographic chemicals, motor oil, cooking oil, paint thinners, medicines, swimming pool chemicals, paints, and garden chemicals should not be disposed into septic tanks or directly into the environment as they cause serious contamination.

4. Petroleum Products

Petroleum storage tanks are either located underground or above ground. Also, the transportation of petroleum products is mainly done underground using pipeline. Leakages from this substances can lead to contamination of water.

5. Solid Waste

The chemicals from these substances are leached into the ground water through precipitation and surface run off.

6. Agricultural Chemicals

Excessive use of chemicals can lead to contamination of groundwater. Chemicals such as pesticides are known to remain in the ground for years and when diluted with the rain water they seep deeper into the groundwater.

Effects

1. Health Issues

Contaminated ground water have detrimental effects on health. In areas where septic tanks installation is not set up correctly, the human waste may contaminate the water source. The waste may contain hepatitis causing bacteria that may lead to irreversible damage to the liver.

2. Affects economic growth

Contamination of ground water sources renders the area incapable of sustaining plant, human, and animal life. The population in the area reduces and the land value depreciates. Another effect is that it leads to less stability in industries relying on ground water to produce their goods.

3. Can lead to damaging impacts on the environment such as aquatic systems and the overall ecosystem

Control measures

1. Legislation

There are federal laws in most countries that help in protecting the quality of ground water. Safe Drinking and Clean Water regulations should ensure protection of drinking water by establishing measures for them to meet the health standards.

2. Municipal wastewater treatment

In urban areas of developed countries, municipal wastewater (or sewage) is typically treated by centralized sewage treatment plants. Well-designed and operated systems (i.e., with secondary treatment steps or more advanced treatment) can remove 90 percent or more of the pollutant load in sewage.

3. On-site sanitation and safely managed sanitation

Households or businesses not served by a municipal treatment plant may have an individual septic tank, which pre-treats the wastewater on site and infiltrates it into the soil.

4. Industrial wastewater treatment

Some industrial facilities generate wastewater that is similar to domestic sewage and can be treated by sewage treatment plants. Industries that generate wastewater with high concentrations of organic matter (e.g. oil and grease), toxic pollutants (e.g. heavy metals, volatile organic compounds) or nutrients such as ammonia, need specialized treatment systems.

Industries generating large volumes of wastewater typically operate their own treatment systems. Some industries have been successful at redesigning their manufacturing processes to reduce or eliminate pollutants, through a process called pollution prevention.

5. Agricultural wastewater treatment

SOIL POLLUTION

Definition

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/or the ecosystem. In the case of contaminants which occur naturally in soil, even when their levels are not high enough to pose a risk, soil pollution is still said to occur if the levels of the contaminants in soil exceed the levels that should naturally be present.

Causes

1. Industrial waste

Industries are by far the worst polluters of the soil with all the chemicals they release into the environment be it in liquid or solid form.

2. Deforestation

Clearing of trees leaves soil exposed to the elements so they are easily carried away by soil erosion. This leaves land barren and incapable of supporting vegetation.

3. Excessive use of fertilisers and pesticides

The increased demand for food has forced farmers to use fertilisers and pesticides that release nothing but toxins into the soil, killing useful microorganisms that are important in plant growth.

4. Garbage pollution

Garbage that cannot be recycled is disposed of carelessly and this is not only an eyesore but pollutes the land. Some of this waste can literally take thousands of years to decompose!

5. Acid rain

6. Industrial accidents

7. Nuclear wastes

8. Land fill and illegal dumping

9. Mining and other industries

10. Oil and fuel dumping

11. Disposal of coal ash

12. Electronic waste

Effects

1. Effect on Health of Humans

Crops and plants are grown on polluted soil absorb much of the pollution and then pass these on to us. Long term exposure to such soil can affect the genetic make-up of the body, causing congenital illnesses and chronic health problems that cannot be cured easily. In fact, it can sicken the livestock to a considerable extent and cause food poisoning over a long period of time. The soil pollution can even lead to widespread famines if the plants are unable to grow in it.

2. Effect on Growth of Plants

The ecological balance of any system gets affected due to the widespread contamination of the soil. Most plants are unable to adapt when the chemistry of the soil changes so radically in a short period of time. Fungi and bacteria found in the soil that bind it together begin to decline, which creates an additional problem of soil erosion.

The fertility slowly diminishes, making land unsuitable for agriculture and any local vegetation to survive. The soil pollution causes large tracts of land to become hazardous to health. Unlike deserts, which are suitable for its native vegetation, such land cannot support most forms of life.

3. Decreased Soil Fertility

The toxic chemicals present in the soil can decrease soil fertility and therefore decrease in the soil yield. The contaminated soil is then used to produce fruits and vegetables which lacks quality nutrients and may contain some poisonous substance to cause serious health problems in people consuming them.

4. Toxic Dust

The emission of toxic and foul gases from landfills pollutes the environment and causes serious effects on the health of some people. The unpleasant smell causes inconvenience to other people.

5. Changes in Soil Structure

The death of many soil organisms (e.g. earthworms) in the soil can lead to alteration in soil structure. Apart from that, it could also force other predators to move to other places in search of food.

Control measures

1. Develop necessary legislation on soil pollution control

Although efforts are being put in place to ensure soil pollution control, the process ought to be accelerated by drafting the necessary legislation. The existing registrations such as urban and rural planning, agricultural practices, and land management should be revised and updated to include contemporary soil pollution control and prevention measures.

Legislations on pesticide management, contaminated sites management, and farmland soil management should as well be updated. Furthermore, measures should be put in place to promote continuous improvement of soil pollution control standards.

2. Proper management of agricultural land and the practice of organic farming

Poor utilization of land is a major concern in the prevention and control of soil pollution. Agricultural land pollution usually causes the loss of soil fertility as it involves the loss of organic matter, topsoil and nutrients, and the soil's ability to retain water. In agricultural land management, ideal soil conservation methods include mechanical and biological control techniques.

The biological method refers to forestry and crop-related soil management. The crop related control measures include crop rotation, strip cropping, planting along the contours, protector belt, crop residues, and use of organic composts. Forests also play an important role in preventing soil erosion.

3. Proper Solid Waste Treatment

It is important to dispose of solid waste properly by treated it before it's released into the environment. Acidic and alkaline waste, for example, can be neutralized before they are disposed of to avoid soil contamination. Biodegradable waste should also be broken down in a controlled environment before it is released into the environment. A great example is the proper treatment of sewage sludge.

4 Transfer treatment and remediation costs to polluting companies

The government should make an effort to improve the quality of soil through pollution treatment and remediation. To ensure the sustainability of the project, the individuals and companies that pollute the soil should be held responsible for the treatment and remediation costs.

To ensure consistency, the government should formulate treatment and remediation plans as well as identify responsible entities, identify key tasks, and develop projects database for easy management.

5. Embrace technological research and development

To ensure sustainability in the prevention and control of soil pollution, research on soil pollution prevention and control should be advanced by strengthening technological research. The government should integrate the resources from various research institutions and universities to support relevant research on soil environmental capacity and ecological effects of soil contamination among other possibilities.

6. Proper hygienic condition

People should be trained regarding sanitary habits.

7. Public awareness

Informal and formal public awareness programs should be imparted to educate people on health hazards by environmental education.

8. Recycling and Reuse of wastes

To minimize soil pollution, the wastes such as paper, plastics, metals, glasses, organics, petroleum products and industrial effluents etc should be recycled and reused.

9. Ban on Toxic chemicals

Ban should be imposed on chemicals and pesticides like DDT, BHC, etc which are fatal to plants and animals. Nuclear explosions and improper disposal of radioactive wastes should be banned.

MARINE POLLUTION

Definition

Marine pollution refers to direct or indirect introduction by humans of substances or energy into the marine environment (including estuaries), resulting in harm to living resources, hazards to human health, hindrances to marine activities including fishing, impairment of the quality of sea water and reduction of amenities.

Causes

1. Direct discharge

Pollutants enter rivers and the sea directly from urban sewerage and industrial waste discharges, sometimes in the form of hazardous and toxic wastes, or in the form of plastics.

2. Land runoff

Surface runoff from farming, as well as urban runoff and runoff from the construction of roads, buildings, ports, channels, and harbours, can carry soil and particles laden with carbon, nitrogen, phosphorus, and minerals. This nutrient-rich water can cause fleshy algae and phytoplankton to thrive in coastal areas; known as algal blooms, which have the potential to create hypoxic conditions by using all available oxygen.

3. Ship pollution

Ships can pollute waterways and oceans in many ways. Oil spills can have devastating effects. While being toxic to marine life, polycyclic aromatic hydrocarbons (PAHs), found in crude oil, are very difficult to clean up, and last for years in the sediment and marine environment. Discharge of cargo residues from bulk carriers can pollute ports, waterways, and oceans.

4. Atmospheric pollution

Another pathway of pollution occurs through the atmosphere. Wind-blown dust and debris, including plastic bags, are blown seaward from landfills and other areas.

5. Deep sea mining

Deep sea mining is a relatively new mineral retrieval process that takes place on the ocean floor. Ocean mining sites are usually around large areas of polymetallic nodules or active and extinct hydrothermal vents at about 1,400 – 3,700 meters below the ocean's surface. The vents create sulphide deposits, which contain precious metals such as silver, gold, copper, manganese, cobalt, and zinc. The deposits are mined using either hydraulic pumps or bucket systems that take ore to the surface to be processed. As with all mining operations, deep sea mining raises questions about environmental damages to the surrounding area.

Effects

1. Effect of Toxic Wastes on Marine Animals

The oil spill is dangerous to marine life in several ways. The oil spilled in the ocean could get on to the gills and feathers of marine animals, which makes it difficult for them to move or fly properly or feed their children. The long term effect on marine life can include cancer, failure in the reproductive system, behavioural changes, and even death.

