**UNIT -1** NATURAL RESOURCES

* Life on this planet earth depends upon a variety of goods and services provided by the nature, these are known as natural resources.
* Any stock (or) reserve that can be drawn from nature is known as natural resources.
* Air, water, soil, minerals, coal, forests, crops and wild life are the examples of Natural resources.
* Natural resources are of two kinds –based on their existence. (i.e)
  + RENEWABLE RESOURCES –which are inexhaustible and can be regenerated with a specific time. E.g:- forests, wild life, wind energy, biomass energy etc.
  + NON RENEWABLE RESOURCES-which are exhaustible and may not be regenerated or it takes some million years to replenish. E.g:-fossil fuels, minerals.
* Even our renewable resources can become non-renewable, if we exploit them to such extent that their rate of consumption exceeds their rate of regeneration.

# FOREST RESOURCES.

* Forests are one of the most important natural resources on this earth, covering the earth like a green blanket.
* About one third of the world’s land area is forested.
* Total forest area of the world in 1900 was estimated to be 7,000 million ha, which was reduced to 2,890 million ha in 1975 and fall down to 2,300 million ha by 2000.
* Deforestation rate is relatively less in the temperate countries, but it is very alarming in the tropical countries.

#### Uses of forests

|  |  |
| --- | --- |
| **Commercial uses** | **Ecological uses** |
| Forests provide us a large no. of commercial goods like –Timber, pulpwood, fuel wood fruits, honey, spices, fodder, rubber, gum, drugs, medicines, minerals, nuts, fiber, raw materials for industries etc. | Regulates water cycle, Produces oxygen, absorbs pollutants, reduce global warming, habitat for wild life, conservation of soil, protects wild life, prevents flash floods, provides shelter for tribal’s. |

**Over exploitation of Forests:-**

* Forests have been exploited since early times to meet the human demands like
* To get the raw materials like timber, pulpwood, and fuel wood etc.
* Deforestation to construct roads.
* clearing of forests to create more agricultural lands
* To construct hydro power projects.
* Live stocks grazing on a grass land or pasture areas.
* Mining activities etc.

#### Over grazing:-

* Over grazing removes the vegetal cover over the soil and soil gets compacted, causing erosion.
* Over grazing removes the humus content and leads to organically poor, dry, compacted soil (i.e) loose soil fertility.
* Loss of top soil reduce percolation of water into the soil
* The exposed soil gets eroded by strong wind, rain fall etc.
* Grass roots are very good binders of soil. Overgrazing in grass land leads to reduction in soil binding capacity.
* When live stock grazes upon the pastures heavily, the root stocks which carry the reserve food for regeneration get destroyed.
* Overgrazing converts the good quality pasture land to an ecosystem with poor quality thorny vegetation.
* Coastal Western Ghats and North-east India is facing the over-grazing problem.

## Deforestation

* Clearing of the forests to create more agriculture land for building industries, for constructing roads, for constructing dams, for mining leads to desertification.

#### Causes of Deforestation:-

Shifting cultivation:-

* This is the method followed by the tribal communities, in which small forests area is cleared and burnt. Crops are successfully grown in this area for few years. After they left this area and go in search of new area.
* Due to this annually 5 lakh ha of forests area are in degradation.
* In India, this practice in north- east and to some extent in A.P, Bihar and M.P. clearing half of the forest area annually.

Overgrazing:-

* Overgrazing leads to loss of top soil and soil fertility.( refer the previous page)

Raw materials for industrial use:

* Wood for making boxes, furniture, railway sleepers, ply wood, match boxes, pulp for making paper etc have exerted tremendous pressure on forests.
* Ply wood is in great demand for packing tea for tea industry of Assam while fir wood is exploited greatly for packing apples in J & K.

Development projects:-

* Massive destruction of forests occurs for various development projects like hydro electric projects, big dams, road construction, mining etc.

Growing food needs:-

* To meet the demands of rapidly growing population, agricultural lands and settlements are created by clearing forests.

Mining:-

* Mining operations for extracting minerals and fossil fuels like coal often involves vast forest areas.
* More than 80,000ha of land is presently under the stress.
* Large scale de-forestation has reported in Mussorie and Dehradun valley (40km).
* Indiscriminate mining in forests of Goa has destroyed more than 50,000 ha forest land.
* Mining of magnesite and soap-stones has destroyed 14 ha in the hill slopes at Khirakot, Kosi valley, Almora.
* Mining of Radio-active minerals in Kerala, Tamil Nadu and Karnataka posing similar threats.

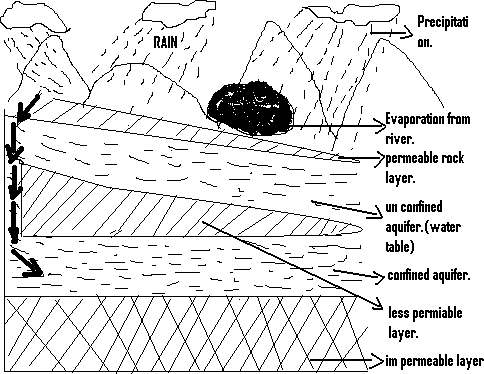
**Consequences of Deforestation:-**

* Threats the existence of many wild life species.
* Bio-diversity is lost.
* Hydrological cycle gets affected.
* Problems of soil erosion and loss of soil fertility increases.
* More carbon is added to atmosphere and global warming is disturbed.
* In hilly areas it often leads to landslides.
* Reduction in oxygen.

# WATER RESOURCES

* Water is an indispensible natural resource on this earth on which life depends.
* Water covers 70% of the earth’s surface, but only 35 of this are fresh water. Of which 25% is as polar ice caps and only 15 is usable water in rivers, lakes and sub soil aquifers. (Only 0.0035 is readily available to us in the form of ground water).
* On a global average 70% of water withdraws is used for agriculture. India uses 90% of its water for agriculture, 7% for industry and 3% for domestic use.
* Human beings depend on water for almost every developmental activity.
* Over use of ground water for drinking, irrigation and domestic purpose has resulted in rapid depletion of ground water in various regions leading to lowering of water table.
* Pollution of the ground aquifers has made many of the wells unfit for consumption.
* It is estimated that 2024, two-third of the world population would suffer from acute water shortage.

#### Ground water:-

* About 9.86% of total fresh water resources are in the form of ground water.
* A layer of sediment rock that is highly permeable and contains water is called aquifer.
* Aquifer may be of two types’ i.e un-confined aquifer & un-confined aquifer.
* Un- confined aquifers which are sandwiched between two permeable layers of the rock and are recharged only in these areas where the aquifer intersects the land surface.
* Ground water is not static, it moves, though at a very slow rate.

Effects of ground water:-

* When ground water withdrawal is more than its recharge rate, the sediments in the aquifer get compacted, a phenomenon known as ground subsidence. This causes a huge damage to the sinking of overlying land surface.
* Mining of ground water is done extensively in the arid and semi arid areas. This causes a sharp decline in the future production due to water lowering of water table.
* When excessive irrigation is done with brackish water it raises the water table gradually leading to water logging and salinity problems.

Water rich vs. water poor countries.

Water rich countries are ice land, Guyana, New Guinea, Canada, Norway, Panama & Brazil. Water poor countries are Kuwait, Egypt, United Arab Emirates, Jordan, Saudi Arabia, Singapore, Israel.

#### Floods:-

* In some countries like India & Bangladesh rainfall does not occur throughout the year, 90% of it is concentrated into a few months (June-sep).
* Heavy rain fall often causes floods in the low-lying coastal areas.
* Prolonged downpour can also causes the over-flowing of lakes and rivers resulting in to floods.
* Deforestation in the Himalayas causes floods that year after year, damaged crops and destroy homes in the Ganges and its tributaries.
* During floods tons of valuable soil is lost to the sea.
* Severe floods from excessive Himalayan runoff and storms in 1970, about one million people were drowned while 1, 40,000 people died in 1991.

#### Drought:-

* There are about 80 countries in the world, lying in the arid and semi arid regions that experience frequent spells of drought.
* When annual rainfall is below normal and less than evaporation, drought conditions are created.
* Over grazing, deforestation, mining etc are causes for drought.
* Erroneous and intensive crop pattern and increased exploitation of water resources through wells or canals to get high productivity has converted drought-prone areas in to decertified ones.
* In Maharashtra there has been no recovery from drought for last 30 yrs.

#### Sustainable water Management:-

* **“**Save water” campaigns are essential to make people aware of dangers of water scarcity.
* Building several small reservoirs instead of mega projects.
* Treating and recycling municipal wastes water for irrigation.
* Preventing leakage from dams.
* Carefully selected mixed cropping.
* Pricing water at its real value makes people use it more responsibly and effective to fight against this drought problems (by making bunds)

**BIG DAMS -BENEFITS AND PROBLEMS**

Big dams are often regarded as a symbol of national development. However there are several issues and problems related to these.

Negative ecological impacts.

Positive ecological impacts

1. Reduction in famines
2. Prevention of floods
3. Promotion in productivity.

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* Deforestation,
* loss of plants &wild life,
* Flash floods,
* micro climate change,
* water logging,
* Salinity

IMPACTS OF

MAJOR DAMS

Positive socio-economical impacts

* provides employment
* generates electricity
* generates electricity
* supply drinking water
* Promotion of navigation, fisheries.

