SOIL POLLUTION

Soil is also polluted through polluted water and air. These pollutants are mixed into the soil through the rain water.

Such as H_2SO_4 acid is formed by mixing of SO_2 with rainy after in the air. The fertilizers, pesticides and weedicides are being sprayed over the crops. All these are missed with soil to produce harmful effects. The growth of plants in inhibited or reduced due to this type of pollution and sometime their death also take place. Excluding these, soil pollution also caused by the disposal of house hold detergents, sewage, flowing oil, radio active substances and hot water etc. The main pollutants of soil are D.D.T. and weedicides [**2, 4d** (2, 4 tri chlorophenoxy acetic acid) **2, 4, 5-T (**2,4,5 tri chloropheinoxy acetic acid.)]

Control : Soil pollution can be controlled through biological degradation of waste materials. The various carbonic materials of agriculture waste, cattle dung etc can be minimized by the used of bio-gas plants which can produce energy also. Inspite of all the measures pesticides and weedicides should be used in limited quantity only when it is required.

SOUND POLLUTION

Increase in the noise in the atmosphere is called noise pollution or sound pollution. Noise is a loud and unwanted or unpleasant sound. The common things which are responsible for noise pollution are - industries and mills, means of transportation, television stereo, loud speaker and jet plant etc.

Intensity :- The intensity of sound in measured in **bel or decibel** [1 bel = 10 decibel]. A cam can **hear at 0-decibel.** Normally at 25 decibel, the atmosphere may be peaceful. Above **80** decibel intensity of sound in called noise pollution.

Effect : It causes drousyness, irritation, weakness and 130-140 decibel causes heart and pain. Noise pollution reduces the capacity of hearing and results in headache. Sudden excitation in skin, constriction of gastric muscles starts above the 90 decibel. It also produces excitation is habit of man and anger. Noise pollution causes ulcers, heart disease, high blood pressure, higher secretion of adrenal hormones etc. Excluding these high intensity of sound can also break down the walls of the houses and burning of rubber.

Control :

Noise pollution can be control be the use of such type of apparatus which can decreases the intensity of sound at place of origin. Sound absorber must be used to minimize the sound. Excluding this growing of more plants can also minimize the noise pollution.

	Day time	**Night time**
Industrial	75 dB	70 dB
Commercial	65 dB	55 dB
Residential	55 dB	45 dB
Silence zone	50 dB	40 dB

Very Quiet	20 - 30 dB	Sound quite place is - 20 dB, Motion Picture studio, Broadcasting studio
Silence/Quiet	30-35 - 50 dB	Hospital (30 - 35), Schools (45 - 50), Libraries (45 - 50), Office (40 - 50)
Normal voice	55 dB	
Conversational speech	60 dB	
Moderately Loud	70 dB - 90 dB	Factories (60 - 65) Average traffic - 70 dB Heavy city traffic - 90 dB
Uncomfortable	above 100 dB	Air craft (120 dB)
Painful	above 130 dB	Rocket (180 dB)
		Jet plane (150 dB)

RADIOACTIVE POLLUTION

The property of sudden emission of the different particles (charged) and radiation (rays) by the decay of atomic nuclei is called radioactivity and the elements are called as radioactive elements. The radioactivity of the atmosphere is increased by Atomic power stations and Atomic tests. Radioactivity contributes to the pollution of air, water as well as soil and it proves extremely harmful to the organisms.

The various sources of radioactive materials as follows

- **Natural sources :-** Cosmic rays, radiation from the earth such as Radium - 224, Uranium 235, Uranium 238, Thorium 232, Radon 222, Potassium - 40 and Carbon 14.
- **Man made Radiation :-** The radiations are released in the atmosphere during mining and purification of Thorium and Plutonium and in producing nuclear weapons etc.
  Nuclear reactor and nuclear fuel causes pollution by radioactive radiation. The nuclear fuel and coolants are the sources are the sources of radioactive radiation. Radioactive waste is also most important radio-active pollutants because these wastes are not dumped at particular or right place.
- **Other sources :-** Some of the radioactive elements (isotopes) are used in experimental laboratories for scientific researches which causes radio active pollution. X-rays are also proved to have harmful effects

Harmful radiation are divided into two categories

(a) Non Ionising components :- Non ionizing components such as UV radiation. UV radiations are harmful for living beings. These radiations causes harm to the DNA, RNA and protein. Higher concentrating of U.V. radiation can causes xeroderma pigmantosum named disease.

(b) Ionising components :- X-ray, α-particles, β-particles etc are ionizing components Ionizing radiations are high energy radiations which release electrons from atoms and form a pair of negative and positive ions.
Ionising radiation cause physical weakness and sudden death of living beings. The effects like hereditary changes mutations, tumours, cancer, and developmental changes are seen due to radiations.
Excluding these, Iodine 131, Strontium - 90 are spreading in the environment through nuclear explosion and their effects remains for long duration. Iodine-131 reaches in the human body through the food chain and causes harm to the bone marrow, WBC, Lymph nodes and spleen. Similarly. They lead to skin cancer, sterility and poorer eye sight. Stronstium-90 leads of bone cancer and degeneration of tissues.

Control Measures :- The competition of nuclear weapons should be completely banned to percent radioactive pollution. An atomic bomb was first used in Hiroshima and then in Nagasaki in 1945 during the second world ward and due to that genetic disorders are present every today therefore, such type of atomic blast should be avoided. Leakage of nuclear reactions has been totally plugged. Transpiration, use and disposal of the radioactive fuels and wastes has to be handled carefully.

SPECIAL POINT

1. **Air pollution :** According to central pollution control board (CPCB), particulate size 2.5micrometers or less in diameter are responsible for causing the greatest harm to human health. These fine particulates can be inhaled deep into the lungs and can cause breathing and respiratory symptoms, irritation, inflammations and damage due to the lung and premature deaths.