2. Disruption to the Cycle of Coral Reefs

Oil spill floats on the surface of the water and prevents sunlight from reaching to marine plants and affects the process of photosynthesis. Skin irritation, eye irritation, lung and liver problems can impact marine life over a long period of time.

3. Depletes Oxygen Content in Water

Most of the debris in the ocean does not decompose and remain in the ocean for years. It uses oxygen as it degrades. As a result of this, oxygen levels go down. When oxygen levels go down, the chances of survival of marine animals like whales, turtles, sharks, dolphins, penguins for a long time also goes down.

4. Failure in the Reproductive System of Sea Animals

Industrial and agricultural wastes include various poisonous chemicals that are considered hazardous for marine life. Chemicals from pesticides can accumulate in the fatty tissue of animals, leading to failure in their reproductive system.

5. Effect on Food Chain

Chemicals used in industries and agriculture get washed into the rivers and from there are carried into the oceans. These chemicals do not get dissolved and sink at the bottom of the ocean. Small animals ingest these chemicals and are later eaten by large animals, which then affects the whole food chain.

6. Affects Human Health

Animals from impacted food chain are then eaten by humans which affects their health as toxins from these contaminated animals get deposited in the tissues of people and can lead to cancer, birth defects or long term health problems.

Control measures

1. Ban single use plastic and adopt litter control policies
2. Reduce or recycle plastic
3. Diminish discharge of untreated sewage
4. Control chemical and industrial pollution
5. Increase funding for marine pollution prevention and control
6. Strengthen laws on marine litter
7. Integrate prevention and control policies into national policy
8. Raise public awareness
9. Establish partnerships to address marine pollution

NOISE POLLUTION

Definition

unwanted or excessive sound that can have deleterious effects on human health and environmental quality. Noise pollution is commonly generated inside many industrial facilities and some other workplaces, but it also comes from highway, railway, and airplane traffic and from outdoor construction activities.

Causes

1. Industrialization

Most of the industries use big machines which are capable of producing a large amount of noise. Apart from that, various equipment like compressors, generators, exhaust fans, grinding mills also participates in producing big noise.

2. Poor Urban Planning

In most of the developing countries, poor urban planning also plays a vital role. Congested houses, large families sharing small space, fight over parking, frequent fights over basic amenities leads to noise pollution which may disrupt the environment of society.

3. Social Events

Noise is at its peak in most of the social events. Whether it is marriage, parties, pub, disc or place of worship, people normally flout rules set by the local administration and create nuisance in the area.

4. Transportation

A large number of vehicles on roads, airplanes flying over houses, underground trains produce heavy noise and people get it difficult to get accustomed to that. The high noise leads to a situation wherein a normal person loses the ability to hear properly.

5. Construction Activities

6. Household Chores

We people are surrounded by gadgets and use them extensively in our daily life. Gadgets like TV, mobile, mixer grinder, pressure cooker, vacuum cleaners, washing machine and dryer, cooler, air conditioners are minor contributors to the amount of noise that is produced but it affects the quality of life of neighbourhood in a bad way.

Effects

1. Hearing Problems

Any unwanted sound that our ears have not been built to filter can cause problems within the body. Our ears can take in a certain range of sounds without getting damaged. Man-made noises such as jackhammers, horns, machinery, airplanes and even vehicles can be too loud for our hearing range. Constant exposure to loud levels of noise can easily result in the damage of our eardrums and loss of hearing. It also reduces our sensitivity to sounds that our ears pick up unconsciously to regulate our body's rhythm.

2. Health Issues

Excessive noise pollution in working areas such as offices, construction sites, bars and even in our homes can influence psychological health. Studies show that the occurrence of aggressive behaviour, disturbance of sleep, constant stress, fatigue, and hypertension can be linked to excessive noise levels. These, in turn, can cause more severe and chronic health issues later in life.

3. Sleeping Disorders

Loud noise can certainly hamper your sleeping pattern and may lead to irritation and uncomfortable situations. Without a good night sleep, it may lead to problems related to fatigue.

4. Cardiovascular Issues

Blood pressure levels, cardiovascular disease, and stress-related heart problems are on the rise. Studies suggest that high-intensity noise causes high blood pressure and increases heartbeat rate as it disrupts the normal blood flow.

5. Trouble Communicating

High decibel noise can put trouble and may not allow two people to communicate freely. This may lead to misunderstanding and you may get difficult understanding the other person. Constant sharp noise can give you a severe headache and disturb your emotional balance.

6. Effect on Wildlife

Wildlife faces far more problems than humans because of noise pollution since they are more dependent on sound. Animals develop a better sense of hearing than us since their survival depends on it. They become disoriented more easily and face many behavioural problems. In nature, animals may suffer from hearing loss, which makes them easy prey and leads to dwindling populations. Others become inefficient at hunting, disturbing the balance of the eco-system.

Control measures

1. Turn off Appliances at Home and offices
2. Shut the Door when using noisy Machines
3. Use Earplugs
4. Lower the volume
5. Follow the Limits of Noise level
6. planting trees
7. Use Noise absorbents in noisy machineries
8. Use Proper Lubrication and Better maintenance
9. Notify Authorities about Disobedience of Noise Rules

THERMAL POLLUTION

Definition

Thermal pollution is defined as sudden increase or decrease in temperature of a natural body of water which may be ocean, lake, river or pond by human influence. This normally occurs when a plant or facility takes in water from a natural resource and puts it back with an altered temperature. which changes the oxygen levels and can have disastrous effects on local ecosystems and communities.

Causes

1. Water as Cooling Agent in Power, Manufacturing and Industrial plants

Production and Manufacturing plants are biggest source of thermal pollution. These plants draw water from nearby source to keep machines cool and then release back to the source with higher temperature. When heated water returns to the river or ocean, the water temperature rises sharply. When oxygen levels are altered in the water, this can also degrade the quality and longevity of life in wildlife that lives underwater. This process can also wipe away streamside vegetation, which constantly depends on constant levels of oxygen and temperature. By altering these natural environments, industries are essentially helping decrease the quality of life for these marines based life forms and can ultimately destroy habitats if they are not controlled and careful about their practices.

2. Soil Erosion

Soil erosion is another major factor that causes thermal pollution. Consistent soil erosion causes water bodies to rise, making them more exposed to sunlight. The high temperature could prove fatal for aquatic biomes as it may give rise to anaerobic conditions.

3. Deforestation

Trees and plants prevent sunlight from falling directly on lakes, ponds or rivers. When deforestation takes place, these water bodies are directly exposed to sunlight, thus absorbing more heat and raising its temperature.

4. Domestic Sewage

5. Natural Causes

Natural causes like volcanoes and geothermal activity under the oceans and seas can trigger warm lava to raise the temperature of water bodies. Lightening can also introduce massive amount of heat into the oceans.

Effects

1. Decrease in DO (Dissolved Oxygen) Levels

The warm temperature reduces the levels of DO (Dissolved Oxygen) in water. The warm water holds relatively less oxygen than cold water. The decrease in DO can create suffocation for plants and animals such as fish, amphibians and copepods, which may give rise to anaerobic conditions. Warmer water allows algae to flourish on surface of water and over the long term growing algae can decrease oxygen levels in the water.

2. Increase in Toxins

With the constant flow of high temperature discharge from industries, there is a huge increase in toxins that are being regurgitated into the natural body of water. These toxins may contain chemicals or radiation that may have harsh impact on the local ecology and make them susceptible to various diseases.

3. Loss of Biodiversity

A dent in the biological activity in the water may cause significant loss of biodiversity. Changes in the environment may cause certain species of organisms to shift their base to some other place while their could be significant number of species that may shift in because of warmer waters.

4. Ecological Impact

A sudden thermal shock can result in mass killings of fish, insects, plants or amphibians.

5. Affects Reproductive Systems

A significant halt in the reproduction of marine wildlife (although this may be true, reproduction can still occur between fish – but the likelihood of defects in newborns is significantly higher) can happen due to increasing temperatures as reproduction can happen within a certain range of temperature. Excessive temperature can cause the release of immature eggs or can prevent normal development of certain eggs.

6. Increases Metabolic Rate

Thermal pollution increases the metabolic rate of organisms as increasing enzyme activity occurs that causes organisms to consume more food than what is normally required, if their environment were not changed. It disrupts the stability of food chain and alters the balance of species composition.

7. Migration

The warm water can also cause particular species of organisms to migrate to a suitable environment that would cater to its requirements for survival. This can result in loss for those species that depend on them for their daily food as their food chain is interrupted.

Control measures

1. Cooling Ponds

Cooling ponds or reservoirs constitute the simplest method of controlling thermal discharges. Heated effluents on the surface of water in cooling ponds maximize dissipation of heat to the atmosphere and minimize the water area and volume. This is the simplest and cheapest method which cools the water to a considerable low temperature. However, the technique alone is less desirable and inefficient in terms of air-water contact.

2. Cooling Towers:

Using water from water sources for cooling purposes, with subsequent return to the water body after passing through the condenser is termed as cooling process. In order to make the cooling process more effective, cooling towers are designed to control the temperature of water. In fact, cooling towers are used to dissipate the recovered waste heat so as to eliminate the problems of thermal pollution.

3. Artificial Lake

Artificial lakes are man-made bodies of water which offer a possible alternative to once-through cooling. The heated effluents may be discharged into the lake at one end and the water for cooling purposes may be withdrawn from the other end. The heat is eventually dissipated through evaporation.