Negative socio- economical impacts

* loss of fertile lands
* loss of tribal communities
* submergence of villages
* Outbreak of vector born diseases.
* Resettlement issues.
  + Big dams and river valley projects have multi-purpose uses and have been referred as”Temples of modern India”. However those are responsible for the destruction of vast areas of forest.
  + India has more than 1550 large dams. The highest one is Tehri dam. On river Bhagirathi in Uttarakhand and the largest in terms of capacity is Bhakra dam on the river Sutlej in Himachal Pradesh.
  + The crusade against the ecological damage and deforestation caused due to Tehri dam was laid by sh.sunderlal bahuguna , the leader of chipko movement.
  + Likewise the cause of Sardar sarovar dam related issues has been taken up by environmental activists Medhapatkar , Arundhati Roy and Baba Amte.
  + Sardar sarovar dam is situated on river Narmada and is spread over three sates of Gujarat, Maharastra, and Madhya Pradesh.
  + A total of 1, 44,731 ha of land is submerged by this dam, out of which 56,547 ha is forest land.
  + A total of 573 villages are submerged by the Narmada Dam.
  + This dam has displaced thousands of tribal flok, whose lives and livelihoods were linked to the river, the forest and agricultural lands.

# MINERAL RESOURCES

* + Minerals are naturally occurring, inorganic, crystalline solids having definite chemical composition and diaracteristic properties.
  + Minerals are formed over a period of millions of years in Earth’s crust.
  + Aluminum, zinc, Manganese, copper – Raw materials for industries.
  + Coal, clay, cement, silica - non-metallic minerals.
  + Granite, marble, lime stone, quartz, feldspar-stone minerals.
  + Diamond, Emeralds and rubies – special property minerals.

#### Uses of Minerals:-

* + Development of industrial plants
  + Generation of energy
  + Construction, housing, settlements
  + Defense equipments
  + Transportation means
  + Communication – wires, cables, electronic devices
  + Medicinal system
  + As fertilizers in agriculture
  + Ornamental use

#### Some Major Minerals of India:-

* + Coal and lignite:- west Bengal, Jharkhand, Orissa, M.P, A.P
  + Uranium:- Jharkhand, A.P(Nellore, Nalgonda), Rajasthan
  + Aluminum: - Jharkhand, W.B., Maharashtra, M.P., T.N.
  + Iron: - Jharkhand, Orissa, M.P., A.P, T.N, Karnataka, Goa, Maharashtra.
  + Copper:- Rajasthan, Bihar, Jharkhand, M.P., W.B., A.P.,

Physical impacts

1. Land subsidence
2. Underground fire
3. Soil erosion
4. Landscape destruction

Ecological impacts

* loss of flora & fauna
* Ecosystem degradation.

Positive socio- Economic Impacts

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



Employment Infrastructure facilities

Economic gain

IMPACTS OF MINERAL EXTRACTIO

N (OR)

MINING

ACTIVITIES

Negative Socio- Economic Impacts

1. Resettlement issues
2. Displacement of Native people
3. loss of fertile lands

Environmental impacts

1. Air pollution
2. Water pollution
3. Soil pollution
4. Noise pollution

Occupational Health

* Health hazards due to long term exposure to hazardous chemical.
* Accidents.

#### Conflicts:-

* + India is the producer of 84 minerals, the annual value of which is about 50000 crore. Six major mines which are causing several problems are :
  + Jaduguda uranium mine-Jharkhand
  + Jharia coal mine – Jharkhand
  + Sukinda chromite mine – Orissa
  + Kudremukh iron mine – Karnataka
  + East coast bauxite mine – Orissa
  + North –East coal fields – Assam
  + Mining operations in Sariska Tiger Reserve in Aravalli ranges has left many areas permanently infertile & barren.
  + The precious wildlife is under serious threat.
  + This reserve is very rich in wildlife and has enormous mineral reserves.
  + Supreme court on December 31st 1991 has given a Judgment that all mining activity within the park be stopped (Tarun Bharat Sangh NGO litigation.
  + More than 400 mines were shut immediately. But, still illegal mining is in progress,. (May6, 2002 Supreme Court ordered to ban the illegal mining).
  + About 200 open cast mining and quarrying centers in Udaipur. About half of which are illegal are involved in stone mining have caused many adverse impacts on environment.
  + Uranium mining in Nalgonda –AP, with the pathetic condition of Jaduguda Uranium mines in Jharkhand where there is black history of massive deaths and devastation has outraged the public, who do not want it to be repeated in Nalgonda. The fate of the proposed mining is yet to be decided. (It is 10 km from Nagarjun Sagar and 4km from Akkampalli reservoir a new source of drinking water to Hyderabad.)

#### Remedial Measures:-

* + In order to minimize the adverse impacts of mining it is desirable to adopt eco-friendly mining technology.
  + The low-grade ores can be better utilized by using Microbial leaching technique.
  + The bacterium Thiobacillus ferroxidans has been successfully and economically used for extracting gold embedded in iron sulphide etc.

# FOOD-RESOURCES

* + We have thousands of edible plants and animals, of which only three dozen types constitute the major food of humans.
  + The main food resources include wheat, rice, maize, potato, barley, oats sweet potato, sugarcane, pulses, sorghum, millets etc.
  + The Food and Agriculture Organization (FAO) of United Nations estimated that average caloric intake on a global scale is 2500 calories per day.
  + Besides the minimum caloric intake are also need, proteins minerals etc. Deficiency or lack of nutrition often leads to malnutrition resulting in several diseases.

### IMPACTS OF MALNUTRITION

|  |  |  |  |
| --- | --- | --- | --- |
| **DEFICIENCY** | **HEALTH EFFECTS** | **NO.OFCASES** | **DEATH PER**  **YEAR(in million** |
| Proteins & calories | Kwashiorkor & marasmus | 750-1million | 15-20 |
| Iron | Anemia | 350 | 0.75-1 |
| Iodine | Goitre, cretinism | 150million,6million | - |
| Vitamin A | Blindness | 6million | - |

#### World food problems:-

* + During the last 50 years world grain production has increased almost three times.
  + But at the same time population growth increased at such a rate in less developed countries (LDC’s) that outstripped food production.
  + Every year 40 million people (50% of which are young children) die of under nourishment and malnutrition.
  + Although India is the third largest producer of staple food, an estimated 300 million Indians are still under nourished.

**IMPACTS OF OVER-GRAZING AND AGRICULTURE**

**OVERGRAZING AGRICULTURE**

SOIL EROSSION LAND DEGRADATION LOSS OF USEFUL SPECIES TRADITIONAL MODERN

IMPACTS DUE TO **HYV** FERTILIZER IMPACTS PESTICIDEIMPACTS WATER LOGGING SALINITY PROB

MICRO NUTRITENTIMBALANCE NITRATE POLLUTION EUTRIFICATION

FOREST CLEARING

SOIL EROSSION

DEPLETION OF NUTRIENTS

PEST RESISTANT PROBLEM LOSS OF NONTARGET SPECIES BIOLOGICALMAGNIFICATION

#### Overgrazing Impacts:-

* + Land degradation-Due to overgrazing the humus content of the soil decreases and overgrazing leads to organically poor, dry, compacted soils.
  + Soil erosion – Overgrazing removes the vegetal cover of the soil. The soil becomes exposed and gets eroded by the action of wind and water currents.
  + Loss of useful species - Overgrazing adversely effects the composition of plant population and their regeneration capacity. Some livestock keep on overgrazing on the same species also. –
  + As a result of overgrazing vast areas in AP. And Meghalaya are getting invaded by thorny bushes, weeds etc.
  + Traditional Agriculture impacts:-Deforestation – the slash and burn of trees in forests for shifting cultivation results in loss of forests.
  + Soil erosion – cleaning of fo0rest cover exposes the soil to wind and rain, there by resulting in loss of top fertile soil.
  + Depletion of nutrients – During slash and burn the organic matter in the soil gets destroyed and most of the nutrients are taken up by the crops within a short period of time, thus making the soil nutrients poor.

#### Modern Agriculture impacts:-

* + HYV: – The uses of high yielding varieties encourage monoculture. In case of an attack by some pathogen, there is total devastation of the crop by the disease.
  + Fertilizer related impact:-
    - Most of the chemical fertilizers used in modern agriculture are N,P,K. Excess use of these fertilizers to boost up the crop causes micronutrient imbalance.
    - Nitrogenous fertilizers applied in the field leach deep in to the soil and contaminate ground water. Excess concentration of nitrogen i.e. >25 mg per liter causes serious health hazards like ‘Blue Baby Syndrome” or “Methaemoglobinemia”.
    - A large portion of N& P used fields is washed off and reach the water bodies causing over nourishment of lakes, a process known as “Eutrophication”. due to these lakes get invaded by algal blooms. These are often toxic and badly affect the food chain. Very soon the water gets depleted of dissolved oxygen. Thus affects aquatic fauna. Thus due to excessive use of fertilizers the lake ecosystem gets degraded.
  + Pesticide related problem:-
    - Pest resistance problem – some individuals of pest servive usually even after pesticide spray. The survivors give rise to highly resistant generations called “Super pests,”
    - Loss of non-target organisms:- Many of the insecticides not only kill the target organisms, but also the non/targeted species.
    - Many pesticides are non-degradable and accumulate in food chain, a process called biological – magnification, which is very harmful.
    - Water logging: – over irrigation of crops for good growth leads to water – logging. Excess accumulation of water forms a continuous column with water

table. This depletes soil-air. Due to his the roots of plants do not get adequate air for respiration, which results in fall of yielding.