2. **Catalytic converters :** Automobiles are a major cause for atmospheric pollution in the metro cities. Proper maintenance of automobiles along with use of lead fee petrol or diesel can reduce the pollutants they emit.
   Catalytic converters, having expensive metals namely platinum - palladium and rhodium as the catalysts, are fitted into automobiles for reducing emission of poisonous gases. As the exhaust passes the catalytic converter unburnt hydrocarbons are converted into CO_2 and water, and CO and nitric oxide are changed into CO_2 and nitrogen gas respectively.
   Motor vehicles equipped with catalytic converter should use unleaded petrol because lead in the petrol inactivates the catalyst.

CNG (compressed natural gas) :-

- In the 1990s, Delhi ranked fourth among the 41 most polluted cities of the world.
- All the buses of Delhi were converted to run on CNG by the end of 2002.
- CNG is the better than diesel because CNG burn most efficiently as compare to diesel or petrol in the automobiles and very little of it is left unbrunt. CNG is cheaper than petrol or diesel.

3. **MIC [Methyl Isocyanate]** was released in Bhopal gas tragedy on 3rd December 1984. Which is used in the production of “Savin” insecticide in Union Carbide.

4. Tetraethyl lead and tetramethyl lead are formed by combustion of petroleum. They are known to hamper haemoglobin formation.
   - The disease produced by the use of lead polluted water is called as **plumbism.**
   - Lead causes nervousness anaemia in human beings. It also damages kidney.

5. Common dust disease is known as **Pneumoconiosis.**
   - Disease due to cotton dust in textile workers is - **Lung fibrosis or Byssionosis**
   - Disease due to coal dust - **Anthracosis**
   - Disease due to asbestos dust - **Abestosis**
   - In stone grinders disease due to sillica dust - **Sillicosis**
   - In Iron mill disease due to iron dust - **Siderosis**
   - Cadmium causes anaemia, hypertension, damage to liver and kidneys. In Japan it caused bone softening or skeleton deformitcis called **Itai-Itai disease or Ouch-Ouch**
6. **Stone leprosy** is caused due to acid rain because due to acid rain outer surface of metals, marbles, and stone destroyed.
7. **Blue Baby disease :-** This disease is caused by the high amount of nitrate in water. It is also known as **methaemoglobinaemia** or **cyanosis.**

8. **Hypertension and Uremia -** Caused by Copper
9. **Arsenic :-** It cases black- foot disease and poisoning in fodder plants which are eaten by live stock and causes their death.
10. **Fluorides :-** The higher concentration of fluorides cause chlorosis or necrosis in tips and margin of leaf (leaf lamina). The compounds of fluorine reach in the animals through the fodder and cause abnormal calcification of teeth, this is called Fluorosis.

Note : The experts hold that the maximum level of fluoride which the human body can tolerate is **1.5 parts** per million [ppm]. When ingested in excess over a long period of time cause "Fluorosis".

11. **ALNino effect -** it is the process in which water of Pacific ocean get warm, in this process warm water current flows to equator & peru in beteen 5 to 8 year at Christmas time. **Effect of ALNino is flood** drought and monsoon damage in India.
12. Cesium [Cs] accumulates in muscles and causes muscular pain.
13. Strontium-90 is radioactive element which causes Leukemia and bone cancer.
14. Iodine isotope -131[I^{131}] causes damage to RBC, bone marrow, Lymphynodes and Skin cancer.
15. Tobacco and smoke contain seven poly cyclic hydrocarbon and Radio active Polonium-210 which is carcinogen and causes Lung cancer.
16. Aldehydes produce irritation in the gastrointestinal and respiratory tract.
17. Phenols caused damage to spleen, Kidney, Liver and lungs.
18. D.D.T. caused Cerebral hemorrhage and malfunctioning of sexual maturity.
19. Largest source of air pollution (80%) caused by automobiles in the cities i.e., CO(77.2%), Nitrogen oxide (7.7%), Hydro carbon (13.7%), SO_2, NH_3, Aldehyde and Lead [in the form of $Pb(C_2H_5)_4$ and Pb $[(CH_3)_4]$ as antikonking agent]. Lead is an air pollutant. Automobiles also reduce atmospheric O_2 which is utilised in oxidation.
20. Particulate pollutants [soot] are Carcinogenic [Cancer causing].
21. The particulate matter released to the atmosphere by mechanical operations include a number of tracemental contained in the **flyash.** Some of harmful trace metals are Antimony, Arsenic, Beryllium, Cadmium, Germanium, Lead, Mercury, Nickel, selenium, Vanadium and yttrium.**22.** Studies have shown that tobacco smoke contain at least seven polycyclic hydrocarbons and radio active Polonium 210 which are known carcinogens. An average smoker has the risk of developing and dying from lung cancer **ten times** more than a non-smoker. The risk of lung disease is six times and that of heart disease twice as compared to a non-smoker.

Some Other Information's :-

1. **Third pollution or land scape pollution : -** To make Fertile - land barren by dumping wastes e.g., ash, industrial waste
2. **Incineration -** Solid wasted burning in presence of oxygen.
3. **Pyrolysis -** Solid wasted burning (combustion) in the absence of oxygen.
4. **Flue gas -** Gas which release of form chimnies.
5. **Plume -** Smoke which release from chimnies.
6. **Hydro thermal vents -** The are hot water springs in the deep ocean having high concentration of H_2S, ocean water oxidizes H_2S producing energy which is used by bacteria, Filter-Feeders (clams) eat the bacteria so that this food chain based on chemical energy.
7. **Phtotrons -** A such type of house where plants are grown in controlled environment
8. **Hydrocarbon -** Are also known as volatile organic carbons (VOC).
9. **Snow - blindness -** In human eye cornea absorbs U.V.B. radiation, and a high does of U.V.B. radiations causes inflammation of cornea, called snow-blindness cataract.
10. Electronic wastes is also called e-wastes
11. Ganga Action plan for controlling pollution in ganga (1985) included city : (i) Kolkata (ii) Kanpur.