4. Industrial treated water can be recycled for domestic use or industrial heating.

NUCLEAR POLLUTION

Definition

Radioactive pollution occurs when there is presence or depositions of radioactive materials in the atmosphere or environment, especially where their presence is accidental and when it presents an environmental threat due to radioactive decay. The destruction caused by the radioactive materials is because of the emissions of hazardous ionizing radiation (radioactive decay) like beta or alpha particles, gamma rays or neutrons in the environment where they exist.

Since the substances are characterized by radiation – because there is a lot of instability of the particles present in the radioactive materials, it can seriously affect, alter and even destroy plant, animal, and human life. The extent of damage or danger posed to the environment depends upon the radioactive material concentration, the energy emitted by the radiation, proximity of the radioactive materials to those exposed, and the radiation type.

Causes

1. Nuclear accidents from nuclear energy generation plants

In the postmodern world, various forms of energy are being discovered. Among them is nuclear energy, which is touted to be the most potent source of energy due to its high latent power. Reports indicate that the high latent power is due to its high level of radiation.

Its use is, therefore, prohibited but research is underway to determine its environmental safety and to put in place the most appropriate precautionary measures for its use.

2. The use of nuclear weapons as weapons of mass destruction (WMD)

The use of nuclear missiles and atomic bombs, a form of nuclear energy, in the Second World War not only explains cause but also the damaging nature. The effects of those two strikes in Hiroshima and Nagasaki that prompted the end of the war in 1945 have been seen to date with children born with complications such as mental retardation as well as conditions such as autism and other disorders. The number of cancer cases present in the two towns is more than those of the rest of Japan.

3. Use of radio isotopes

Radio isotopes are used to make detectors and in other industrial activities.

4. Mining

Mining mostly involves the excavation of the mineral ores which are then broken into smaller manageable pieces. Radium and Uranium, for instance, are naturally occurring in the environment and are equally radioactive. Hence, mining increases the natural geological processes by moving these materials from underneath the earth to the surface. Other minerals with a hint of radiation are thorium, plutonium, radon, potassium, carbon and phosphorus.

5. Spillage of radioactive chemicals

There have been instances of spillages over oceans when ships hit glaciers or coral reefs and end up releasing chemicals on waterways and in the atmosphere. The majority of these chemicals including petroleum products have a significant level of radiation which can be detrimental to the environment.

6. Tests on radiation

Radiation has been seen to have a lot of interesting properties which has promoted a lot of scientists to conduct tests to learn more about it. It is one of the key elements in the cure and treatment of cancer.

Chemotherapy, a cancer curative health initiative uses radiation to prevent further growth of the cancer cells as well as keep the immune system strong. Despite this, scientists have been exposed to radiation leading to their deaths or to complications.

7. Cosmic rays

These come from outer space to our planet with intense radiation as their nature, therefore, causing radioactive pollution. Gamma rays, for example, are said to have the highest level of radiation and yet, depending on their intensity, some are not visible to the human eye.

Effects

1. Genetic mutations

Radiation has adverse effects when it comes to genetics. It leads to damage of DNA strands leading to genetic break up in the course of time. The degree of genetic mutation leading to changes in DNA composition vary due to the level of radiation one has been exposed to and the kind of exposure.

In the event that a human or an animal is exposed to too much radiation from the atmosphere, food consumed and even water used then chances are that their bodies have already absorbed the radiation. Once in the body, it remains active because energy cannot be destroyed.

The resulting mutation makes one highly susceptible to cancer. For pregnant women, kids born have adverse defects caused by genetic mutations like low weight during birth. Effects such as disfigured births and impairment like blindness in children have also been reported. Infertility has also been mentioned as an effect of radiation.

2. Diseases

Cancer is the most dominant radiation related disease. It has developed over the years and poses great risk in global health. Others include leukemia, anemia, hemorrhage, a reduction in the life span leading to premature aging and premature deaths as well as others such as cardiovascular complications. Leukemia, for instance, is caused by radiation in the bone marrow.

3. Soil infertility

Exposure of radiation to the atmosphere means it is present even in soils. Radioactive substances in the soil react together with the various nutrients leading to destruction of those nutrients, thus rendering the soil infertile and highly toxic. Such soil leads to the harvest of crops that are riddled with radiation and thus, unfit for consumption by both humans and animals.

4. Cell destruction

Radioactive pollution has diverse effects such as the alteration of cells. The bodies of living organisms are unique in that there are millions of cells in one single body, where each has its purpose to fulfill. Radiation distorts the cells present leading to permanent damage of the various organs and organ systems. In the face of too much radiation, permanent illnesses and death are inevitable.

5. Burns

Radiation is not easy to feel but it is easy to realize that you have been affected by it. The immediate presence of burns, red lesions and sores is evidence. To make it worse, this can lead to skin cancer.

Control measures

1. Proper method of disposing radioactive waste

Radioactive waste still has some level of radiation. Accordingly, it cannot be disposed in the same way as normal waste. It cannot be incinerated or buried. Since there is likelihood of seepage, this waste should be stored in heavy and thick concrete containers. Another option is to dilute the radiation since storage may not be possible. Since there are no easy ways of disposing of radioactive material, professional assistance should always be sought.

2. Proper labeling

It is necessary for any material with radioactive content to be labeled and the necessary precautions advised on the content of the label. The reason for this is because radiation can enter the body by a mere touch of radioactive material. Containers with such elements should be well labeled in order for one to use protective gear when handling them.

3. Banning of nuclear tests

It has already been proven that nuclear power has a lot of latent power that is very destructive. Tests though done in the deserts end up escaping from one ecosystem to another eventually affecting the lives of many people.

4. Alternative energy sources

The evolution and use of nuclear power was not a bad thing initially. However, considering the damage and threats it has on the environment, it is high time for its use to be discontinued and for the world to perhaps focus on alternative and environmentally friendly energy sources – like renewable sources of energy namely Solar, hydro-electric and wind power.

5. Proper storage

It is mandatory for containers carrying radioactive material to be stored properly. For starters, such substances should be stored in radiation proof containers to ensure no seeping or leakage during handling. Proper storage means no harm and can minimize cases of accidental leakage.

6. Reusing

Since it is not easy to store or dispose the waste, it can be recycled and used for other purposes like in another reactor as fuel thereby protecting the environment.

SOLID WASTE MANAGEMENT

Solid-waste management, the collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful. Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and to outbreaks of vector-borne disease—that is, diseases spread by rodents and insects. The tasks of solid-waste management present complex technical challenges. They also pose a wide variety of administrative, economic, and social problems that must be managed and solved.

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Causes of urban and industrial waste

1. Residential

Residences and homes where people live are some of the major sources of solid waste. Garbage from these places include food wastes, plastics, paper, glass, leather, cardboard, metals, yard wastes, ashes and special wastes like bulky household items like electronics, tires, batteries, old mattresses and used oil. Most homes have garbage bins where they can throw away their solid wastes in and later the bin is emptied by a garbage collecting firm or person for treatment.

2. Industrial

Industries are known to be one of the biggest contributors of solid waste. They include light and heavy manufacturing industries, construction sites, fabrication plants, canning plants, power and chemical plants. These industries produce solid waste in form of housekeeping wastes, food wastes, packaging wastes, ashes, construction and demolition materials, special wastes, medical wastes as well as other hazardous wastes.

3. Commercial

Commercial facilities and buildings are yet another source of solid waste today. Commercial buildings and facilities in this case refer to hotels, markets, restaurants, go downs, stores and office buildings. Some of the solid wastes generated from these places include plastics, food wastes, metals, paper, glass, wood, cardboard materials, special wastes and other hazardous wastes.

4. Institutional

The institutional centers like schools, colleges, prisons, military barracks and other government centers also produce solid waste. Some of the common solid wastes obtained from these places include glass, rubber waste, plastics, food wastes, wood, paper, metals, cardboard materials, electronics as well as various hazardous wastes.

5. Construction and Demolition Areas

Construction sites and demolition sites also contribute to the solid waste problem. Construction sites include new construction sites for buildings and roads, road repair sites, building renovation sites and building demolition sites. Some of the solid wastes produced in these places include steel materials, concrete, wood, plastics, rubber, copper wires, dirt and glass.

6. Municipal services

The urban centers also contribute immensely to the solid waste crisis in most countries today. Some of the solid waste brought about by the municipal services include, street cleaning, wastes from parks and beaches, wastewater treatment plants, landscaping wastes and wastes from recreational areas including sludge.

7. Treatment Plants and Sites

Heavy and light manufacturing plants also produce solid waste. They include refineries, power plants, processing plants, mineral extraction plants and chemicals plants. Among the wastes produced by these plants include, industrial process wastes, unwanted specification products, plastics, metal parts just to mention but a few.

8. Agriculture

Crop farms, orchards, dairies, vineyards and feedlots are also sources of solid wastes. Among the wastes they produce include agricultural wastes, spoiled food, pesticide containers and other hazardous materials.

9. Biomedical

This refers to hospitals and biomedical equipment and chemical manufacturing firms. In hospitals there are different types of solid wastes produced. Some of these solid wastes include syringes, bandages, used gloves, drugs, paper, plastics, food wastes and chemicals. All these require proper disposal or else they will cause a huge problem to the environment and the people in these facilities.

Effects

1. Due to improper waste disposal systems particularly by municipal waste management teams, wastes heap up and become a problem. People clean their homes and places of work and litter their surroundings which affects the environment and the community.

This type of dumping of waste materials forces biodegradable materials to rot and decompose under improper, unhygienic and uncontrolled conditions. After a few days of decomposition, a foul smell is produced and it becomes a breeding ground for different types of disease causing insects as well as infectious organisms. On top of that, it also spoils the aesthetic value of the area.

2. Solid wastes from industries are a source of toxic metals, hazardous wastes, and chemicals. When released to the environment, the solid wastes can cause biological and physicochemical problems to the environment and may affect or alter the productivity of the soils in that particular area.