* + Salinity problem:-
    - Canal water or ground water contains dissolved salts. Excessive irrigation with these waters causes salinity problem. Under dry conditions the water evaporated leaving behind salts in upper soil profile. This causes stunted plant growth and lowers crop yield. Thousands of ha of land area in Haryana and Punjab are affected by soil salinity and alkalinity.

## Energy resources

#### Growing energy needs:-

* + Development in different sectors relies largely upon energy.
  + Agriculture, industry, mining, transportation, lighting, cooling and heating in buildings all need energy.
  + With the demands of growing population the world is facing further energy deficit.
  + In developed countries like U.S.A and Canada an average person consumes 300 GJ per year.
  + By contrast, an average man in a poor country like Bhutan, Nepal or Ethiopia consumes less than 1 GJ per year.
  + This clearly shows that our life-style and standard of living are closely related to energy needs.

#### Renewable and Non-Renewable energy sources:-

* + Life on earth depends upon a large number of things and services provided by nature, which are knows as energy resources.
  + Energy Resources are of two kinds.
* **Renewable resources**: which are in exhaustive and can be regenerated within a given span of time eg. Forests, wildlife, wind energy, biomass energy etc. Solar energy is also a renewable form of energy as it is an inexhaustible source of energy.
* **Non-renewable resources** which cannot be regenerated eg. Fossil fuels like coal, petroleum etc. Once we exhaust these reserves, the same cannot be replenished.

#### Renewable energy resources:-

Solar energy:

* + Sun releases enormous quantity of energy in the form of heat and light.
  + The solar energy received by the near earth space is approximately1.4 kJ/s/m2 known as solar constant.
  + Now we have several techniques for harnessing solar energy.
  + Solar heat collectors, solar cells, solar cooker, solar water heater, solar furnace and solar power plant are some important solar energy harvesting devices.

Wind Energy:

* + The high speed winds have a lot of energy in them as kinetic energy due to their motion.
  + Wind energy is very useful as it does not cause any air pollution.
  + After the installation cost, the wind energy is very cheap.

Hydro power:

* + The water flowing in a river is collected by constructing a big dam where the water is stored and allowed to fall from a height.
  + The blades of turbine located at the bottom of the dam move with the fast moving water which in turn rotates the generator and produces electricity.
  + Hydro power does not cause any pollution.
  + Hydro power projects help in controlling floods, used for irrigation, navigation etc. Tidal energy:
  + Ocean tides produced by gravitational forces of sun and moon contain enormous amounts of energy.
  + The tidal energy is harnessed by constructing a tidal barrage.
  + During high tide, the water flows into the reservoir of the barrage and turns the turbine, which in turn produces electricity by rotating the generators.
  + During low tide, when the sea-level is low, the sea water stored in the barrage reservoir flows out into the sea and again turns the turbines.

Ocean thermal energy (OTE):

* + The energy available due to the difference in the temperature of water at the surface of the tropical oceans and at deeper levels is called OTE.
  + This energy is used to boil liquid like ammonia.
  + The high pressure vapours of the liquid formed by boiling are then used to turn the turbine of a generator and produce electricity.

Geothermal energy:

* + The energy harnessed from hot rocks present inside the earth is called geothermal energy.
  + Sometimes the steam or boiling water underneath the earth does not find any place to come out.
  + We can drill a hole up to the hot rocks and by putting a pipe in it make the steam or hot water gush out through the pipe at high pressure which turns the turbine of a generator to produce electricity.

Biomass energy**:**

* + Biomass is the organic matter produced by the plants or animals which include wood, crop, residues, cattle dung agricultural wastes etc.
  + The burning of biogas cause air pollution and produce a lot of ash.
  + It is therefore more useful to convert biomass into biogas or bio fuels. Biogas:
  + Biogas is a mixture of methane, carbon dioxide, hydrogen and hydrogen sulphide.
  + Biogas is produced by anaerobic degradation of animal wastes in the presence of water.
  + Anaerobic degradation means break down of organic matter by bacteria in the absence of oxygen.
  + Biogas has many advantages. It is clean, non-polluting and cheap.
  + There is direct supply of gas from the plant and there is no storage problem Bio fuels:
  + Biomass can be fermented to alcohols like ethanol and methanol which can be used as fuels.
  + Gasohol is common fuel in Brazil and Zimbabwe for running cars and buses.
  + Methanol is very useful since it burns at a lower temperature than gasoline or diesel.
  + Due to its high calorific value, hydrogen can serve as an excellent fuel.
  + Moreover it is non-polluting and can be easily produced.
  + Presently H2 is used in the form of liquid hydrogen as a fuel in spaceships

#### Non -Renewable energy resources:

Coal:

* + Coal was formed 255-250 million years ago in the hot, damp regions of the earth during the carboniferous age.
  + The ancient plants along the banks of rivers were buried after death into the soil and due to the heat and pressures gradually got converted into peat and coal over million years of time.
  + When coal burnt it produces carbon dioxide, which is a green house gas responsible for causing enhanced global warming.

Petroleum:

* + It is the life line of global economy.
  + Petroleum is a cleaner fuel as compared to coal as it burns completely and leaves no residue.
  + It is also easy to transport and use.
  + Crude petroleum is a complex mixture of alkane hydrocarbons.
  + Hence it has to be refined by the process of fractional distillation, during which we get large variety of products namely, petroleum gas, kerosene, petrol, diesel, fuel oil, lubricating oil, paraffin wax etc.
  + The petroleum gas is easily converted to liquid form under pressure as LPG. Natural gas:
  + It is mainly composed of methane with small amounts of propane and ethane.
  + It is used as a domestic and industrial fuel in thermal power plants for generating electricity.
  + It is used as a source of hydrogen gas in fertilizer industry and as a source of carbon in tier in

Nuclear energy**:**

* + Nuclear energy is known for its high destructive power.
  + Nuclear energy can be generated by two types of reactions:
* *Nuclear fission***:** It is the nuclear reaction in which heavy isotopes are split into lighter nuclei on bombardment by neutrons. Fission reaction of U235 is given below.

92U235 +0n1 → 36Kr92 + 56Ba141 + 3 0n1 + energy

* *Nuclear fusion:* Here two isotopes of a light element are forced together at extremely high temperatures (1 billion ºC) until they fuse to form a heavier nucleus releasing enormous amount of energy in the process.

1H2+1H2 → 3He2+0n1+energy

* + Nuclear energy has tremendous potential but any leakage from the reactor may cause devastating nuclear pollution. Disposal of the nuclear waste is also a big problem.

## Land Resources

* + We depend upon land for our food, fibre, and fuel wood.
  + About 200-1000 years are needed for the formation of one inch or 2.5 cm soil, depending upon the climate and the soil type.
  + But, when rate of erosion is faster than rate of renewal, then the soil becomes a non- renewable resource

#### Land degradation:

* + With increasing population growth the demands for land for producing food, fibre and fuel wood is also increasing.
  + Hence there is more and more pressure on limited land resources which are getting degraded due to over-exploitation.
  + Soil erosion, water-logging, salinization and contamination of the soil with industrial wastes like fly-ash, press-mud or heavy metals all cause degradation of land.

#### Man induced landslides

* + Various anthropogenic activities like hydroelectric projects, large dams, reservoirs, construction of roads and railway lines, construction of buildings, mining etc are responsible for clearing of large forested areas.
  + Earlier there were few reports of landslides between Rishikesh and Byasi on Badrinath Highway area. But, after the highway was constructed, 15 landslides occurred in a single year.
  + During the construction of roads, mining activities etc. huge portions of fragile mountainous areas are cut or destroyed by dynamite and thrown into adjacent valleys and streams.
  + These land masses weaken the already fragile mountain slopes and lead to landslides.
  + They also increase the turbidity of various nearby streams, thereby reducing their productivity.

#### Soil erosion:

* + Soil erosion is defined as the movement of soil components, especially surface litter and top soil from one place to another.
  + Soil erosion results in the loss of fertility because it is the top soil layer which is fertile.
  + There are two types of agents which cause soil erosion. They are climatic agents and biotic agents
  + **Climatic Agents – Water and Wind:** Water affects soil erosion in the form of rain. Water induced soil erosion is of following types:
* Sheet erosion
* Rill erosion
* Gully erosion
* Slip erosion
* Stream bank erosion

Wind erosion is responsible for the following three types of soil movements:

* Saltation
* Suspension
* Surface creep

#### Biotic Agents:

* + Excessive grazing, mining, and deforestation are the major biotic agents responsible for soil erosion.
  + Deforestation without reforestation, overgrazing by cattle, surface mining without land reclamation, irrigation techniques that lead to salt build- up, water logged soil, make the top soil vulnerable to erosion

#### Soil conservation practices:

* + In order to prevent soil erosion and conserve the soil the following practices are employed.

Conventional till farming:

* + In traditional method the soil is broken up and smoothed to make a planting surface.
  + Conservational till farming, popularly known as no-till-farming causes minimum disturbance to the top soil.
  + Here special tillers break up and loosen the subsurface soil without turning over the top soil.
  + The tilting machines make slits in the soil and inject seeds, fertilizers, and little water in the slit, so that crop grows successfully.

Contour farming:

* + On gentle slopes, crops are grown in rows across, rather up and down also knows as contour farming.
  + It helps to hold soil and slow down loss of soil through run-off water.