- ~~Maximum NO_2 pollution in Ahmdabad~~
- Maximum SO_2 pollution in Kolkata

- Maximum SPM pollution in Kolkata
- Land of maximum wind mills-Nether land
- Largest wind will complex in India, Lamba (Gujarat)

12. At 50 ppm, CO coverts 7.5% of haemoglobin in the carboxy haemoglobin with in 8 hours.

- **CEPHERI :** An institution established in India to center radioactive pollution i.e. "Central Environmental and Public Health Engineering research institute "(CEPHERI). This institution submits the measures on the basis of results of detailed survey.
- **NEERI :** National Environmental Engineering Research Institute - Nagpur.
- **IPCC :** The "Intergovernmental Panel on Climate Change".
- **I.A.P. :** Index of atmospheric pollution prepared with the help of lichens.
- **I.W.P. :** Index of water pollution, prepared by Daphnia, E. coli, Trout.
- **M.P.N. :** Most probable number of E. coli in water.

The increase in the concentrations of greenhouse gases in the atmosphere as affected by human activities

Greenhouse gases	**Pre- industrial concentration ~ -- 1750 AD**	**Concentration in 2000 AD**	**Increase since ~ 1750 AD%**	**Atmospheric life - Time (years)**
Carbon dioxide (CO_2)	280 ppm	368 ppm	31	5-200
Methane (CH_4)	700 ppb	1750 ppb	151	12
Nitrous oxide (N_2O)	270 ppb	316 ppb	17	114
Chlorofluorocarbons (CFC - 11) + Hydroflurocarbons (HFC - 23)	0	282 ppt		45-260

SOIL CONSERVATION

Soil is the mixture of living and nonliving materials. Soil is only responsible for anchorage and sustenance of the plants. The fertility of soil is reduced due to growing of plants again and again. Natural factors like water, air, etc are also responsible for transporting the top soil and decrease fertility. This is called soil erosion.

1. SOIL EROSION

The structure of soil is different at the different depth of land. Its some upper part is called to soil. This region is very essential for the growth of the plants. Its thickness is about 15-20 cm. This top soil contains humus, and various micro-organisms which increase the fertility of the soil. When this top soil removed by fast wind, fast rains, cyclone and running water then it is called soil erosion. The following reasons are responsible to minimize the fertility power of soil in nature.

(i) Shortage of mineral substances

(ii) Leaching :- The dissolved minerals go into the depth (lower layers) with water. Roots of the plants usually remain in top soil so the minerals are not available to the plants.

(iii) Erosion is divided into the following types on the basis of erosing factors -

(A) Wind Erosion :- This type of erosion is carried by fast air, wind, cyclon etc. It is very harmful is dry places**IT IS OF THREE TYPES**

(a) Suspension : The air blows away the find particles of soil in the form of dust in the atmosphere.

(b) Saltation :- The medium size and medium weigh particles of soil colliding with each other during the ransfer through the air.

(c) Surface Creep: The heavy particles of soil creeping on the surface of the earth by the force of **(B) Water Erosion :** The top soil transfer to the another place due to the fast water currents and heavy rains.

IT IS OF THREE TYPES

(a) Rill erosion : The net of groove are formed in the surface due to continuous irregular flow of water.

(b) Sheet erosion : A similar upper layer is removed on the surface through the water.

(c) Gully erosion : If the rill erosion takes place for long time then the groove are wider and deeper and are called gullies.

(C) Land Slides : Such type of erosion is found in such places where heavy rain takes place. Because of heavy rains water flows in gullies which becomes more deeper and water is absorbed in higher amount, so that big pieces of land break off and slide. This type of erosion occurs in hilly areas.

(D) Stream bank or Riparian Erosion : The fast flow of water collides with the bank of river during the flood. So that soil is removed from the banks and by which the direction of flow of river may be changed.

(E) Overgrazing and Deforestation : Over grazing also removes the top soil and decrease the fertility of the soil. The formation of desert in Rajasthan has the main reason as over grazing. Simultaneously deforestation in the catchments areas in the hilly regions causes floods on the plain areas which destroys the useful part of the soil. Excluding all reasons, water fall erosion and soil, Pollution etc also reduce the fertility of soil.

2. SOIL CONSERVATION

Some management measures are essential to check the soil erosion. According to this some principles are as follows :-

(i) To protect the soil from the drops of rainy water.

(ii) To stop the accumulation of water as well as stop the flow of water on the slopes.

(iii) To prevent the transportation of soil particles.

(iv) To slow down the wind velocity on the surface of the earth.

METHODS OF SOIL CONSERVATION

Generally, two methods are used for soil conservation :-

(A) Biological Method : In which soil erosion is checked by the use of plants.

(B) Mechanical Method : These methods are also useful as biological methods in which soil erosion is prevented by dams, water reservoir etc.

(A) Biological Method : The following techniques are used in biological methods :

(i) Reforestation or Afforestation : Afforestation is the main measure to control the soil erosion, floods. Forest are very useful in dry places and deserts to prevent wind erosion. Plants are growing as wind breaker or wind barriers against the direction wind currents. This method is successful in Rajasthan to prevent the spreading to desert in east direction. The plants used as wind breaks are as follows :

Lawsonia alba (Mehandi), Oak, Calotropis gigantata, Agave Americana, Ber = Zizypus jujuba, Katha = Acacia catechu, Shisham = Dalbergia sisso and Mango = Mangifera indica etc.