3. Toxic materials and chemicals may seep into the soil and pollute the ground water. During the process of collecting solid waste, the hazardous wastes usually mix with ordinary garbage and other flammable wastes making the disposal process even harder and risky.

4. When hazardous wastes like pesticides, batteries containing lead, mercury or zinc, cleaning solvents, radioactive materials, e-waste and plastics are mixed up with paper and other scraps are burned they produce dioxins and gasses. These toxic gases have a potential of causing various diseases including cancer.

5. When trash and garbage are put into an enormous pile, they begin to rot. This rotting creates methane, a greenhouse gas that is many times more potent than carbon dioxide. Methane exits the landfill and floats up into the atmosphere, contributing to global warming.
6. The effect of human waste on the oceans is becoming more widely known since wide publicity has been given to the "garbage patch" in the Pacific Ocean, an area larger than the continental United States that is overrun with plastic trash. This is only the most dramatic example of the threat to oceans that is posed by human waste.
7. Everyone wants to stay and live in a healthy, clean, fresh, and sanitary place. A city with poor waste management will certainly not attract tourists or investors. Landfill facilities that are mismanaged can cause the local economy to sink, which can then affect the livelihood of the locals.
8. There is revenue in recycling. Cities that do not implement proper removal and recycling of wastes miss on this. They also miss out on the resources that can be reused and on the employment opportunities that a recycling centre brings.
9. Decomposing waste emits gases that rise to the atmosphere and trap heat. Greenhouse gases are one of the major culprits behind the extreme weather changes that the world is experiencing. From extremely strong storms and typhoons to smouldering heat, people are experiencing and suffering the negative effects of greenhouse gases.
10. It is slowly killing the planet.
11. Soil contamination
12. Air contamination

Control measures

1. Sanitary Landfill

This is the most popular solid waste disposal method used today. Garbage is basically spread out in thin layers, compressed and covered with soil or plastic foam. Modern landfills are designed in such a way that the bottom of the landfill is covered with an impervious liner which is usually made of several layers of thick plastic and sand. This liner protects the ground water from being contaminated because of leaching or percolation. When the landfill is full, it is covered with layers of sand, clay, top soil and gravel to prevent seepage of water.

2. Incineration

This method involves burning of solid wastes at high temperatures until the wastes are turned into ashes. Incinerators are made in such a way that they do not give off extreme amounts of heat when burning solid wastes. This method of solid waste management can be done by individuals,

municipalities and even institutions. The good thing about this method is the fact that it reduces the volume of waste up to 20 or 30% of the original volume.

3. Recovery and Recycling

Recycling or recovery of resources is the process of taking useful but discarded items for next use. Traditionally, these items are processed and cleaned before they are recycled. The process aims at reducing energy loss, consumption of new material and reduction of landfills.

4. Composting

Due to lack of adequate space for landfills, biodegradable yard waste is allowed to decompose in a medium designed for the purpose. Only biodegradable waste materials are used in composting. Good quality environmentally friendly manure is formed from the compost and can be used for agricultural purposes.

5. Pyrolysis

This is method of solid waste management whereby solid wastes are chemically decomposed by heat without presence of oxygen. This usually occurs under pressure and at temperatures of up to 430 degrees Celsius. The solid wastes are changed into gasses, solid residue and small quantities of liquid.

ROLE OF AN INDIVIDUAL IN PREVENTION POLLUTION

1. 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.
2. Individuals should prefer walking or use cycles instead of using motor vehicles, especially when distances to be travelled are small.
3. Individuals can make considerable contribution by using mass transport (buses, trains, etc) instead of using personal vehicles.
4. When going to workplace, colleagues from nearby localities should pool vehicles instead of going in individual personal vehicles.
5. Taking personal vehicles for periodic pollution checks at centres approved by authorities.
6. Individuals should reuse items whenever possible.
7. Products that are made of recycled material should be given preference.
8. Use gunny bags made of jute instead of plastic bags.

9. Take part in environment conservation drives such as tree planting drives.
10. Use water resources efficiently.
11. Use renewable resources by installing equipment such as solar heaters and using solar cookers.
12. Dispose potentially harmful products such as cells, batteries, pesticide containers, etc properly.
13. Use of refrigerators should be minimised wherever possible as they are main source of CFC, which is responsible for Ozone layer depletion.
14. Follow and promote family planning, as more population means more resources utilized and more resources utilized imply more pollution.
15. Avoid making noise producing activities such as listening to loud music.
16. Use handkerchiefs instead of paper tissues.
17. Organize drives to clean streets and clean drains with help of other people of locality.
18. 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

FLOODS

Floods are the most common and widespread of all natural disasters. India is one of the highly flood prone countries in the world. Around 40 million hectares of land in India is prone to floods as per National Flood Commission report. Floods cause damage to houses, industries, public utilities and property resulting in huge economic losses, apart from loss of lives. Though it is not possible to control the flood disaster totally, by adopting suitable structural and non-structural measures the flood damages can be minimised. For planning any flood management measure latest, reliable, accurate and timely information is required. In this context satellite remote sensing plays an important role.

Rescue & Evacuation

Evacuation is a pre-emptive move to protect life and property, where as rescue is a post-disaster phenomenon of helping people to move from areas that have been hit by disaster to a safer place. However, the situation of evacuation and rescue comes along with numerous unanswered queries in mind. Very often, due to lack of information or in haste, living during evacuation and rescue becomes difficult and painful. However, during such the situations, following precautionary norms should be kept in mind.

Preparing for a Flood

Here are some basic steps to take to prepare for the flood:

1. Contact the local geologist or town planning department or meteorology department to find out if your home is located in a flash-flood-prone area or landslide-prone area.
2. Learn about your community's emergency plans, warning signals, evacuation routes, and locations of emergency shelters.
3. Plan and practice a flood evacuation route with your family. Ask an out-of-state relative or friend to be the "family contact" in case your family is separated during a flood. Make sure everyone in your family knows the name, address, and phone number of this contact person.
4. Post emergency phone numbers at every phone.
5. Inform local authorities about any special needs, i.e., elderly or bedridden people, or anyone with a disability.
6. Identify potential home hazards and know how to secure or protect them before the flood strikes. Be prepared to turn off electrical power when there is standing water, fallen power lines etc. Turn off gas and water supplies before you evacuate. Secure structurally unstable building materials.
7. Buy a fire extinguisher and make sure your family knows where it is and how to use it.
8. Buy and install sump pumps with back-up power.
9. Have a licensed electrician to raise electric components (switches, sockets, circuit breakers and wiring) at least 12" above your home's projected flood elevation.
10. For drains, toilets, and other sewer connections, install backflow valves or plugs to prevent floodwaters from entering.

If you are under a flood watch or warning:

1. Gather the emergency supplies you previously stocked in your home and stay tuned to local radio or television station for updates.
2. Turn off all utilities at the main power switch and close the main gas valve if evacuation appears necessary.
3. Have your immunization records handy or be aware of your last tetanus shot, in case you should receive a puncture wound or a wound becomes contaminated during or after the flood.
4. Fill bathtubs, sinks and plastic soda bottles with clean water. Sanitize the sinks and tubs first by using bleach. Rinse and fill with clean water.
5. Bring outdoor possessions, such as lawn furniture, grills and trash cans inside or tie them down securely.

Preparing to Evacuate

Expect the need to evacuate and prepare for it. When a flood watch is issued, you should:

1. Fill your vehicle's gas tank and make sure the emergency kit for your car is ready.

2. If no vehicle is available, make arrangements with friends or family for transportation.
3. Fill your clean water containers.
4. Review your emergency plans and supplies, checking to see if any items are missing.
5. Tune in the radio or television for weather updates.
6. Listen for disaster sirens and warning signals.
7. Put livestock and family pets in a safe area. Due to food and sanitation requirements, emergency shelters cannot accept animals.

If You Are Ordered to Evacuate

1. Take only essential items with you.
2. If you have time, turn off the gas, electricity, and water.
3. Disconnect appliances to prevent electrical shock when power is restored.
5. Follow the designated evacuation routes and expect heavy traffic.
6. Do not attempt to drive or walk across creeks or flooded roads.

EARTH QUAKE

An earthquake is a sudden tremor or movement of the earth's crust, which usually originates at or below the surface. The outer layer of the earth is solid and is divided into many sections known as plates. The point of origin of the earthquake within the crust or mantle is called the seismic focus.

PROTECTION AGAINST EARTHQUAKES

1. The information about earthquakes and their intensity should be shared with the public through radio, television and newspapers
2. Construction of buildings based on earthquake-resistant techniques .
3. Construct buildings over pillars made of concrete and iron that are built deep in the ground
4. Water, ration, first-aid kits, radios, flash lights, battery, blankets, jackets and fire extinguishers should be stored in safe places.
5. If inside a building or a house, take cover under a solid surface like a table, or stand in the doorway
6. If one is outside, move to an open space away from trees, electric poles and buildings .
7. Switch off the gas and electric supply in the house during a quake and do not use elevators .
8. After the quake is over, the affected people should be given immediate medical help .

9. Transport and communication facilities should be restored as soon as possible .

CYCLONE

CYCLONES are atmospheric disturbances and are formed around a low-pressure area.

Mitigation and Management

1. Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters.
2. Main aim of the mitigation process is to save lives, reduce economic disruption, decrease vulnerability.
3. Understanding the way that people are killed and injured in a particular disaster is a best way for reducing casualties.
4. Creating awareness of risk is the main role in Mitigation process. Mitigation also helps in the protection of the economy from disasters.
5. Mobilisation of vehicles for evacuation.
6. Setting up emergency shelter.
7. Search and rescue operation.
8. Establishing communication with cut-off villages and moving population to the safe areas.
9. Medical assistance such as setting up camps.
- 10 Arrangements of short term food and water.
11. Improvements of damaged infrastructures such as roads, bridges.
12. Re-establishment of electricity, communication networks and contact with remote areas.
13. Clearance of discarded materials.
14. Choosing an agency for disposal of dead.