Terracing:

* + Still steeper slopes are converted into a series of broad terraces which run across the contour.
  + Terracing retains water for crops at all levels and cuts down soil erosion. Strip cropping:
  + Here strops of crops are alternated with strips of soil saving crops like grasses or grass-

legume mixture.

* + Whatever run-off comes from the cropped soil is retained by the strip of cover- crop and this reduces soil erosion.

Alley cropping**:**

* + It is a form of inter – cropping in which crops are planted between rows of trees or shrubs. This is also called Agro forestry.
  + Even when the crop is harvested, the soil is not fallow because trees and shrubs still remain on the soil holding the soil particles and prevent soil erosion.

#### Desertification:

* + Desertification is characterized by loss of vegetal over,
  + Desertification leads to the conversion of irrigated croplands to desert like conditions in which agricultural productivity falls..

#### Causes of Desertification:

* + The major man made activities responsible for desertification are as follows.
* Deforestation
* Overgrazing
* Mining and quarrying

**Unit-2 A** ECOSYSTEM

## Structure of an ecosystem

The structure of an ecosystem explains the relationship between the abiotic (nonliving) and the biotic (living) components.

#### ​Biotic Structure

* + The plants, animals and microorganisms present in an ecosystem from the biotic component.
  + These organisms have different nutritional behaviour and status in the ecosystems and are accordingly known as Producers or Consumers, based on how they get their food.

#### ​A biotic structure

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

#### Producers:

* + Producers are mainly the green plants, which can synthesize their food themselves by making use of carbon dioxide present in the air and water in the presence of sunlight by involving chlorophyll, the green pigment present in the leaves, through the process of photosynthesis. These are also known as photo autotrophs (auto=self; troph=food, photo=light).
  + There are some microorganisms also which can produce organic matter to some extent through oxidation of certain chemicals in the absence of sunlight. These are known as chemosynthetic organisms or chemo-autotophs.

#### Consumers:

* + All organisms which get their organic food by feeding upon other organisms are called consumers. Consumers are further classified as

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

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

Omnivores: They feed on both plants and animals. Eg: human, rat, fox, many birds. Detritivores: They feed on the parts of dead organisms, wastes of living organisms, their castoffs and partially decomposed matter e.g. beetles, termites, ants, crabs, earthworms etc.

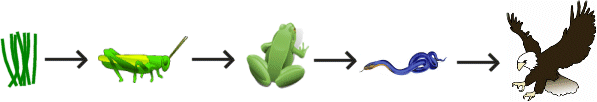
#### Decomposers:

* + Decomposers derive their nutrition by breaking down the complex organic molecules to simpler organic compounds and ultimately into inorganic nutrients. Various bacteria and fungi are decomposers.

## Function of an ecosystem

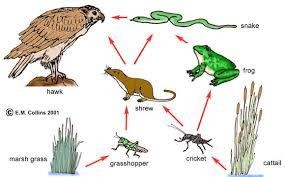
#### Food Chain:

* + The sequence of eating and being eaten in an ecosystem is known as food chain. All organisms, living or dead are potential food for some other organism and thus, there is essentially no waste in the functioning of a natural ecosystem. A caterpillar eats a plant leaf, a sparrow eats the caterpillar, a cat or a hawk eats the sparrow and when they all die, they are all consumed by microorganism like bacteria or fungi which break down the organic matter and convert it into simple inorganic substances that can again be used by the plants.
    - Grass - grasshopper – frog – snake – hawk.
    - Phytoplankton – water fleas – small fish – big fish.



#### Food Web:

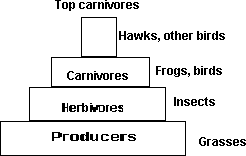
* + Food web is a network of food chains where different types of organisms are connected at different trophic levels, so that there are a number of options of eating and being eaten at each trophic level.



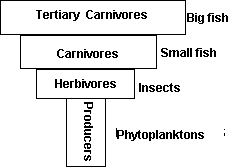
#### Ecological Pyramids:

* + Graphic representation of trophic structure and function of an ecosystem, starting with producers at the base and successive trophic levels forming the apex is known as an ecological pyramid. These are three types.

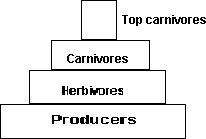
Pyramid of numbers: It represents the number of individual organisms at each trophic level.



Pyramid of biomass: It is based upon the total biomass at each trophic level in a food chain.

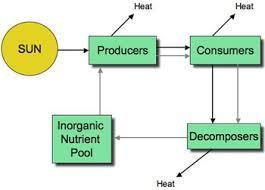


Pyramid of energy: The amount of energy present at each trophic level is considered for this type of pyramid.



#### Energy Flow in an Ecosystem:

* + Flow of energy in an ecosystem takes place through the food chain and it is this energy flow which keeps the ecosystem going. The most important feature of this energy flow is that it is unidirectional or one-way flow. Unlike the nutrients, (like carbon, nitrogen, phosphorus etc.) energy is not reused in the food chain. Also, the flow of energy follows the two laws of Thermodynamics



## Ecological Succession

* + Ecological succession is defined as an orderly process of changes in the community structure and function with time mediated through modifications in the physical environment and ultimately culminating in a stabilized ecosystem known as climax.
  + Ecological successions starting on different types of areas are named differently as follows:

**Hydrarch or Hydrosere**: Starting in watery area like pond, swamp, bog.

**Mesarch:** starting in an area of adequate moisture.

**Xerarch or Xerosere**: Starting in a dry area with little moisture.

Process of Succession:

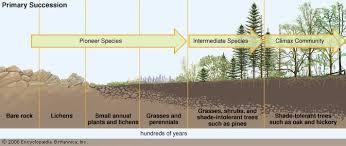
* + The process of succession takes place in a systematic order of sequential steps as follows: Nudation: It is the development of a bare area, without any life form. The bare area may be caused due to several anthropogenic activities.

Invasion: It is the successful establishment of one or more species on a bare area through dispersal or migration, followed by ecesis or establishment.

Competition: As the number of individuals grows there is competition, for space, water and nutrition. They influence each other in a number of ways, known as coaction.

Reaction: The living organisms have a strong influence on the environment which is modified to a large extent and this is known as reaction.

Climax: The succession ultimately culminates in a more or less stable community called climax which is in equilibrium with the environment.



**Unit-2 B** BIODIVERSITY

#### Definition:

* + Biodiversity refers to the variety and variability among all groups of living organisms and the ecosystem complexes in which they occur. It is classified as

Genetic diversity:

* + Genetic Diversity is the basic source of biodiversity. The genes found in organisms can form enormous number of combinations each of which gives rise to some variability.
  + For example, all rice varieties belong to the species oryza sativa, but there are thousands of wild and cultivated verities of rice which show variations at the genetic level and differ in their color, size, shape, aroma and nutrient content of the grain. This is the genetic diversity of rice

Species diversity:

* + Species Diversity is the variability found within the population of a species or between different species of a community.

Ecosystem diversity:

* + Ecosystem diversity is the diversity of ecological complexity showing variations in trophic structure, food-webs, nutrient cycling etc.
  + The ecosystems also show variations with respect to physical parameters like moisture, temperature, altitude, precipitation etc.

## Bio-geographical classification of India

Biogeography comprising of phyto-geography and zoogeography deals with the aspects of plants and animals. There are around ten bio-geographical regions in India.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S.NO | Bio-geographic Zone | Biotic province | Flora | Fauna |
| 1 | Trans Himalayan zone | Upper Himalayas | Deodars | Snow leopard, Musk deer |
| 2 | Himalayan | North-West Himalayas West Himalayas  central Himalayas East Himalayas | Deodars, pine | Black buck and Tibetan ass |
| 3 | Desert | Thar | Date palm | Snakes &  Salmanders |
| 4 | Semi arid | Gujarat | Zyzipus & Date palm | Asiatic lion |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5 | Gangetic plain | Ganga zone | Mango, Jack, Pepel, Baniyan, Bamboo | Elephants, Tigers, Leopards, Bears, Antelops, Sloth, crocodiles |
| 6 | North-East | Brahmaputra | Spices, Pepel, Baniyan | Rhino |
| 7 | Deccan | South India | Neem, Eucalyptus, Teak | Tiger, Deer, |
| 8 | Western ghats | South west India | Teak, Salwood,  Oak | Snakes, Tortoise,  Elephants |
| 9 | coastal | South India coast | Cashew, coconut, Casurina | Turtles, Aligators |
| 10 | Island | Andaman and Nicobar | Spices, Cashew | Dolphin |

## Hot –Spots of Indian diversity

* + **Biological diversity** – or biodiversity – is the term given to the variety of life on Earth. It is the variety within and between all species of plants, animals and micro-organisms and the ecosystems within which they live and interact.
  + The political boundaries of India encompass a wide range of eco-zone like desert, high mountains, highlands, tropical and temperate forests, swamplands, plains, grasslands, areas surrounding rivers, as well as island archipelago. It hosts 3 biodiversity hotspots (i.e) the Western Ghats, the Himalayas and the Indo-Burma region.

|  |  |  |  |
| --- | --- | --- | --- |
| Hot-spot zone | Biotic province | Important Flora | Important Fauna |
| Indo- Burma | Brahmaputra valley & North- Eastern hills | Bamboo, Sal, Jack fruit, tuna  Chestnut, Castor | Elephant, Rhinoceros, Yalk, Deer, Porcupine, White-eared night heron, Grey- crowned Crocias |
| Western Ghats | Malabar Coast, Western Ghat Mountains | Sheesham, Peepal, Tuna, Bahera, | Tortoise, Frog, Lizards, Snakes, Elephants |
| Himalayan | North-west Himalayas, West Himalayas, Central Himalayas, East Himalayas | Pine, Deodar, Cork tree, Sal, Butea, | Wild bear, Sambar, Leopard, Sikkim stag, Musk deer. |

## Values of Bio-diversity

* + The value of biodiversity in terms of its commercial utility, ecological services, social and aesthetic value is enormous.