(ii) Dry farming : This farming has been carried in low rainfall regions. Only few crops are grown in these places. Excluding this, grass land have also been developed for grazing of animals.

(iii) Contour farming : The ridges and furrows are formed in the field during the sowing of seed crops. Rain water accumulates in furrows which is absorbed by soil. The flow of water is minimised due to presence of ridges. Therefore soil erosion is checked.

(iv) Mulching : Stubble are left during the harvesting of crops in this method. These stubbles form a protective layer. The stalks of Maize, Bajara, Potatoes, Tobacco are spreading in the field in the form of a layer, by which evaporation decreases and water holding capacity of soil increases. This methods is useful in both wind erosion and water erosion.

(v) Crop rotation : The repeated growing of the same crops in each year like wheat and Maize, removes some of the specific (N_2) elements in the soil, so that this reduces its fertility. Changing of crops in each season is to maintain the fertility of soil. The leguminous crop plants have the ability to fix atmospheric nitrogen to form nitrogen compounds, which improve the fertility of soil.

(vi) Strip cropping : The crops are grown in lines. These liens may be situated at 90^0 angle to the direction of wind or it may be parallel. The leaves of one type of plants stop the blowing of soil particles, such plants are known as erosion **checking plants.** The other line is having small plants which are unable to check the erosion are called **erosion permitting plants.** In This, alternation of two different types of leaves takes place.

(vii) Ley Farming : The grasses grown along with the crops in various season alternatively.

(viii) Growing of grass of land : The binding of soil particles is the main and special feature of grasses. So that the grasses become the permanent vegetation in grassland areas which minimise the erosion through the rains.

(B) Mechanical Methods : The following techniques are coming under the mechanical methods :

(i) Dam Building : The dams are built to stop the fast flowing water which is used later on according to the needs -

(ii) To control the over grazing of animals.

(iii) Basin Listing : Small catchment area of water are formed for the collection of water during the rain.

(iv) Contour Terracing : The canals are formed along the terraces on the slopes of hills. This reduce the speed of higher amount of water and changes the direction of water.

(v) Gully Control : The bonds dams and canals formed to control the high speed of water and to prevent the soil erosion.

PLANT ADAPTATIOINS

The plants which are found on the earth, posses some specified characters in which order to survive, successfully. A plant must be able to adjust it self to its environment and grows continuously such type of special characters are known as **adaptability.** The ecological factors influence the vegetation of particular area. Plant develops various types adaptation to protect itself from these factors.

Warming, classified plants into three groups on the basis of availability of water.

- **Hydrophytes :** Plants found in places where excess of water is present are called hydrophytes.
- **Xerophytes :** Plants found in places where very insignificant amount of water is present are called xerophytes.
- **Mesrophyte :** Places where is neither too much water nor less availability water. Their habitant is having relative amount of sufficient water.

Note : Ecological adaptations are found in xerophytes and hydrophytes.

HYDROPHYTES

Hydrophytes are divided into five groups

(a) Free floating hydrophytes :
This group includes such type of plants which remains floating at water surface which are not in contact with soil of water reservoir from their roots.
e.g. **Lemna, Wolffia, Salvinia, Eichhorina**
Note : Eichhornia is also known as **'water hyacinth'** and **'Sorraw of Bengal'** This is a dangerous aquatic weed. Eichhornia is a inhabitant plant of **America.** It is found in all ponds and lakes of India.

(b) Suspended hydrophytes :
These plants are suspended in water but not fixed with their root. They do not have contact with the substratum of water body.
e.g. **Najas, Utricularia, Hydrilla**
Note : Utricularia is also known as **'Blader wort'**. This is a root less insectivorous plant. The apparatus for catching the insect is formed by the modification of leaf in plant.

(c) Submerged hydrophytes :
These plants entirely submerged under the water and into the mud with their root, @ such plants includes in this group.
e.g. **Potamogeton, Vallisneria, Ceratophyllum, Eloids**

(d) Fixed floating hydrophytes :
This group included such type of plants in which their root are fixed in the mud and leave and floating on the surface of the water
e.g. **Nymphaea, Nelumbium** (Lotus), **Victoria regia, Trapa**

(e) Emergent hydrophytes :
The basal part of such plants are embedded in water and remaining part floats upon the surface of water, such plants grows both type of characteristic as aquatic and terrestrial. So, they are known as **amphibious plants.**
e.g. Typha, Juncus, Jussiaea, Sagittaria, Ranunculus aquatalis, and Cryptostegia etc.

Adaptation of hydrophytic plants :