LANDSLIDES

A landslide is the rapid mass movement of soil, mud and/or rocks downhill due to the pull of gravity. Landslides are very common and occur in a variety of forms. Land may topple off in a big chunk, or slip down in bits. Landslide may be composed of mud or may contain rocks and other debris. Most landslides occur gradually, but some may be sudden.

Before a Landslide:

1. A ground assessment should be done of your property. When this is done you would know the kind of soil type that your property is built on, and would be able to determine how susceptible it would be to ground movements and if landslides are a possibility.
2. Find out whether the area in which you live is prone to landslides. Landslides usually occur in the same areas, so if a landslide has occurred in your area it would mean that the chances of another landslide occurring in the future are high.
3. If you live in a high risk area an evacuation plan should be prepared.
4. Plant trees and other types of vegetation that would help to stabilize soil on the slopes of your property.

During a landslide:

1. If you are inside of a building, stay inside; don't leave your home until it is officially safe to do so.
2. If outdoors, try to get to the nearest high ground in the direction away from the path of the landslide.
3. If you are at a river, be prepared to leave the area immediately if there are signs that a landslide has occurred higher upstream. Don't try to take your belongings, just leave the area as fast as possible.
4. If driving, remain alert and look out for collapsed pavements, mud and fallen rocks.

After a Landslide

1. Don't go into or return to an area that just experienced a landslide since there may be additional landslides. Only return to the area once it is officially safe to do so.
2. Flooding may occur after a landslide since they might be caused by the same factors.
3. Provide assistance to neighbours and to any special needs individuals such as children and to the elderly.
4. Check your property for any structural damage.

Unit-6

Social issues and the Environment

From unsustainable to sustainable development:-

(i) More and more natural resources are consumed in the process of satisfying human need. The human society can't leave without any developmental activity.

(ii) The developments which are at the cost of our life supporting system like air, water, soil is known as unsustainable development.

(iii) Due to excess use of natural resources some day it will lead to collapse of earth.

(iv) The development which is carried out by taking account of the natural resources is known as sustainable development.

To be sustainable the development process must follow the economical as well as the ecological sustainability.

(v) There are two types of sustainable development:-

① Inter generational equity

② Intra generational equity

(1) Inter generational equity: This states that we should stop over exploitation of natural resources reduce waste discharge & maintain a ecological balance.

(2) Intra generational equity: (i) This states that technological development should support economic growth of poor countries.

(ii) There are some ~~measure~~ ^{major} point to measure the sustainable development: To promote environmental education. This can be possible by introducing environment as a subject in education line. Media also plays a important role in public awareness.

(iii) 3R approuse: It means reduce, reused & recycle. We should reduce the excessive use & can reused a instead of passing it to waste stream. Recycle the material to reduce the pressure on our existing resources.

Urban Problem Related to energy:-

- ① Urban areas are developing very fast therefore it is difficult to place all the industries, commercial and residential facilities within one limit as a result cities are sprayed in to the sub-urban or rural areas.
- ② Energy is required in every step of life like industry, transport, agriculture, education, domestic purpose etc. The energy requirements of the urban population is much higher than the rural ~~more~~ once.
- ③ Energy problems become more serious due to limited amount of natural resources of energy.
- ④ There are following causes of energy problem:
 - (a) Increase use of energy for domestic and commercial purpose
 - (b) Industrial plants using big portion of energy
 - (c) Increasing of transport means
 - (d) Decrease in production of hydroelectricity due to insufficient ~~very~~ rain.
 - (e) Over exploitation of natural resources, like coal, petroleum, water etc.
- ⑤ There are some following:
 - (a) To develop renewable sources of energy like solar energy, wind power, nuclear power etc
 - (b) Spreading awareness program to save energy
 - (c) Effective measure for transmission loss & energy theft.

WATER CONSERVATION

Water conservation day is celebrated on 22nd of March. Water conservation includes all the policies, strategies and activities to sustainably manage the natural resource of fresh water, to protect the hydrosphere, and to meet the current and future human demand. Population, household size and growth and affluence all affect how much water is used. Factors such as climate change have increased pressures on natural water resources especially in manufacturing and agricultural irrigation. Many countries have already implemented policies aimed at water conservation, with much success.

The goals of water conservation efforts include:

1. Ensuring the availability of water for future generations where the withdrawal of freshwater from an ecosystem does not exceed its natural replacement rate.
2. Habitat conservation where minimizing human water use helps to preserve freshwater habitats for local wildlife and migrating waterfowl, but also water quality. The water that leaks from aquaguard should be collected and could be used for household works.

Conservation of Water

1. Afforestation can help water to penetrate into the soil and replenish the water table.
2. Building Dams and hydropower projects which help in checking flood and regulating the supply of water to agriculture.
3. Treatment of industrial and domestic wastewater in sewage plants before its disposal in water bodies help in conservation of water. It reduces the water pollution.
4. Rainwater harvesting
5. Use of efficient watering systems such as drip irrigation and sprinklers to reduce water consumption by plants and help in conservation of water.

RAIN WATER HARVESTING

Rainwater harvesting is the process of collection of rainwater from surfaces on which rain falls, filtering it and storing it for multiple uses. Rainwater harvesting puts the supply of water back to normal levels. It is the collection and storage of water from surfaces that rain has fallen upon. Rainwater harvesting is an innovative technique utilized to harvest rainwater from roofs and other above surfaces to be stored for later use. Rain harvested water can be used for garden and crop irrigation, watering livestock, laundry, and flushing toilets. However, you cannot use harvested rainwater for showering, bathroom sink or kitchen use because it's not really fit for consumption.

In a normal scenario the rainwater is collected from roof buildings and then stored inside of a special tank. Rainwater harvesting systems are designed after assessing site conditions that include rainfall pattern, incident rainfall, subsurface strata and their storage characteristics. Rainwater harvesting is popular all across the world, although in countries that are very dry, such as Australia, it is even more popular.

Rainwater can be harvested and used by those in the city who have running city water just as well as it can be used by those in more rural towns where adequate water supply may be unavailable. It is simple to replace many things that you are using regular city water with rainwater and enjoy numerous benefits when you do. Not only it helps you to conserve water but can also help you to save energy as the need to maintain centralized water system can be bypassed.

Components of Rainwater Harvesting system

A rainwater harvesting system comprises components of various stages - transporting rainwater through pipes or drains, filtration, and storage in tanks for reuse or recharge. The common components of a rainwater harvesting system involved in these stages are illustrated here.

1. Catchments

The catchment of a water harvesting system is the surface which directly receives the rainfall and provides water to the system. It can be a paved area like a terrace or courtyard of a building, or an unpaved area like a lawn or open ground. A roof made of reinforced cement concrete (RCC), galvanised iron or corrugated sheets can also be used for water harvesting.

2. Coarse mesh

at the roof to prevent the passage of debris.

3. Gutters

Channels all around the edge of a sloping roof to collect and transport rainwater to the storage tank. Gutters can be semi-circular or rectangular.

4. Storage tanks

Rain water stored

5. Water treatment

The filters and equipment as well as additives to settle, filter and disinfect.

Rainwater Harvesting system method and technique

1. Roof top rain water harvesting and its recharge to underground through existing wells or bore wells or by constructing new wells.
2. Harvesting runoff in the catchments by construction structures such as checkdams, bhandaras, percolation trench.
3. Impounding surplus runoff in the village catchment and water sheds in village ponds and percolation tanks.
4. Recharging treated urban and industrial effluents underground by using it for direct irrigation or through recharge ponds or well etc.

The main objectives of rain water harvesting are

- To restore supplies from the aquifers depleted due to over exploitation.
- To improve supplies from aquifers lacking adequate recharge.

- To store excess water for use at subsequent times.
- To improve physical and chemical quality of ground water.
- To reduce storm runoff and soil erosion.
- To prevent salinity ingress in coastal areas.

WATER SHED MANAGEMENT

Water shed is an area bounded by the divide line of water flow. It may be drainage basin or stream. The management of rainfall and resultant runoff is based on a natural unit called water shed. The Himalayas are one of the most critical water sheds in the world. Damodar valley corporation in 1949 adopted first integrated watershed management.

Water shed management include soil and land use survey, soil conservation in catchments of River valley projects and flood prone rivers, afforestation, social forestry programmes, drought prone area development programme, desert development and control of shifting cultivation.

The watersheds are very often found to be degraded due to uncontrolled, unplanned and unscientific land use activities. Grazing, deforestation, mining, construction activities, industrialization, shifting cultivation, natural and artificial fires, soil erosion and ignorance of local people have been responsible for degradation of various watersheds.

Objective of water shed management are

- Supply and securing of clean and sufficient drinking water for the population.
- To manage the watershed for beneficial developmental activities like domestic water supply, irrigation, hydropower generation etc.
- To minimize the risks of floods, droughts and landslides.
- To develop rural areas in the region with clear plans for improving the economy of the regions.
- To increase agricultural production
- The rational utilisation of natural resources like soil, water and vegetation.

Watershed Management Practices

In the fifth year plan, watershed management approach was included with a number of programs for it and a national policy was developed. In watershed management the aspects of development are considered with regard to availability of the resources.

RESETTLEMENT AND REHABILITATION OF PEOPLE; ITS PROBLEMS AND CONCERN

People are forced to move out of their land due to both natural and man made disasters. Natural disasters like earthquakes, cyclones, tsunami etc. render thousands of people homeless and sometime even force them to move and resettle in other areas. Similarly, developmental projects like construction of roads, dams, canals and flyovers displace people from their home. You must all be aware of the recent nuclear leakage in Japan due to which millions of people were forced to leave the area for their safety. Thus, resettlement refer to the process of settling again in a new area. Rehabilitation means restoration to the former state.