Consumptive use value:

* + These are direct use values where the biodiversity product can be harvested and consumed directly e.g. fuel, food, drug, fibre etc. About 75% of the world’s population depends upon plants or plant extracts for medicines. Our forests have been used since ages for fuel wood.

Productive use values:

* + These includes the products like tusks of elephants, musk musk deer, silk from silk- worm, wool from sheep, fur of many animals, lac from lac insects etc.

Social value:

* + These are the values associated with the social life, customs, religion and psycho-spiritual aspects of the people.

Ethical value:

* + It involves ethical issues like “all life must be preserved”. It is based on the concept of “live and let Live”.

Aesthetic value:

* + People from far and wide spend a lot of time and money to visit wilderness areas where they can enjoy the aesthetic value of biodiversity.

Option values:

* + These values include the potential of biodiversity. There is a possibility that we may have some potential cure AIDS or cancer existing within the depths of a marine ecosystem or a tropical forest.

## Threats to Biodiversity

* + Extinction or elimination of a species is a natural process of evolution. In the geologic period the earth has experienced mass extinctions. During evolution, species have died out and have been replaced by others. The process of extinction has become particularly fast in the recent years of human civilization. The major causes of extinction is

Loss of Habitat:

* + Destruction and loss of natural habitat is the single largest cause of biodiversity loss. Billions of hectares of forests and grasslands have been cleared over the past 10,000 years for conversion into agriculture lands, pastures, settlement areas or development projects.

Poaching:

* + Illegal trade of wildlife products by killing prohibited endangered animals i.e. poaching is another threat to wildlife. Despite international ban on trade in products from endangered

species, smuggling of wild life items like furs, hides, horns, tusks, live specimens and herbal products worth millions of dollars per year continues.

Man-Wildlife conflict :

* + Instances of man animal conflicts keep on coming to lime light from several states in our country. Dwindling habitats of tigers, elephants and bears due to shrinking forest cover compels them to move outside the forest and attack the field or sometimes even humans. In Sambalpur, Orissa 195 humans were killed in the last 5 years by elephants.
  + In retaliation the villagers killed 98 elephants and badly injured 30 elephants.
  + Several instances of killing of elephants in the border regions of Kote-Chamarajanagar belt in Mysore have been reported recently.
  + In the early 2004, a man-eating tiger was reported to kill 16 Nepalese people and one 4- year old child inside the Royal Chitwan National Park of Kathmandu.

## Conservation of Biodiversity

* + The enormous value of biodiversity due to their genetic, commercial, medical, esthetic, ecological and optional importance emphasizes the need to conserve biodiversity. There are two approaches of biodiversity conservation:

In situ conservation (within habitat):

* + This is achieved by protection of wild flora and fauna in nature itself. At present in our country we have:

7 major Biosphere reserves: Nanda Devi (U.P.), Nokrek (Meghalaya), Manas 80 National Parks:

|  |  |  |
| --- | --- | --- |
| National park | State | Wild life |
| Khaziranga | Assam | Single horned Rhino |
| Gir | Gujarat | Asiatic lion |
| Bandipur | Karnataka | Elephants |
| Periyar | Kerala | Elephants, Tigers |
| Sariska | Rajasthan | Tiger |

420 wild-life sanctuaries and 120 Botanical gardens

They totally cover 4% of the geographic area.

Ex situ conservation (outside habitats):

* + This is done by establishment of gene banks, seed banks, zoos, botanical gardens, culture collections etc. In India we have

NBPGR: National burea of plant genetic research institute NBAGR: National burea of animal genetic research institute Tissue culture labs. Working towards Ex-situ conservation units.

**Unit-3** POLLUTION

Addition of different harmful gases to the environment (or) atmosphere which adversely affect the quality of atmosphere and make it unfit for life is called pollution.

### AIR POLLUTION

Air is a mixture of gases. The presence of different harmful substances in air which causes injury to Human life and other living beings is called air pollution.

MAJOR AIR POLLUTANTS

PRIMARY POLLUTANTS

SECONDARY POLLUTANTS

PARTICULATE POLLUTANTS

DUST, SMOKE, MIST,POLLENGRAINS etc

GASEOUS POLLUTANTS

CO,CO NO SO ,CFC'S etc

2, X, X

ELECTRO MAGNETIC

RADIATIONS

-Major air pollutants are of two type’s i.e. primary air pollutants & secondary air pollutants. Secondary air pollutants are under the influence of Electromagnetic radiations from the sun.

* Rapid industrialization, motorization, power production from thermal and atomic plants, domestic fuels are the major sources for producing pollutants.
* Coal & cement factories release dust; power plants release fly ash, iron oxides, zinc oxides.
* Industrial fumes produce mist & fog.
* Vehicles release smoke, so2, No2, Co and chlorine.
* Air pollution causes diseases like asthma, bronchitis, lung cancer, irritation of eyes, heart& brain damage.

### CARBON MONOXIDE:

-It is colourless, odourless, highly toxic gas.

* It is released from burning of coal, gasoline, tobacco products.
* It is very harmful to humans causing serious heart and respiratory problems.
* It causes headache and irritation in mucous membranes.

-It combines with haemoglobin and forms carboxyhaemoglobin.

Co + Hb → COHb

* Increase in the level of COHb (100 ppm) leads to coma and death of humanbeings.
* Co has affinity for haemoglobin 210 times more than oxygen.

### CARBON DI OXIDE:

* It is the gas that is released from burning of fossil fuels, domestic cooking etc.
* Heavy exposition to co2 causes respiratory problems, irritation in respiratory track and reddishness of eyes.
* Excess flow of co2 into the atmosphere causes an increase in global temperature.

### NITROGEN OXIDES:

* The important oxides of nitrogen like nitrogen oxide and nitrogen dioxide are emitted from motor vehicles, burning of soft coal and acid manufacturing industries.
* Nitrogen oxides effect the human life seriously.
* It causes bronchitis in humans.
* It causes respiratory problems.
* Nitrogen oxides dissolve in rain water and causes acid rains.
* It also causes photo chemical smog.
* Smokers may readily develop lung diseases and cancers as the cigarettes contain 330 to 350 ppm nitrogen.

### SULPHUR OXIDES:

* It is a colorless gas with suffocating and strong pungent odor.
* It is released from burning of fossil fuels, thermal power stations, smelting industries , fertilizer industries, petroleum refineries and automobiles.
* SO2 causes irritation of eyes and respiratory tract.
* IT causes broncho- constrictions in asthmatics.
* SO2 is also involved in erosion of building materials as lime stone marbles.
* It deteriorate the adjoining historic monuments.
* It causes bleaching of leaves, chlorosis, injury and necrosis of leaves.
* It causes bronchitis, irritation in throat, headache, vomtings and even death.
* In atmosphere it combines with oxygen and water to form sulphuric acid.
* This sulphuric acid in atmosphere dissolves in rain water and causes acid rains.

### CHLORO FLUORO CARBONS:

* These are widely used as coolants in air conditioners and refigirators.
* These are also used in fire extinguishing equipments.
* These escapes as aerosols.
* These are also release from jet planes.
* These depletes ozone layer.
* ​

### FLUORO CARBONS:

* These are emitted from industrial process of phosphate fertilizers, aluminium, ceramics etc.
* It causes fluorosis which is a major health problem.

### HYDRO CARBONS:

* These are emitted from three wheelers.
* They have carcogenic effects on lungs.
* It causes cancer .Benz –a- pyrene is potent cancer inducing hydro carbon.
* Benzo-a- pyrene (BAP) : a house wife using wood as fuel inhales BAP equivalent to 20 packers of cigarette a day.

### COTROL OF AIR POLLUTION:

* Siting of industries after proper environ mental impact assessment studies.
* Modification of process and or equipments.
* Use of appropriate materials.
* Using low sulphur coal in industries.
* Using mass transport systems, bicycles etc.
* Shifting to less polluting fuels.
* Using biological filters and bio scrubbers.
* Planting more trees.

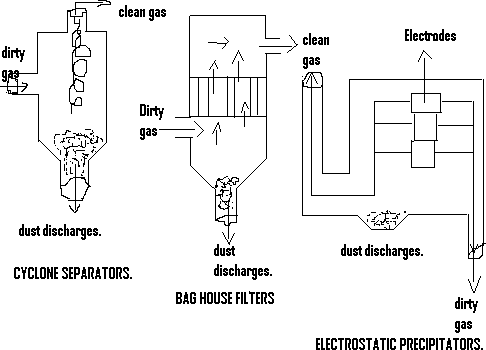
**Reduction of air pollutants at source**

### CYCLONES:

* It consists of cylinder with an inverted cone.
* The gas with particles in it enters tangentially at the top of the cylinder and spins.
* Due to centrifugal force, the particles strike the wall of cylinder.
* Then particles fall in the hopper due to gravity were removed.

### BAG HOUSE FILTERS:

* It consists of a large number of filter bags made of fabric.
* Dry gas is passed through the filter bags.
* The dust particles gets deposited on the inner surface of the bag filters and forms a cake which can be removed by shaking.