1. **Osmotic Pressure :** The osmotic pressure of cells of aquatic plants is very less, so plants are saved from the absorption of unwanted water due to low osmotic pressure.
   Note : But, osmotic pressure of cells is high in those plants which live in salty water as in sea and Sambhar lake of Rajasthan because it can reduce the loss o water.
2. **Mucilage -** Mucilage is found on the surface of aquatic plants. Mucilage protects the plants from the action of bacteria and fungus.
3. **Cuticle -** Cuticle is absent on the surface of aquatic plants. These plants exchanged gases through the whole surface of the plant. But, cuticle and wax is present on the floating leaves, so the upper surface o floating leaves are bright [shining], smooth and hydrophobic.
4. **Aerenchyma -** Aerenchyma is present in hydrophytics plant which provide **buoyancy** to the plants and store oxygen which is produce in photosynthesis.
   Note : The oxygen is the limiting factor in respiration of aquatic plants.
5. **Chlorenchyma -** The chlorenchyma tissue of these plants is well developed. The intensity of light is the limiting factor in photosynthesis of aquatic plants. The intensity of light decreases in the deep water so, absorption of more light takes place through well developed chlorenchyma. The whole plant is green excluding roots.
   Note : Photosynthetic green rots are present in **Trapa.**
6. **Epidermis -** The epidermis of aquatic plants bear chloroplast. For maximum photosynthesis is carried by aquatic plants.
   The 90% production is done by aquatic plants in out of gross production of photosynthesis of the world.
7. **Mechanical tissue -** Mechanical tissue is less developed in hydrophytes. Scelechyma is either absent or reduced so, aquatic plants are soft water is providing support for them.
8. **Conducting tissues -** Conducting tissues [xylem & phloem] are poorly developed in hydrophytes.
   - **Xylem** of these plants is not differentiated completely the most of the part of xylem is living. The tracheids and vessels of xylem are also living. Water is absorbed by the whole surface of aquatic plants so that need of conducting tissue is less.
   - **Phloem** is also less developed because whole plants prepare its own food.
9. **Roots -** The root system of hydrophytes are either absent [**Wolffia** and **Utricularia**] or reduced [**Trapa** and **Eichhornia**].**Note -** Root cap is absent in **Eichhornia.** In place of root cap, root pocket is present which is filled by air.
10. **Leaf -** The leaves of suspended and submerged hydrophytes are either dissected [**Hydrilla** and **Ceratophyllum**] or long, soft and ribbon like [**Vallisnaria**]. Dissected and ribbon's like leaves to not produce resistance in water current so that, are protected from destruction.
    - Usually **heterophylly** is present in emerged hydrophytes. Two types of leaves are found in these plants. The emerged leaves are dissected and aerial leaves are large and complete.
    - But leaves of floating hydrophytes are long, broad and strong, **astrosclereids** and **trichoslereids** are present in these leaves. The leaves becomes solid due to presence of these sclereids.
    - The leaves of Victoria are strongest and highest in diameter. Their diameter is approximately 1 meter.**11. Stomata -**
    - **Astomatic -** The leaves of suspended and submerged plants are automatic. In their leaves stomata are either absent or reduced. These plants exchange gases through the general surface of the body.
    - **Epistomatic -** Floating leaves are epistomatic, if means stomata are prevent only on upper surface of the leaf the lower surface remains in contact of water, therefore stomata are absent on the lower surface.

12. **Reproduction :** Hydrophytes reproduce vegatatively and sexual reproduction is found less, the presence of more water stimulates vegetative reproduction. Sexual reproduction only takes place in adverse climatic conditions.
Note : The vegetative reproduction takes place vigorously so that these plants becomes a weeds.

XEROPHYTES

These plants live in deficiency of water. This deficiency of water may be of two types

(a) Physical dryness : These plants grow in that region which have very insignificant amount of water is called physical dryness.
In desert, from where only 20 cm rain fall or less than this, takes place and the slopes of hills are also having physical dryness.

(b) Physiological dryness : Sometimes water is present in the habitat but due to some reasons plant can not absorb this water, is called physiological dryness.
High concentration of salt water, and low temperature habitat is a type of physiological dryness habitat.

Xerophytic plants are of many types on the basis of Habitat

1. **Halophyte :** Those plant which grown in saline habitat known as halophyte. Such soil is called marshy soil. Such type of land is unfertile and barren.
2. **Epiphyte :** Such type of autotrophic plant which grown on other plants are called epiphytes. They require only support and shelter.
3. **Psychrophyte :** Those plants which grow in cold soil such as plants grown on high range of Himalaya.
4. **Chamophyste :** These plants are grow in the crevices of rocks.
5. **Psamophyte :** Such plants which grown in sandy soil are called psammophyte, as plants grown in desert. The plant which grown on the river bank are mesophyte, because this sand contain sufficient amount of water.
6. **Lithophyte :** These plants are gown on either rocks or sedimentary soil as plants grown on the slope of Aravali hill.

Xerophytes are divided into three groups by **Kearney** and **Shantz** on the basis of their habit-

. **Drought Escapers or Ephemerals -**
Such type of plants usually grown in desert. These plants complete their life cycle in **favourable** moisture [humid] season. They leave their mature seed and degenerated before unfavour condition. These plants are **not facing** the scarcity of water so they are not true (real) xerophytic plants.
Adapatation : These plants do not have xerophytic adaptation. **Spines** are found on the surface of these plant, which protect it from the grazing animals.
e.g. **Argemone mexicana** (Yellow kanteli)
Solanum xanthocarpum (Blue or violet kanteli)

II. **Drought Resistant or Succulent xerophytes -**
These plants absorb water in moist season and stored in plant organs. They stored maximum amount of water and they continue their life processes on this stored water during the drought, so, these plants are not facing the drought. Therefore, they are also not true xerophytes. They are the most successful plants in places of deficient water supply.

Note : The most of the plants of this group are lithophytes.

Adapatation : The specific type of adaptation are found in these plants for absorption of heir amount of water and to avoid the loss of water.

- **Root System:** The root system of these plant are shallow means spreading near the surface of earth and highly branched. They can absorb very less rainy water. They can also absorb water drops of dew.
- **Mucilage -** Mucilage is present in the plant organs. It is a **colloidal** substance. Colloids have a great capacity of imbibition of water. Colloids can absorb mo re water than its weight. These plants becomes succulent due to presence of mucilage and absorption of water.
- **Stomata -** Scotactive stomata are found in these plants. Such type of stomata remains close during the day opens at night. The possibility of transpiration is more during the day. They exchange gases during the night.
- **Modification -** In most of the plants, leaves are transformed into spines. The stem function as leaves, in the absence of leaves - it means stem becomes like a leaf. Such type of stem is known as **phylloclade.** e.g. **Opuntia.**

Note : Those plants in which leaves are not transformed into a spines that becomes thick and succulent. These Succulent type of leaves are called **malacophilly.**
e.g. Aloe, Euphorbia

- All the plants of Cactaceae and Crassulanceae families are succulent plants.
- Most of the plant of Euphorbiaceae family are succulent.