Reasons for displacement of people

- Natural disasters like earthquake, cyclones, tsunamis, volcanic eruptions, prolonged droughts conditions, floods, hurricanes etc.
- Man made disasters like industrial accidents (e.g. Bhopal gas tragedy), nuclear accidents(Current disaster in Japan), oil spills(Exxon Valdez oil spill), toxic contamination of sites etc.
- Developmental projects like:
 - construction of dams, irrigation canals, reservoirs etc.
- Infrastructural projects like flyovers, bridges, roads etc.
- transportation activities like roads, highway, canal etc.
- Energy related project like power plants, oil exploration, mining activities, pipelines like HBJ pipeline etc.
- Agricultural projects
- Projects related with the conservation of wildlife like national parks, sanctuaries and biosphere reserves.

PROBLEM

- Displacement mainly hits tribal and rural people who usually do not figure in the priority list of any political authorities or parties.

- The compensation for the land lost is often not paid, it is delayed or even if paid, is too small both in monetary terms and social changes forced on them by these mega developmental projects.
- Displacement is not a simple incident in the lives of the displaced people. They have to leave their ancestral land and forests on which they depend for their livelihood. Many of them have no skills to take up another activity or pick up any other occupation. Usually, the new land that is offered to them is of poor quality and the refugees are unable to make a living.
- When people are resettled in a new area, basic infrastructure and amenities are not provided in that area. Very often, temporary camps become permanent settlements. It is also a major problem of displacement or resettlement that people have to face.
- Resettlement disrupt the entire life of the people. They are unable to bear the shocks of emptiness and purposelessness created in their life.
- Lack of nutrition due to the loss of agriculture and forest based livelihood, lead to the general decline in the health of the people. People are used to traditional home remedies. But the herbal remedies and plants gets submerged due to the developmental projects
- Resettlement increases the poverty of the tribal due to the loss of land, livelihood, food insecurity, jobs, skills etc.
- The tribal people are not familiar with the market trends, prices of commodities and policies. As such, they are exploited and get alienated in the modern era.

OBJECTIVES OF REHABILITATION

The following objectives of rehabilitation should be kept in mind before the people are given an alternative site for living

- Tribal people should be allowed to live along the lives of their own patterns and others should avoid imposing anything on them.
- They should be provided means to develop their own traditional art and culture in every way.
- The displaced people should be given employment opportunities.
- If resettlement is not possible in the neighbour area, priority should be given to the development of the irrigation facilities and supply of basic inputs for agriculture, drinking water, wells, grazing ground for the cattle, schools for the children, primary healthcare units and other amenities.

ENVIRONMENTAL ETHICS: ISSUES AND POSSIBLE SOLUTION

Environmental ethics is a branch of ethics that studies the relation of human beings and the environment and how ethics play a role in this. Environmental ethics believe that humans are a part of society as well as other living creatures, which includes plants and animals. These items are a very important part of the world and are considered to be a functional part of human life. Thus, it is essential that every human being respect and honour this and use morals and ethics when dealing with these creatures.

In relation to environmental protection or in need of environmental ethics two world views are

1. Eco-centric world view

This states that earth resources are limited, and they are not for the human beings alone but for all species. So we have to draw our requirements from environment, but not to that extent it degrades the environment. A healthy environment depend upon how we cooperate with nature while trying to use resources of environment.

2. Anthropocentric world view

It states that man is the most important species of nature. Earth has unlimited supplies of resources. Most of the industrial societies believe in this view. So success and healthy economy of mankind depend upon how nicely man derives benefits from nature.

We must follow the certain environmental ethics for better future.

1. One should love and honour the earth.
2. Do not waste and exploit the natural resources.
3. We should respect the plant and animal which provide us food.
4. We should not do anything at the cost of nature.
5. We should concentrate on general awareness regarding environmental ethics from primary education.
6. We should conserve the ecosystem and promote appropriate sustainable development.
7. We should consume the natural resources in moderate amounts so that all may share this treasure.

CLIMATE CHANGE

periodic modification of Earth's climate brought about as a result of changes in the atmosphere as well as interactions between the atmosphere and various other geologic, chemical, biological, and geographic factors within the Earth system.

Climate is often defined loosely as the average weather at a particular place, incorporating such features as temperature, precipitation, humidity, and windiness. A more specific definition would state that climate is the mean state and variability of these features over some extended time period. Both definitions acknowledge that the weather is always changing, owing to instabilities in the atmosphere. And as weather varies from day to day, so too does climate vary, from daily day-and-night cycles up to periods of geologic time hundreds of millions of years long.

The atmosphere is a dynamic fluid that is continually in motion. Both its physical properties and its rate and direction of motion are influenced by a variety of factors, including solar radiation, the geographic position of continents, ocean currents, the location and orientation of mountain ranges, atmospheric chemistry, and vegetation growing on the land surface. All these factors change through time.

Some factors, such as the distribution of heat within the oceans, atmospheric chemistry, and surface vegetation, change at very short timescales. Others, such as the position of continents and the location and height of mountain ranges, change over very long timescales. Therefore, climate, which results from the physical properties and motion of the atmosphere, varies at every conceivable timescale.

GLOBAL WARMING

Global warming is a phenomenon of climate change characterized by a general increase in average temperatures of the Earth, which modifies the weather balances and ecosystems for a long time. It is directly linked to the increase of greenhouse gases in our atmosphere, worsening the greenhouse effect.

Causes of global warming

1. **Burning fossil fuels**

When we burn fossil fuels like coal, oil and gas to create electricity or power our cars, we release CO₂ pollution into the atmosphere.

2. **Deforestation & Tree-Clearing**

humans clear vast areas of vegetation around the world for farming, urban and infrastructure development or to sell tree products such as timber and palm oil. When vegetation is removed or burnt, the stored carbon is released back into the atmosphere as CO₂, contributing to global warming.

3. **Agriculture & Farming**

Some fertilisers that farmers use also release nitrous oxide, which is greenhouse gas.

Animals, particularly livestock like sheep and cattle, produce methane, a greenhouse gas. When livestock are grazed at a large scale, as in Australia, the amount of methane produced is a big contributor to global warming.

4. gases used for refrigeration and industrial processes
5. methane released from landfills, natural gas and petroleum industries
6. Green house effect

ACID RAIN

Acid rain is a rain or any other form of precipitation that is unusually acidic, meaning that it has elevated levels of hydrogen ions (low pH). Acid rain results when sulphur dioxide (SO₂) and nitrogen oxides (NO_x) are emitted into the atmosphere and transported by wind and air currents. The SO₂ and NO_x react with water, oxygen and other chemicals to form sulfuric and nitric acids. These then mix with water and other materials before falling to the ground.

While a small portion of the SO₂ and NO_x that cause acid rain is from natural sources such as volcanoes, most of it comes from the burning of fossil fuels. The major sources of SO₂ and NO_x in the atmosphere are:

- Burning of fossil fuels to generate electricity. Two thirds of SO₂ and one fourth of NO_x in the atmosphere come from electric power generators.
- Vehicles and heavy equipment.
- Manufacturing, oil refineries and other industries.

Adverse effects

- Surface waters and aquatic animals

Both the lower pH and higher aluminium concentrations in surface water that occur as a result of acid rain can cause damage to fish and other aquatic animals. At pH lower than 5 most fish eggs will not hatch and lower pH can kill adult fish. As lakes and rivers become more acidic biodiversity is reduced. Acid rain has eliminated insect life and some fish species.

- Soils

Soil biology and chemistry can be seriously damaged by acid rain. Some microbes are unable to tolerate changes to low pH and are killed. The enzymes of these microbes are denatured by the acid. The hydronium ions of acid rain also mobilize toxins, such as aluminium, and leach away essential nutrients and minerals such as magnesium.

- Forests and other vegetation
- Human health effects

Increased amounts of fine particulate matter in the air contribute to heart and lung problems including asthma and bronchitis.

- Other adverse effects

Acid rain can damage buildings, historic monuments, and statues, especially those made of rocks, such as limestone and marble, that contain large amounts of calcium carbonate. Acids in the rain react with the calcium compounds in the stones to create gypsum, which then flakes off.

OZONE LAYER DEPLETION

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 ozone layer forms a thick layer in stratosphere, encircling the earth, that has large amount of ozone in it. The ozone layer protects life on earth from strong ultraviolet radiation that comes from the sun.

Ozone holes refer to the regions of severely reduced ozone layers.

Causes of Ozone Layer Depletion

The ozone layer depletion is a major concern and is associated with a number of factors. The main causes responsible for the depletion of the ozone layer are listed below:

- Chlorofluorocarbons

Chlorofluorocarbons or the CFC are the main cause of ozone layer depletion. These are released by soaps, solvents, spray aerosols, refrigerators, air-conditioners, etc. The molecules of chlorofluorocarbons in the stratosphere are broken down by the ultraviolet radiations and release chlorine atoms. These atoms react with ozone and destroy it.

- Unregulated Rocket Launches

Researches say that the unregulated launching of rockets result in much more depletion of ozone layer than the CFCs do. If not controlled, this might result in a huge loss of the ozone layer by the year 2050.

- Nitrogenous Compounds

The nitrogenous compounds such as NO₂, NO, N₂O are highly responsible for the depletion of the ozone layer.

- Natural Causes

The ozone layer has been found to be depleted by certain natural processes such as Sun-spots and stratospheric winds. But it does not cause more than 1-2% of the ozone layer depletion.