### ELECTRO STATIC PRECIPITATORS:

* These are plate type or cylinder type.
* Vertical wires or plates is hung along the axis of the cylinder.
* High negative voltage is applied to the wire.
* Dust particles while passing get negatively charged and are collected on the positive charged surface.
* The deposited dust particles fall down in the dust collectors are removed by scrapping.

### WATER POLLUTION

Water is very important to life. Water covers about 70% of earth’s surface. If water is polluted, it affect the entire life on earth. Water is vital to our basic existence, but due to technological revolution, it is facing considerable threats.

Chemical and toxic wastes from industries, residues of fertilizers, pesticides and insecticides from agriculture uses, residues from washing and cleaning pollute water.

The primary sources of water pollution are of three types. They are

1. Industrial wastes
2. Agricultural wastes
3. Sewage wastes.

### INDUSTRIAL WASTES:

* A wide variety of both, inorganic and organic pollutants are present in effluents.
* The pollutants include oils, grease, plastics, plasticizers, metallic wastes, phenols, acids, salts, dyes , cyanides etc. Many of these are not readily degradable and causes pollution.
* H2SO4 as acid wastes from coal mines is a serious pollutant that increases the hardness of water, has serious affect on living organisms.

### AGRICULTURAL WASTES:

* It includes the pesticides that sprayed on crops, as well as sediments, fertilizers and plant & animal debris.
* These are carried out to water bodies during rain fall.
* Since these wastes are organic these increases the BOD of water.
* In fresh water and marine water systems they enter the food chain, undergo concentration in non target organisms and increase in animal tissues to alarming levels.(biomagnifications)
* Through ground water systems they may also enter the drinking water.
* In 1953 people of Japan suffered from Minimata disease due to consumption of fish contaminated with methyl mercury.
* Nitrate when present in excess in drinking water causes Blue baby syndrome or methamoglobinemia.
* Excess of fluorides in water causes defects in teeth and bones called fluorosis.

### SEWAGE WASTES:

* Sewage is the water borne waste derived from house and animal or food processing plants.
* It includes excreta, paper, cloth, soap, etc.
* This water becomes unfit for drinking.
* As the amount of organic matter increases the micro-organisms that use the nutrients rapidly increase.
* The inorganic nutrients released by decomposition serve as nutrients for algae which form waterblooms .(Eutrification)
* This consume most of available oxygen and decreases o2 level in water.
* Eventually aerobic organisms die with lack of oxygen.
* Pollution due to heavy metal cadmium accumulated in rice caused the diseased in Japan called Itai-Itai.

**Eutrification:**

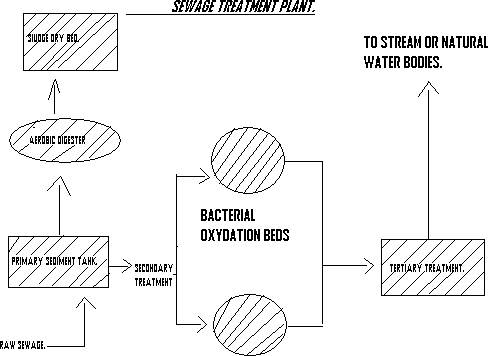
* Due to addition of domestic waste phosphates, nitrates etc. from wastes or their decomposition products and nitrate ions. Thus with the passage of these nutrients through such organic wastes, then water bodies become highly productive or eutrophic and the phenomenon as eutrophication.

### WASTE WATER TREATMENT:

* The purpose of waste water treatment is to remove or reduce organic and in organic substances, nutrients, toxic substances, kill pathogenic organisms, etc.
* The waste water treatment plant contains primary, secondary, and tertiary tanks.

**Primary tank**: it involves the physical removal of debris, large particles with the help of screen. The waste water after screening is passed to the grit chamber where sand grit and other solids settle down. The floating particles are passed to anaerobic digester. Then the materials digested are passed to sludge drying bed where the sludge is dried and removed.

**Secondary tank**: it is the biological process which involves micro organisms. It removes up to 90% of BOD and 90% of suspended solids. Biodegradable oxygen demanding wastes are stabilized.



**Tertiary tank:** After the primary and secondary treatment many undesirable substances remained are to be removed. The materials to be removed include nitrates, phosphates, color, bacteria, viruses, pesticides. Chlorination of water is generally done to kill harmful bacteria and viruses. The sludge produced after this process is used as a fertilizer in the fields.

### SOIL POLLUTION

* Industrial, agricultural and urban wastes are major pollutants of soil.
* Industries like textile, power plants, pharmaceuticals, cement, rubber, plastics food processing release wastes on the land.
* Industrial solid wastes like paper plastic, metal, glass, ash etc are also dumped on the land, as a result land gets polluted .

Case study: the love canal which is dug by Willam love was used to dump sealed steel drums of chemicals in 9153.The dump site was sold to city board of education which built an elementary school. In 1976 the residents started complaining of foul smelling. Nearly 26 toxicants were identified which districted the total village.

* Urban wastes like garbage, hospital wastes, hotel wastes are also damage land.
* Plastics and carry bags dumped on open land pollute land.
* This decreases the ground water level as the plastic obstructs the sinking of rain water.
* Plastic pollutants also restrict the plant growth.
* Agricultural effluents increases the soil acidity and becomes unfit for plat growth.
* Strontium -90 gets deposited in the bones and tissues, cause bone cancer.

### CONTROL:

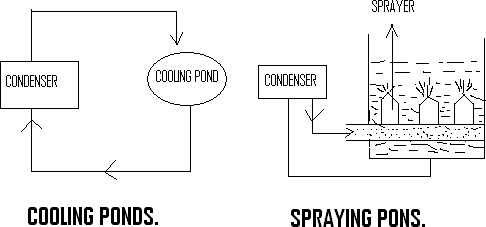
* Toxic pollutants from industries and sewage plants should not be discharged in coastal waters.
* Dumping of toxic , hazardous waste should be banned.
* Oil and grease from service stations should be processed for reuse.
* Oil ballast should not be dumped in to sea.

### THERMAL POLLUTION

* Thermal pollution can be defined as presence of waste heat in the water which can cause un desirable changes in the natural environment.
* Heat producing industries i.e thermal power plants, nuclear power plants, refineries, steel mills etc are the major sources of thermal pollution.
* Thermal pollution affects the dissolved oxygen content of water.
* High temperature becomes a barrier for oxygen penetration.
* Toxicity of pesticides , detergents and chemicals in the effluents increases with increase in temperature.
* Discharge of heated water near the shores can disturb spawing and kills young fishes.

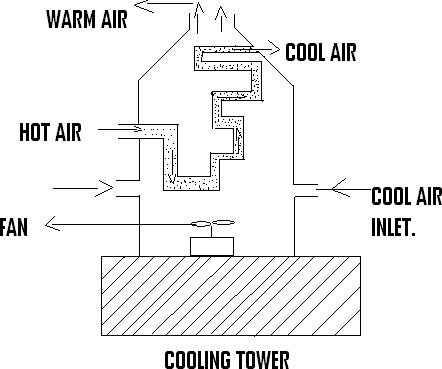
### CONTROL

* COOLING PONDS: Water from condensers is stored in ponds where natural evaporation cools theater and then discharged to nearby water body.



SPRAY PONDS: The water from the condenser is received in spray ponds. Here the water is sprayed through the nozzles where fine droplets are formed. Heat from these fine droplets is dissipated to the atmosphere.

COOLING TOWERS: The heated water flows in a system of pipes. Air is passed over these hot pipes with fans. There is no water loss in this method.



### NOISE POLLUTION

* Noise can affect the human ear because of its loudness and frequency (pitch).
* Human ear is able to tolerate the sound frequency of 20 Hz.
* Above 85 dB sound frequency is treated as noise.
* The main sources of sound are industrial operations, construction activities, celebrations, and electric home appliances.
* In a noisy areas communication is severely affected.
* It can cause temporary or permanent hearing loss.
* Continuous exposure to noise affects the functioning of various systems of body.
* It may results in hypertension, insomnia (sleeplessness0, gastro intestinal problems, digestive disorders, peptic ulcers, blood pressure, emotional changes etc.

**Control:**

* Heavy vehicles may not be able to ply.
* Noise making machines should kept in container.
* Proper oiling will reduce the noise from machinery.
* Silencer can reduce noise by absorbing sound.
* Planting more trees.

### NUCLEAR POLLUTION

* Radioactive substances are present in nature.
* Nuclear power plants, nuclear accidents, x-rays diagnostic –kit etc are radioactive substances.
* Ionization radiations can affect living organisms by causing harmful changes in the body cells and also changes at genetic level.
* These causes mutations in the DNA.
* Radioisotopes enter the environment during mining of uranium.
* Radioactive **iodine (I131)**
* Accumulates in thyroid gland and causes cancer.
* Strontium-90 accumulates in the bones and causes leukemia or cancer of bone marrow.

Case study- In 1986 Chernobyl nuclear accident occurred in ukarine, due to faulty shutting down the plant. Nearly 5,76,000 people were recorded with thyroid cancer and leukemia. 31 persons killed and 239 people were hosptialised.

Control of pollution:

* Siting of nuclear power plants should be done.
* Proper disposal of wastes from laboratory involving the use of radioactive isotopes should be done.