III Drought Endurers or Non Succelent Xerophytes -
Psamophytes are included in it. The plants which are found in desert are perennial. They do not store water in their plants organ. However the plant continues to be alive during the drought. Therefore, they are **real xerophytes.** The highest adaptations are only found in these plans.

THE ADAPTATION ARE FOUND IN THESE PLANTS ARE AS FOLLOWS

- **Root system -** The root system is very long and penetrate the soil to great depth and is well developed. The shoot is less developed as compare to the root, so that it reduces the transpiration.
  Note : The roots are well developed in sandy soil. Length of roots are more than shoot

- **Leaves -** The maximum adaptation are related with the leaves. The leaves are pinnately compound in most of the plant of this group.
  Note : A thick layer of the cuticle and wax is present on the upper surface of leaf.

- **Rolling leaves -** Rolling leaves are found in some of the xerophytic plants. The leaves of these plant fold during the mid day.
  For example : **Ammophila, Exmptera, Poa** etc.

- **Stipules -** The stipules of xerophytic plants are modified into spines. These spines protect the plant from the grazing animals e.g. Acacia (Babool) Shoots of these plant are small, so that it is essential to protect it from grazing animals.

- **Stomata -** The stomata are present only on the lower surface of the leaf i.e. leaves re **hypostomatic** Stomata are sunken type. A cavity is present out side the stomata which is called hypostomatic cavity.
  Note : These stomata are surrounded by hais. Such type of tomato prevent the loss of water. The presence of hair on the leaves are called **trichophilly.**
- **Mechanical tissue and vascular tissue -** The mechanical tissue and vascular tissue are well developed in these plants. The intercellular spaces are absent in these plants, so that cells are tightly arranged

Calotropic : This plant is most successful in the desert. This is sand - bounded plant and prevent soilerosion. The leaves of calotropi are simple, but maximum amount of was present on it.
Latex, resins, tannis etc substances are found in the leaves of xerophytic plants. These substances also help in prevention of water loss.

Caparis aphylla : The leaves are completely absent in this plant. A very tasty pickle is prepared from the seeds of this plant.

Nerium is a typical xerophytic plant. The maximum adaptations are found in this plant such as follows.

- the epidermis of the both surfaces are multilayered.
- A sclerenchymatous hypodermis is present below the epidermis.
- Palisade tissue is found on both the sides of the surfaces.
- Vascular bundles are surrounded by sclerenchymatous endodermis.
- All the adaptations are only to check the transpiration. Thick cuticle is found in Nerium and was is present on it.

STUDY OF SOME SPECIAL XEROPHYTES

HALOPHYTES

Those plants which grow in salty soils or saline soils are called halophyte. **Physiological dryness** is found in halophytes.

Adaptation :

1. **Stomata :** The adaptations of halophytes are similar as succulent xerophytes i.e. **scotoactive** stomata are present in their leaves.
   They are succulent and water is stored in plant - organs.
2. **Osmotic Pressure :** The osmotic pressure of cell sap is highest of these plants. The osmotic pressure of cell sap reaches 30 mm of Hg - (atmosphere pressure)
3. **Chalk Glands :** Chalk glands are found on the leaves in some plants of halophytes. Which secretes lime, The leaves absorb water from the atmosphere with the help of lime.
   e.g, **Casurina, Atriplex, Portualaca, Chukander**

Mangrove Vegetation :

This is a special group of halophyte. They are found in **saline marshy areas** of sea shores and near estuaries. Mangrove vegetation is found in sundar bans [W. Bengal] in India. Marshy places are **physiologically dry** due to the presence of salts. Specially, seed of these plants can not germinates in swampy land.

The following adaptations are found in mangrove plants.

(i) Pneumatophores : Marsh is water logged i.e. oxygen is absent in march. Oxygen is not available to the roots of the plant in swampy soil so that some special type of **respiratory roots** are found in Mangrove which are know as pneumatopheore. They are **negative geotropic.** Pores are present at the apex of the pneumatophore, they exchange gases through the pores from the atmosphere.

(ii) Vivipary : The germination of seed takes place inside the fruit while it is attached to the parent plant, that juvenile plant is present in fruit, falls on the marshy soil.

(iii) Leaves : Leaves is mangrove plants are either absent or less developed and succulent type.
e.g. Rhizophora, Sonneratia, Avisinia, Salicornia, Salsola

EPIPHYTES

Epiphytes re extensively distributed in tropical forests. Such type of rain forest lies on the equatorial region around the earth. The main feature of this biome is the good amount of annual rain fall which is more than at least 140 cm. per year. Such type of forest are found in **Assam, W. Bengal, Meghalaya** and **Andaman NICO bar** in India.

Epiphyte are those autotrophic plants which grows on other plants. They do not get water and food from them. Their roots are not present in soil. They absorb atmospheric moisture. Therefore epiphytes are only growing in moistened places. Epiphyte never grows in Rajasthan

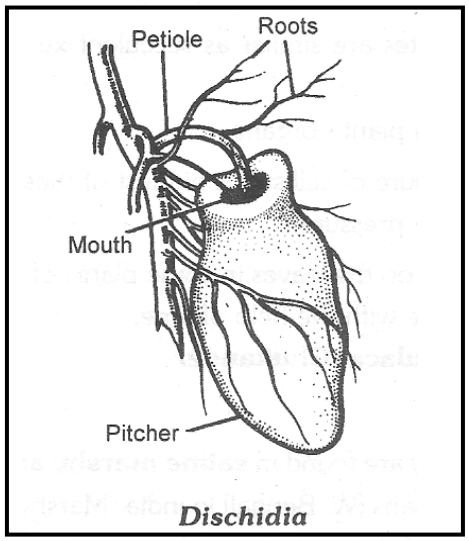
The adaptation are found in epiphytes are as

Heterorhizy : These roots are heterorhizomous. Two type, of roots are found in these plants.