Effects of ozone layer depletion

The depletion of ozone layer has harmful effects on the environment. Let us see the major effects of ozone layer depletion on man and environment.

- Effects on Human Health

The humans will be directly exposed to the harmful ultraviolet radiations of the sun due to the depletion of ozone layer. This might result in serious health issues among humans such as skin diseases, cancer, sunburns, cataract, quick ageing, and weekend immune system.

- Effects on Animals

Direct exposure to ultraviolet radiations leads to skin and eye cancer in animals.

- Effects on the Environment

Strong ultraviolet rays may lead to minimal growth, flowering and photosynthesis in plants. The forests also have to bear the harmful effects of the ultraviolet rays.

- Effects on Marine Life

Planktons are greatly affected by the exposure to harmful ultraviolet rays. These are higher in the aquatic food chain. If the planktons are destroyed the organisms present in the lower food chain are also affected.

Solutions to Ozone Layer Depletion

The depletion of ozone layer is a serious issue and various programmes had been launched by the government of various countries to prevent it. But, steps should be taken at the individual level as well to prevent the depletion of ozone layer. Following are some of the points that would help in preventing this problem at a global level:

- Avoid Using Pesticides

Natural methods should be implemented to get rid of pests and weeds instead of using chemicals. One can use eco-friendly chemicals to remove the pests or remove the weeds manually.

- Minimise the Use of Vehicles

The vehicles emit a large amount of greenhouse gases that lead to global warming as well as ozone depletion. Therefore, the use of vehicles should be minimised as much as possible.

- Use Eco-friendly Cleaning Products

Most of the cleaning products have chlorine and bromine releasing chemicals that find way into the atmosphere and affect the ozone layer. These should be substituted with natural products to protect the environment.

- The Use of Nitrous Oxide should be Prohibited

The government should take actions and prohibit the use of harmful nitrous oxide that is adversely affecting the ozone layer. The people should be made aware of the harmful effects of nitrous oxide and the products emitting the gas so that its use is minimised at the individual level as well.

NUCLEAR ACCIDENTS AND HOLOCAUST

A nuclear holocaust, nuclear apocalypse or atomic holocaust is a theoretical scenario involving widespread destruction and radioactive fallout causing the collapse of civilization, through the use of nuclear weapons. Under such a scenario, some or all of the Earth is made uninhabitable by nuclear warfare in future world wars.

Case study

Chernobyl accident (Ukraine)

The Chernobyl Nuclear disaster is widely considered to have been the worst power plant accident in history, and is one of only two classified as a level 7 event on the International Nuclear Event Scale (the other being the Fukushima, Daiichi disaster in 2011).

The plant was built in the late 1970s about 65 miles north of Kiev in the Ukraine, the Chernobyl plant was one of the largest and oldest nuclear power plants in the world. The explosion and subsequent meltdown that occurred there in April 1986 would claim thousands of lives, cause countless birth defects and unleash a thyroid cancer epidemic on the region. However, it would take years for the full story behind the catastrophe to emerge. A bungled experiment at one of the facility's four reactors created a sudden power surge, which in turn led to a series of blasts that blew the 1,000-ton steel top off of the reactor. A lethal cloud of radioactive material gathered over the nearby town of Pripyat—which was not evacuated

until 36 hours after the explosion—before wafting over large parts of Europe. Soviet officials tried to keep the disaster under wraps, but on April 28 Swedish radiation monitoring stations located more than 800 miles from Chernobyl reported radiation levels 40 percent higher than normal.

In the opening days of the crisis, 32 people died at Chernobyl and dozens more suffered radiation burns. The radiation that escaped into the atmosphere—equivalent to several times that produced by the atomic bombs dropped on Hiroshima and Nagasaki—contaminated millions of acres of forest and farmland. The full human toll from the calamity is still being tallied, but experts believe that thousands of people died and as many as 70,000 suffered severe poisoning. In addition, a large area of land may not be livable for as much as 150 years, including the 18-mile radius around Chernobyl—home to some 150,000 people who had to be permanently relocated. In 2000, the last working reactors at Chernobyl were shut down and the plant was officially closed.

Japanese towns of Hiroshima and Nagasaki

The first atom bomb was exploded about 580 meters in the atmosphere over ill fated Hiroshima on August 6, 1945. The second atom bomb was detonated 507 meters high in air over Nagasaki. At least 100000 people were reported killed, severely injured and missing in Hiroshima alone, where the bomb virtually demolished all structures and all buildings in about 15 square km. area. In Nagasaki 49000 civilians are killed, injured and disappeared while an area of 6 to 7 km. was devastated.

AIR (PREVENTION AND CONTROL OF POLLUTION) ACT

It is also a comprehensive legislation with more than fifty sections. It makes provisions, inter alia, 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 Board can predicate its consent upon the fulfilment of certain conditions. The Air Act apparently adopts an industry wide “best available technology” requirement.

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, sulphur 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. This is measured in parts per million or in milligrams or micrograms per cubic meter. 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

- To provide for the prevention, control and abatement of air pollution.
- To provide for the establishment of central and State Boards with a view to implement the Act.
- 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

1. 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.

2. 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.
- Whoever contravenes any of the provision of the Act or any order or direction issued is punishable with imprisonment for a term which may extend to three months or with a fine of Rs. 10,000 or with both, and in case of continuing offence with an additional fine which may extend to Rs 5,000 for every day during which such contravention continues after conviction for the first contravention.

WATER (PREVENTION AND CONTROL OF POLLUTION) ACT

This is an Act to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water through various management guidelines and restrictions. The act was introduced and incorporated into the Constitution of India in 1974. The act was passed in pursuance of clause (1) of article 252 of the Constitution. Resolutions have been passed by all the Houses of the Legislatures of the States.

One of the prime objectives of this act is carrying out the purposes mentioned above by assigning a set of responsibilities, powers, and functions to the Boards for the prevention and control of water pollution.

The Water Act applies in the first instance to the whole of the States of Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Rajasthan, Tripura and West Bengal and the Union territories.

Central & State Pollution Control Boards (PCBs)

Under this act, one Central board and numerous State boards shall be appointed by notification in the Official Gazette called Central Pollution Control Board (CPCB) and State Pollution Control Board (SPCB) respectively with effect from a date not later than six months of the commencement of this Act.

The State Boards shall investigate, assess, and monitor the issues of concern regarding the quality and pollution of the water resources available in their jurisdiction and shall report the same through quarterly and annual reports during board meetings to the Central Board. The Central Board hereby shall look into the State Board's reports and also monitor and handle major issues regarding national water resources.

Functions of the Central Board

The primary goal of the Central Board as stated in accordance with the Water Act shall be to promote cleanliness of streams and wells in different areas of the States. Highlight functions of the Central Pollution Control Board (CPCB) are as follows:

1. Advise the Central Government on any matter concerning the prevention and control of water pollution.
2. Co-ordinate the activities of the State Boards and resolve disputes among them.

3. 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.
4. Plan and organize the training of persons engaged or to be engaged in programs for the prevention, control or abatement of water pollution.
5. Collect, compile and publish technical and statistical data relating to water pollution and the measures devised for its effective prevention and control.

Functions of the State Board

Highlight functions of the State Pollution Control Board (SPCB) are as follows:

1. Plan a comprehensive programme for the prevention, control or abatement of pollution of streams and wells in the State.
2. Advise the State Government on any matter concerning the prevention, control or abatement of water pollution.
3. Encourage, conduct and participate in investigations and research relating to problems of water pollution and prevention, control or abatement of water pollution.
4. Collaborate with the Central Board in organizing the training of persons engaged or to be engaged in programmes relating to prevention, control or abatement of water pollution.
5. Inspect sewage or trade effluents, works, and plants for the treatment of sewage and trade effluents and to review plans, specifications or other data relating to plants set up for the treatment of water.
6. Evolve methods of utilization of sewage and suitable trade effluents in agriculture.
7. Evolve economical and reliable methods of treatment of sewage and trade effluents, having regard to the peculiar conditions of soils, climate and water resources of different regions.

Penalties

1. If any person fails to comply with the orders of the board under subsection 2 and 3 of Section 20 then in that case on conviction, he is punishable for imprisonment for 3 months or fine or both.

2. If the person fails to comply with orders of the board under clause e of subsection 1 of Section 32 or with subsection 2 of Section 33 then, in that case, the person would be punishable with imprisonment for 6 months extending to 6 years or a fine or both.

3. from the above-mentioned penalties. Section 42 mentions penalties for different kinds of Acts namely:

- If any person removes, destroys or pull down any notice put up by the board.
- If someone obstructs the member of the board or any other person who is Acting under the board.
- If a person fails to produce any information as required by the member of the board for the performance of his duties.
- Or if he gives any information to the members which he knows to be false.

Then In all the above Acts if the person is convicted he would be punishable by imprisonment for a maximum period of 3 months or fine that may extend up to 10,000 rupees or both.

PUBLIC AWARENESS

Environmental pollution, environmental degradation, environmental deterioration, environmental crisis etc are few words which becoming day by day a subject of concern in every walk of life. This is all due to industrialization, rapid population growth, urbanization, changing lifestyle etc. The formulation of various acts and legislation to control population and conserve or protect environment, underlines the will and concern of the Government. But incomplete knowledge, information and ignorance about many aspects of environment has led to misconception. Therefore it is necessary to make people aware about the laws and legislations and to save environment. There is no single subject by which we can have complete knowledge of environmental aspects. Simultaneously it can not be done by single man, agency or institution. It is of the people, by the people and for the people. Thus public awareness means, making the people conscious about the physical, social and aesthetic aspects of environment. To protect and conserve the environment is the basic duty of all section of people. It is necessary to find the permanent solution of environment and ecological problems. It can be done by following means-

1. Through mass media
2. Through education
3. Through rallies orientation and training program
4. Through voluntary organisation and NGOs

5. Merging the ideas and philosophy of environmentalism with the structure of formal education systems, it strives to increase awareness of environmental problems as well as to foster the skills and strategies for solving those problems.