### ROLE OF AN INDIVIDUAL IN PREVENTION OF POLLUTION

* A small effort made by each individual at his own place will have pronounced effect at the global level.
* It aptly said ”think globally act locally”.
* Use eco friendly products.
* Cut down the use of chloro fluoro carbons.
* Do not use polystyrene cups that have CFC’S molecules.
* Adopt and popularize renewable energy resources.
* Promote Reuse, Recycling and Reduce strategy.
* Use mass transport system.
* Use rechargeable batteries.
* Use organic manure instead of commercial fertilizes.
* Plant more trees, as they absorb many toxic gases

- .

### SOLID WASTE MANAGEMENT

Discharges from houses like metal tins, bags, aluminium cans, glass bottles, waste paper, industrial wastes like rubbish, packing materials acids metals etc are the solid wastes.

Management:

* For waste management we stress on three R’s strategy i.e Reduce, Reuse, and Recycle.

REDUCE: Reduce the demand for any metallic products will decreases the mining of their metal can cause less production of waste.

REUSE: The refillable containers which are discarded after use can be reused. Villagers make silos from waste paper and other waste materials.

RECYCLING: It is the reprocessing of discarded materials in to new useful products. Old aluminium cans and bottles are melted and recast into new cans and bottles.

* ​
* COMPOSTING: Biodegradable gar wastes are allowed to degrade in an oxygen rich medium. Good quality nutrient rich and environmental friendly manure is formed, which improves the soil conditions and fertility.
* ​
* SANITARY LAND FILLS: Garbage is spread out in thin layers, compacted and covered with clay or plastic foam. After degradation which is collected out and used.

Unit-4 **A** GLOBAL PROBLEMS & GLOBAL EFFORTS

# GLOBAL WARMING

Some of the Sun’s rays that penetrate the thick layer of co2 are able to strike the earth and get converted into heat. The heated earth is able to re-rediate this absorbed energy as radiations of longer wave length. Much of this does not pass through co2 layer to outer space but gets absorbed by the co2 and water in the atmosphere and adds the heat that has been already present .Thus earth’s atmosphere heats up. This phenomenon is called Green house effect. CO2 thus acts like a glass of green house on global scale. The average global temperature is 150c.Burning of fossil fuels and large scale deforestation increase green house effect. With the result there will be gradual increase in mean air temperature of several degrees, with consequent melting of polar ice and rise in sea level.

#### Global warming consequences:

* Change in rain fall pattern
* Turning productive lands to deserts.
* Melting of polar ice caps which results in raising sea level.
* Low lying lands may submerge.
* Climate change reports may enhance.
* Affect the ozone layer.

#### Kyoto protocol:

* The Kyoto Protocol is an international [treaty](http://en.wikipedia.org/wiki/Treaty), which extends the 1992 [United Nations](http://en.wikipedia.org/wiki/United_Nations_Framework_Convention_on_Climate_Change) [Framework Convention on Climate Change](http://en.wikipedia.org/wiki/United_Nations_Framework_Convention_on_Climate_Change) (UNFCCC) that commits State Parties to reduce [greenhouse gases](http://en.wikipedia.org/wiki/Greenhouse_gases) emissions, based on the premise that (a) [global warming](http://en.wikipedia.org/wiki/Global_warming) exists and (b) man- made [CO2 emissions](http://en.wikipedia.org/wiki/Carbon_dioxide_in_Earth%27s_atmosphere) have caused it.
* The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005.
* There are currently 192 Parties (Canada withdrew effective December 2012)[[4]](http://en.wikipedia.org/wiki/Kyoto_Protocol#cite_note-UNlist-4) to the Protocol.
* The Kyoto Protocol implemented the objective of the UNFCCC to fight global warming by reducing greenhouse gas concentrations in the atmosphere to 'a level that would prevent dangerous anthropogenic interference with the climate system.
* The Protocol is based on the principle of common but differentiated responsibilities: it puts the obligation to reduce current emissions on developed countries on the basis that they are historically responsible for the current levels of greenhouse gases in the atmosphere.

# OZONE DEPLETION

* Ozone is the other form of oxygen.

O2 + O → O3

* Ozone protects us from harmful uv radiations from sun. The amount of atmospheric ozone is measured by Dobson spectrometer, and is expressed in Dobson units.
* Depletion of ozone causes direct harmful effects.

Cl + O2 → ClO + O

Cl O + → Cl + O

* Reduction of ozone increases the uv rays on earth. Due to this cancer, especially relating to skin melanoma will occurs.
* The other disorders are cataract formation, destruction of aquatic life and vegetation and loss of immunity.

#### Montreal protocol.:

* The Montreal Protocol is an international [treaty](http://en.wikipedia.org/wiki/Treaty) designed to protect the [ozone layer](http://en.wikipedia.org/wiki/Ozone_layer) by phasing out the production of numerous substances that are responsible for [ozone depletion](http://en.wikipedia.org/wiki/Ozone_depletion).
* It was agreed on September 16, 1987, and entered into force on January 1, 1989, followed by a first meeting in [Helsinki](http://en.wikipedia.org/wiki/Helsinki), May 1989.
* As a result of the international agreement, the ozone hole in Antarctica is slowly recovering.
* Due to its widespread adoption and implementation it has been hailed as an example of exceptional international co-operation, with [Kofi Annan](http://en.wikipedia.org/wiki/Kofi_Annan) quoted as saying that "perhaps the single most successful international agreement to date has been the Montreal Protocol.

# ACID RAINS

Mainly the oxides of sulphur and nitrogen released from industries, power plants and automobile exhausts, swept up into atmosprere. They oxidized in to acids.

Sulphuric acid and nitric acid are the two main acids that dissolves in atmospheric water and falls on the ground as acid rains.

Effects of acid rains:

* Acid rains increase soil acidity.
* They affect land flora and fauna.
* They cause acidification of lakes and streams thus affecting aquatic life.
* They affects crop productivity and human health.
* They also corrodes buildings, monuments, statutes and bridges.
* Increase in soil acidity causes the death of bacteria and fungi, It disrupts the ecological balance.

## Unit-4 B ENVIRONMENTAL IMPACT ASSESMENT

THE ENVIRONMENT PROTECTION ACT, 1986

-The act came in to force on nov 19th,1986, the birth anniversary of late prime minister Indira Gandhi, who is the pioneer of environmental protection issues.

-The most important functions of central govt. under this act are:

-To set up standards of quality of air, water (or) soil.

-To set up (or) safe guard for the handling of hazardous substances.

-The prohibition and restrictions on the handling of hazardous substances in the different areas.

-Prohibition and restriction on the location of industries.

Under the Environmental Protection 1986 the state pollution control board have to follow the guide lines like:

-To advise the industries for treating waste water and gases.

-To encourage for recycling and re-use the waste.

-To encourage for the bio-gas.

-To emphasize on the implementation of clean technologies.

WILD LIFE PROTECTION ACT,1972

-The Indian Board of wild life (IBWL) was created in 1952, which after the enactment of the wild life protection act took up.

Activities of this act:

-It defines wild life.

-Providing appointment of wild life advisory board.

-listing the endangered wild life species.

-Prohibition of hunting of endangered species.

-Setting up national parks & sanctuaries.

-Imposes a ban on the trade & commerce in the wild life animals.

-To provide breeding programme for endangered species.

FOREST CONSERVATION ACT,1980

-This act deals with the conservation of forest and related aspects.

-To use the forests only for forestry purpose.

-Conservation of all the types of forests.

-Any illegal activity within the forest area can be immediately stopped under this act. 1992 Amendment in the forest:-

-wild life sanctuaries, national parks etc are totally prohibited for any exploitation.

-setting of transmission lines, seismic surveys, exploration, drilling and hydro electric projects in the forest areas without cultivating trees in the forest.

-Tusser cultivation ( a type of silk-yielding insect) in the forest areas by the tribals as a means of their livelihood is treated as a forestry activity.

-To cease the ongoing mining activity immediately.

WATER (PREVENTION& CONTROL OF POLLUTION) ACT, 1974.

-Maintenance and restoration of quality of all the types of surface and ground water.

-Establishment of central and state control boards for pollution control. CENTRAL POLLUTION CONTROL BOARD(CPCB)

-Prevention and control of water pollution.

-Provides technical assistance to st5ate pollution control board.

-Organizes training programs to prevent pollution.

-Publishes technical and statistical data related to pollution.

-Prepares manuals for treatment and disposals of sewage .

-Establishment laboratories for analysis of water, sewage. STATE POLLUTION CONTROL BOARD (SPCB):

-It lays down standards for effluents.

-Every industry has to obtain consent from the Board.

-Board suggests efficient methods for utilization, treatment and disposal of trade effluents.

-It tests the samples from streams from streams, well or sewage passing through an industry to maintain water quality.

AIR (PREVENTION & CONTROL OF POLLUTION) ACT,1981.

-Act provides for prevention, control and abatement of air pollution.

-Checks whether the industry strictly follows the norms laid down by the board or not.

-It funds, accounts, audit, penalties and procedures.

-As per the section 19, the state may declare an area within the state as air pollution control area and can prohibit the use of any other fuel than approved fuel in the area causing air pollution.

UNIT- 5 SOCIAL ISSUES AND ENVIRONMENT

FROM UNSUSTAINABLE TO SUSTAINABLE DEVELOPMENT

-Sustainable development is defined as”meeting the needs of the present without compromising the ability of the future generation to meet their own needs.”

-This definition was given by G.H.BRUNDT LAND, who is the president of W.H.O.