- **Clasping Roots :** These roots are clasped in the strips (fissures) of bark of the plant. Their function is only to provide support (fix) to the plant.
- **Hanging Roots :** These roots hang in the air these roots have special epidermis which is multilayered and made up of thick walled cells, this type of epidermis of root is known as velamen. So velamen is an epidermal tissue. **Velamen** tissue is hygroscopic in nature. It absorbs atmospheric moisture.

Note :

- The plants of **Orchidaceae** family are known as orchids. Orchids are epiphytes
  e.g. **Vanda.**
- **Dischidia** is known as pitcher plant. The leaves modified into a pitcher in these plants. Rainy water is collected in the pitcher.



Dischidia

PSYCHROPHYTES

They are also known as **hekistotherms.** These plants are gown in cold soil (land). Psychrophytes are found in north and south polar regions. The plants grown at 11000 feet or above are only psychrophytes. They are also known as Alpines. Such plants are gown on Himalaya.

Cold lands are physiologically dry. Plants are unable to absorb water because temperature of soil is very less. The following reasons are as follows :-

- The viscosity of the water increase due to decrease in temperature.
- Water potential of water decreases due to low temperature.
- The permeability of plasma membrane decreases at low temperature.

Note : The true characters of xerophytes are found in these plants, such as small leaves, thick cuticle, Sunken stomata and very deep root system.

e.g. Rhododendron, Delphinium, Anemone, Primula, Saxifrage

NATURAL RESOUCES

The materials or any component, that can be utilized by man and are necessary for welfare of life, which is avaialble in the natural environment in Atmosphere, Hydrosphere, Lithosphere is caleld natural resources.

e.g. O_2, Land, Soil, Water, Forest, Animals, Soil, microorganism

Classification of natural resources :

1. **Inexhaustible resources :** Available in unlimited quantities, and the earth quantity may remain unchaged by human impact.

   e.g. Solar Energy, Wind Power, Tidal power, Air, Geothermal Energy

   Note : Its quality can be affected due to continuous increase in human population.

   e.g. Air pollution

2. **Exhaustible resources : -**

   These are likely to be finished by human use or unsustainable uses.

It is further divided in two groups

(i) Renewable resources : Those which are being continuously consumes by man but renewed continuously by nature, always available if managed in a proper way, otherwise they may even get totally exhausted.

e.g. Biotic resources, forest, grazing animals, Rangeland, wild life, Agriculture crop system and fresh water yield, soil etc.

(ii) None renewable resources : They are not renewable after use and are not replaced by nature, can not be regained.
e.g. Fossil fuel (Coal, Petroleum,)Natural Gas, Nuclear energy, Biotic species, Minerals etc.
Note : Nuclear energy is non renewable and unlimited resources.

HYDROSPHERE OR WATER RESOURCES

1. Water is the major constituent of the hydrosphere and covers 3/4 of the earth's surface.
2. The total volume of water in the hydrosphere is 1.4 billion cubic kilometers [Km^3], about **97.5%** is the **ocean water** unsuitable for human use. Only **2.5%** is available as **fresh water.** About **1.97%** is stored in **ice-caps** (Polar ice) and glaciers and 0.5% is ground water and soil moisture (0.01%). The rest [about 0.36 percent] is distributed in lakes swamps, rivers and streams.
3. About 84% of the total global evaporation occurs from ocean surface and 16% from land surface.
4. Kelps and a few marine animals are used as human food. Various chemical s are extracted such as iodine and industrial gums from seaweeds. Afar is produced from the red algae-Gracillaria and Gelidium. Algin is derived from Sargassum and Turbinaria species.

LAND RESOURCES

1. Earth's one-fourth area is formed by land.
2. About 4/5 of the land area is covered by soil.
3. At the beginning of 20th century, about **30%** of land in India was covered with forest but the end of the 20th century, the forest cover reduced to **19.4%.** Out of 19.4% only **12%** area covered by dense forest.
   - Percapita forest area available in India is - **0.06** hec.
   - Percapita forest area available in world is = **0.64** hec.
   - In India **33%** forest area is recommended by national forest policy (1988.)

FOREST CONSERVATION

IT IS CONDUCTED BY TWO METHODS

1. **Protection or conservation forestry :** By Making national park and Bio-sphere Reserve.

2. **Production or commercial forestry :**

IT IS OF TWO TYPES

(a) Social forestry : To grow the trees and shrubs on unused farmland, road sides, Rail sides, community land etc.

(b) Agro forestry : Woody species are grown in combination with herbaceous crops either at the same time or in time sequence.

Taungya system - Growing agricultural crops between rows of planted trees.