6. Publications of environment related resources material in the form of pamphlets or booklets published by Ministry of Environment & Forests can also help in keeping this section abreast of the latest developments in the field. Before we can all take up the task of environmental protection and conservation, we have to be environmentally educated and aware. It is aptly said "if you want to act green, first think green".

UNIT - 7 Human population and the environment

POPULATION GROWTH AND VARIATION AMONG NATION

The period of 600 million years from the present era witnessed tremendous explosion of life forms through evolutionary process with man at the apex of the evolution, appearing only a few million years ago. At present, it is estimated that earth has about 10 to 30 million life forms of which man is one of the life form.

Each population has a characterized pattern of increase which is termed as its growth form. It increases in size in a characteristic S-Shaped or sigmoid fashion. When a population starts growing, first the growing is slow, and then it be-comes rapid and finally slows down until equilibrium is reached. If we plot time on x-axis and number of organisms on y-axis, on a graph paper, we should get a s-shaped sigmoid curve. Human population shows a s-shaped growth. However, if the growth stops abruptly, a J-shaped growth curve is obtained.

The level beyond which no major increase can occur is called the saturation level or carrying capacity. The following states have been ruined to occur in the population growth form:

1. The Period of Positive Growth
2. The Equilibrium Position
3. Oscillations and Fluctuations
4. Decline and Extinction

The world's population is not properly balanced, more than half of the world's people live in Asia (approx. 3.7) billion), which accounts for only one fifth of the world's land area. While

north, central and south America together occupy more than a quarter of the land surface and have only one-fifth of the population (1.3 billion).

The African continent also accounts for a quarter of the land surface but has just over one eighth (840 million) of the world population. On the other hand Europe whose area is only one twenty fifth of the total has about one-ninth (728 million) of the world's people.

The distribution within the continents is also uneven. In Asia, China alone, with about 1.28 billion people, accounts for one-third Asian and one-fifth of the world population. The Indian subcontinent has a further 1.3 billion people — India, 1.05 billion- Pakistan, 143.5 million- Bangladesh, 133.6 million- Nepal, 23.9 million- Sri Lanka, 18.9 million- Bhutan, 0.3 million- Maldives.

In Europe too, the population is unevenly distributed. Far less people live in Northern European countries than in other European countries. The most populous European countries are Russia (143.5 million), Germany (82.4 million), United Kingdom (60.2 million), France (59.5 million); Italy (58.1 million), Ukraine (48.2 million), Spain (41.3 million) and Poland (38.6 million).

The distribution of population depends to a large extent on the quality of land. Thus population density (i.e. the number of people living in unit area) varies widely, the densely populated areas include western Europe, the Indian subcontinent, the plains and river valleys of China and north eastern USA.

The factors encouraging settlement are good land, flat or undulating terrain the existence of renewable resources, a good climate suitable for wide range of crops or a less equable climate suitable for cultivation of specialized cash crops. Other factors include extension of roads, railways and other modes of transportation. The factors discouraging settlement are usually climate or relief factors; the main factors are cold, altitude, heat, drought, poor soils etc.

POPULATION EXPLOSION – FAMILY WELFARE PROGRAM

Population explosion refers to the rapid and dramatic rise in world population that has occurred over the last few hundred years. Between 1959 and 2000, the world's population increased from 2.5 billion to 6.1 billion people. According to United Nations projections, the world population will be between 7.9 billion and 10.9 billion by 2050. The combination of a continuing high birth rate and a low death rate is creating a rapid population increase in many countries in Asia, Latin America and Africa and people generally lived longer. Due to population explosion the condition of having more people than can live on the earth in comfort, happiness and health and still leave the world a fit place for future generations. But some people now believe that the greatest threat to the future comes from over-population.

Causes of Population Explosion

1. Increase in the birth rate
2. A decrease in infant mortality rate
3. The life expectancy growth
4. High level of illiteracy

National Family Welfare programme

Previously this programme was known as National family planning programme. In the year 1977 the name was changed to National family welfare programme. Family planning programme was launched in India in 1952. India was the first country to do so. During the 3rd five year plan family planning was declared as centre of planned development. Then the emphasis was shifted from clinic approach to extensive education approach.

Importance of family welfare programme

1. The family welfare programme occupies an important position in nation's socio economic development.
2. Indian [population which was 34 crores in 1947 has crossed 100 crores in 2000 AD. India has only 2.4% of world's land area but it supports about 15.5% of world's population.
3. Indian population is increasing by 1.8 crore every year. To check this galloping growth, the country has laid down long term demographic goal of achieving an NRR of one by the year 2000 AD.
4. Acceptance of family welfare services is made voluntary.
5. The programme was 100% centrally sponsored scheme. FP programme was integrated with the MCH service

ENVIRONMENT AND HUMAN HEALTH

Environment is the main determinant of health status of a community. Poor housing is a contributor to low physical and mental efficiency. Certainly if we aimed at obtaining optimum

condition for physical and mental well being, in addition to preventing disease, we must include improvement of housing condition in this program.

Environment is defined as all external factor present around man. So it is the entire medium in which population lives and interact. The environment may be divided into four components.

1. Physical environment

All non living things and physical forces present around man. The important components of physical environment are water, air, housing, temperature ,noise, vibration etc.

2. Biological environment

All those living things present around us.

3. Social environment

Social interactions between individual such as their socioeconomic status, religion and the way of living, standard of living, and availability and utilisation of health care facilities.

4. Cultural environment

It is the culture in which the individual lives. It include their knowledge, attitude, beliefs, customs, behaviour etc.

Environmental sanitation is defined by WHO as, the control of all those factors in man's physical environment which exercise or may exercise a deleterious effect on his physical environment, health and survival. The world sanitation covers the whole field of controlling environment with a view to prevent disease. It is known fact that in the countries where environmental sanitation is good, there the communicable disease problem is less. The countries having poor environmental sanitation, the communicable disease problem is high.

HUMAN RIGHTS

Human rights are moral principles or norms that describe certain standards of human behaviour and are regularly protected as natural and legal rights in municipal and international law. They are commonly understood as inalienable, fundamental rights "to which a person is inherently entitled simply because she or he is a human being"[4] and which are "inherent in all human beings", regardless of their age, ethnic origin, location, language, religion, ethnicity, or any other status.

There are a variety of human rights, including:

- Civil rights (such as the rights to life, liberty and security),
- Political rights (like rights to the protection of the law and equality before the law),
- Economic rights (including rights to work, to own property and to receive equal pay),
- Social rights (like rights to education and consenting marriages),
- Cultural rights (including the right to freely participate in their cultural community), and
- Collective rights (like the right to self-determination).

The human rights most relevant to trafficking are

1. The prohibition of discrimination on the basis of race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth, or other status;
2. The right to life
3. The right to liberty and security
4. The right not to be submitted to slavery, servitude, forced labour or bonded labour
5. The right not to be subjected to torture and/or cruel, inhuman, degrading treatment or punishment
6. The right to be free from gendered violence
7. The right to freedom of association
8. The right to freedom of movement
9. The right to the highest attainable standard of physical and mental health
10. The right to just and favourable conditions of work
11. The right to an adequate standard of living
12. The right to social security

VALUE EDUCATION

Now a days, more emphasis is unduly laid on knowledge-based and information-oriented education which takes care of only the intellectual development of the child. Consequently, the other aspect of their personality like physical, emotional, social and spiritual are not properly developed in providing for the growth of attitudes, habits, values, skills and interests among the pupils. It is here that we talk in terms of value-education. A complete description of what value-education is, could entail a study in itself.

The very purpose and main function of value 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.

What is Value Education

The meaning of Value Education is to teach universal values like moral values, patience, honesty etc, to the human. The purpose of value education is the development of the personality of the human.

1. The human should develop in all dimensions so that they can serve the nation more democratic, cohesive, socially and responsibly.
2. The full development of human's personality in its physical, mental, emotional and spiritual aspects.
3. Development of good manners and responsibility towards citizenship.
4. The way of thinking and living should be developing at the democratic level.
5. Developing patience, honesty, moral values etc.
6. Inculcation of a spirit of patriotism and national integration.
7. Developing tolerance towards and understanding of different religious faiths.
8. Enabling human to make decisions on the basis of sound moral principles.

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. Different thematic maps containing digital information on a number of aspects like water resources, forest land, soil type, crop land, industrial growth, human settlement etc. are superimposed in a layered form in computer using soft-wares.

(e) The World Wide Web (WWW)

With the availability of resources on every aspect, things like classroom activities, digital files of photos, web-exercises, animations, PowerPoint lecture presentations, and quiz

competitions have proved to be more helpful for both the students as well as the teachers who pursue environmental studies.

Role of Information Technology in Human Health

1. Information technology is playing a major role in bioinformatics, genome sequencing, biotechnology, gene engineering, online medical transcription and in maintaining DTA databases for a better human health. It also helps in identifying several disease-infected areas which are prone to some vector-borne diseases like malaria, schistosomiasis etc. based upon mapping of such areas.
2. Bioinformatics, an emerging field of it is used in curing severe diseases like osteoporosis and in human genome project (HGP) by developing a computer programme that helps in completing the genome sequencing. The aim of HGP is to create a map of entire set of genes (genome) in the human cell by decoding the three billion units of human DNA.
3. It provides vast quantum of information on different subjects including human health and environment. The patient can seek help of a super-specialist doctor placed at far off distance. The National Institute of Occupational Health provides computerized information on occupational health of people working in various hazardous and non-hazardous industries and safety measures etc.