-Today sustainable development has become a buzz word and hundreds of programmes have been initiated in the name of sustainable development.

-Our natural resources are just dwelling due to over exploitation, if it continues, very soon we are facing a “doom’s day” – as suggested by meadows etal.

-This issue of sustainable development emerged on an international level in 1992, in the UN conference on Environment and Development (UNCED). This is popularly known as Earth Summit, held at Rio de Janeiro, Brazil.

-This declaration aim at a new and equitable global partnership through the creation of new levels of cooperation among states.

MEASURE FOR SUSTAINABLE DEVELOPMENT

#### -Using appropriate technology:-

-It is one which is locally adaptable, eco-friendly and resource efficient and culturally suitable.

-This concept of Nature – often taken as model is called “design with Nature”.

-The technology should use less of resources and should produce minimum waste.

#### -Reduce, Reuse, Recycle:-

-The 3-R approach advocating minimization of resource use, using them again, recycling the materials goes a long way in achieving the goals of sustainability.

-It reduces pressure on our resources as well as reduces waste generation and pollution.

#### -Promoting Environmental Education & Awareness:-

-Making environmental education the centre of all learning process will, greatly help in changing the thinking and attitude of people towards our earth and the environment.

#### -Resource Utilization as per carrying capacity:-

-In order to attain sustainability it is very important that consumption should not exceed regeneration and changes should not allow to occur beyond the tolerance capacity of the system.

WATER CONSERVATION

**-**Water being one of the most precious and indispensable resource needs to be conserved.

-The strategies that can be adopted for conservation of water are:

1. Decreasing run –off losses.
2. Reducing evaporation losses.
3. Reducing irrigation losses.
4. Re use of water.
5. Preventing wastage of water.

-Decreasing run –off losses: water loss through run –off can be reduced by using counter cultivation, terrace farming, chemical treatment etc.

- contour cultivation:- cultivation on small furrows and ridges across the slopes trap rain water and allow more time for infiltration.

-conditioners like gypsum or HPAN (Hydrolysed polyacryl nitrile) when applied to sodic soils improve soil permeability.

-Terracing constructed on deep soils have large water storage capacity.

-Chemical wetting agents ( surfactants) increase the water intake rates when added to normal irrigated water.

-Reducing evaporation loss:

* Asphalt placed below the soil surface increase water availability. A co-polymer of starch and acrylnitrile called “super slurpre” absorbs more water and very affective in sandy soils.
* Reducing irrigation loss: -Irrigation in early or late hours reduces evaporation loss.
* Sprinkling or drip irrigation methods conserve 30-40% of water.
* Growing hybrid crops with less water requirements and tolerance to saline water helps in conserving water.

-Use of lined (or) covered canals are the methods to be adopted to reduce irrigation loss.

* Preventing wastage of water: - closing taps when not in use.
* Repairing any leakage from pipes.
* Using small capacity flush in toilets.
* Consumers has to pay a proportionately higher bill with higher use of water. This helps in economic use of water by the consumers.

RAIN WATER HARVESTING

-Rain water harvesting is a technique of increasing the recharge of ground water by capturing and storing water. This is done by constructing special water harvesting structures like dug wells, percolation pits, lagoons, check dams etc.

Objectives of Rain water harvesting:

-To reduce run off loss

To avoid flooding of roads

-To meet the increasing demands of water

-To raise the water table by recharging ground water

#### Modern techniques of Rain water harvesting:

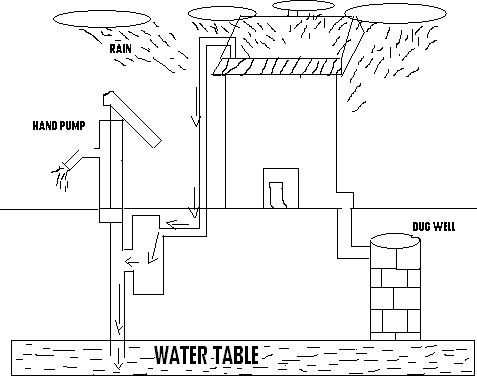
-In arid and semi arid areas artificial ground water recharging is done by constructing shallow percolation tank.

-Rajendra singh of Rajesthan popularly known as water man of has been doing a commendable job for harvesting rain water by building check dams in Rajasthan and he was honored with the prestigious Magasaysay award for his work.

-Ground water flows can be intercepted by building ground water dams to store water in under - ground.

-In roof top rainwater harvesting ,which is a low cost and effective technique for urban houses. The rain water from the top of the roofs is diverted to some surface tank or pit through a delivery system which can be later used for several purposes.

-Also it can be used to recharge underground aquifers by diverting the stored water to some abandoned dug-well or by using a hand pump.



### ROOF TOP RAIN WATER HARVESTING.

POPULATION EXPLOSION

The enormous increase in population due to low death rate and high birth rate.

**Causes:** Modern medical facilities, life expectancy, illiteracy,

**Effects:** Poverty, Environmental degradation, Over –exploitation of natural resources, Treat, Communal war

**Remedy**:- Through birth control programmes.

**Family welfare programme:**

**Objectives:**

Slowing down the population explosion Over exploitation of natural resources Family planning programme

ENVIRONMENT AND HUMAN HEALTH

1. Physical Hazards – Radioactive and UV radiations, Global warming, Chlorofluro carbons, Noise etc.
2. Chemical Hazards – Combustion of Fossil fuels, industrial effluence, pesticides, heavy metals,
3. Biological Hazards- Bacteria, Viruses, Parasites

HIV /AIDS

AIDS is the abbreviated form for Acquired Immuno Deficiency Syndrome caused by a virus called HIV.

**Effects**

1. Death
2. Loss of labor
3. Inability to work
4. Lack of energy .

CLIMATE CHANGE

-Climate is the average weather of an area. It is general weather conditions, seasonal variations and extremes of weather in a region. Such conditions which average over a long period- at least 30 yrs is called climate.

-The Inter-governmental panel on climate change (IPCC) published the best available evidence about past climate change, the green house effect and recent changes in global temperature.

* The fourth Assessment Report (AR4) of United Nations Intergovernmental Panel on climate change (IPCC) 2007 has been prepared by more than 2,500 scientific experts reveals that :-
* Un-equality in water (i.e.) excess in some areas and draught in some areas.

-Glaciers in Himalayas will melt and this leads to increase in size of the glacial lakes.

-Semi-arid regions of the world will face drier years.

-Africa will experience water stress.

-Sea level and human activities will leads to loss of coastal wetlands.

-Fresh water availability will decrease by 2050.

-Human health will be affected.

-There will be Increase in deaths, spread of contagious diseases etc.

REMOTE SENSING & GIS

-Employing geographic information systems (GIS) and remote sensing (RS) techniques is a very important issue these days as they aid planners and decision makers to make effective and correct decisions and designs.

-They allow the engineer to continuously monitor any change any intended plans to secure their success or rectification to meet the requirements.

-It supplies the needed geo database to build informative and rich GIS. The role of GIS is in storing, managing a great deal of data about the images and all the related attributes to allow their manipulation, analysis and finally presentation according to choice. .

-The remote sensing data are using for the following

* + Deforestation (rainforest, mangrove colonies)
  + Species inventory
  + Watershed protection (riparian strips)
  + Coastal protection (mangrove forests)
  + Forest health and vigor.

-The use of remote sensing technology in geological resource management are

* + Surficial deposit/ bedrock mapping
  + Litho logical mapping
  + Structural mapping
  + Sand and gravel exploration
  + Mineral exploration
  + Hydrocarbon exploration
  + Environmental geology
  + Baseline infrastructure
  + Sedimentation mapping and monitoring
  + Event mapping and monitoring
  + Geo-hazard mapping
  + Planetary mapping

-New technique which integrates satellite remote sensing and Geographical Information System (GIS) can be used to continually monitor air quality at micro-scale level.

Images from Land sat data are used to determine two air pollutant parameters, i.e. Carbon Monoxide (CO) and Particulate Maters

-The high resolution data of TM, SPOT, and IRS permit more accurate of water quality mapping Developed regression models to represents best relationships between salinity, turbidity, total suspended solids and chlorophyll concentrations and the corresponding mean radiance values from LANDSAT

-The CIR sensors are used for pollution control related to agriculture, forestry, mining, and land development activities.

The most widely used water balance technique for operational use is crop specific drought index.

ENVIRONMENTAL ETHICS

-Environmental ethics can provide us the guidelines for putting our beliefs into action and help us decide what to do when faced with crucial situations. Some important ethical guide lives known as earth ethics (or) Environmental Ethics are as follows:

* you should love and honour the earth since it has blessed you with life.

-You should keep each day sacred to earth and celebrate the changing of its seasons.

-You should not hold yourself above other living things

* You should be grateful to the plants and animals which nourish you by giving you food.
* You should limit your off-springs because too many people will overburden the earth.

-You should not waste your resources

-You should not steal from future generations their right to live in clean and safe planet by polluting it.

-You should consume the materials in moderate amounts. So that all may share the earth is precious treasure of resources.

VALUE EDUCATION

**Objectives**

1. To improve the integral growth of human beign
2. To create attitudes and improvement towards sustainable lifestyle.
3. To increase awareness about our national history our cultural heritage, constitutional rights, national integration, community develo9pment and environment.
4. To create and develop awareness about the values and their significance and role
5. To know about various living and non- living organisms and their interaction with environment.

**Types of values:**

1. Universal values
2. Cultural values
3. Individual values
4. Global values
5. Spiritual values