MINERAL RESOURCES

Table - Some Important Minerals and some of their uses

1. Metalic

Minerals	Uses
Uranium	Nuclear bombs, electricity, tinting glass
Thorium	Nuclear bombs, electricity, gas mantles
Iron	Steel
Manganese	Alloy steels, disinfectants
Cobalt Alloy,	catalysts, radiography, therapeutics
Columbium	Stainless steel, nuclear reactors
Chromium	Metallurgy, refractory, chemical
Molybdenum	Alloys steels
Nickel Over	3000 alloys
Tungsten	Alloys and chemicals
Vanadium	Alloys
Copper	Electrical products, alloys
Lead	Batteries, gasoline, paints, alloys
Tin	Tin plate, solder, chemicals
Zinc	Galvanising, solder, die-casting, chemicals
Aluminum	Aircraft, rockets, building materials, electrical wiring, utensils
Magnesium	Structural refractories
Titanium	Pigments, aircraft, alloys
Zirconium	Refractories, ceramics, metals, chemicals
Beryllium	Copper alloys, refractories, atomic energy field
Gold	Monetary purposes, jewelry, dentistry
Radium	Medical and industrial uses, radiography

2. Non-metallic Minerals

Minerals	Uses
Asbestos	Insulation, textiles, roofing's, glass, ceramic, gasoline, solid propellants
Corundum	Abrasives
Feldspar	Ceramic flux, artificial teeth
Fluorspar	Flux, acid, refrigerants, propellants

Phosphates	Fertilisers, chemicals
Salt	Chemicals, glass, metallurgy
Sulphur	Fertilisers, acid ,iron and steel industries

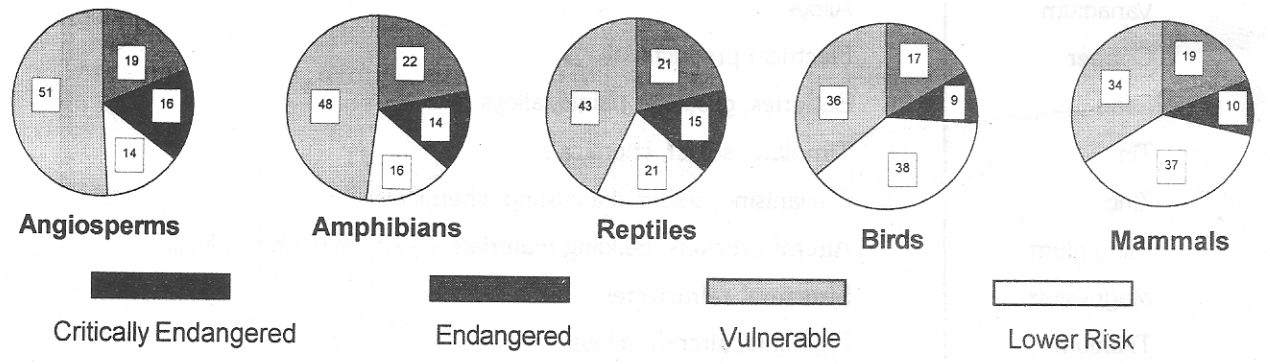
THREATENED SPECIES CONEPT

The International Union for Conservation of Nature and Natural Resources (IUCN), having its head quarters at Margins in Switzerland and maintain a Red Data Book providing a record of animals and plants which are known to be in danger. In India the Wildlife (Protection) Act, 1972 provides four schedules categorising the fauna of India based on their conservation status. Schedule I lists the rare and endangered species which are afforded legal protection. For the purpose of conservation species are categorized as below :

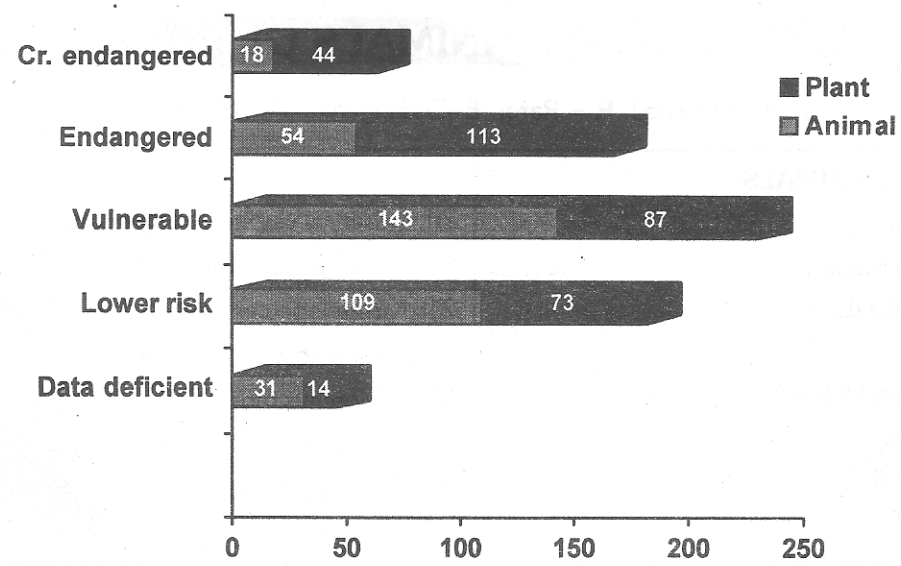
Threatened (T) : The term is used in context with conservation of the species which are in any one of the above 3 categories (E, V, R).

Threatened = Endangered + Vulnerable + Rare

1. **Endangered (E) :** Those species which are in the immediate danger of extinction and whose survival is unlikely, whose number have been reduced to a critical level, if the casual factors continue to be operating.
2. **Vulnerable (V) :** The species likely to move into the endangered category in the near future if the casual factors continue to operate. Their population is still abundant but are under threat throughout their range.
3 **Rare (R) :** These are species with small population in the world. These are not at present endangered and vulnerable, but are at risk due to their less number. These species are usually localised within restricted geographical areas of habitats.



The percentage of threatened angiosperms, amphibians, reptiles, birds and mammals categories a critically Endangered, Endangered, Vulnerable and at Lower Risk



The number of plant and animal species of various threat categories in India

SOME IMPORTANT EXAMPLES OF THREATENED SPECIES IN INDIA

Category	Plants	Animals
(1) Critical endangered	Barberis nilghirensis	Sus salvanius (Pigmyhog)
(2) Endangered	Bentinckia nicobarica	Ailurus fulgens (Red panda)
(3) Vulnerable	Cupressus cashmeriana	Antelope cervicapra (Black buck)