GE8291: ENVIRONMENTAL SCIENCE AND ENGINEERING

(REGULATION – 2017)

UNIT I

ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY

Introduction to Environmental Studies

Introduction:

Environment is a French word meaning surrounding.

All biological and non biological things surrounding an organism is called an environment.

Environment:

It is also defined as the sum of total of water, air and land, interrelationship among themselves and also with the human beings, other living organisms and property.

Environmental Science:

It is the study of environment, it's biotic and abiotic and their inter relationship.

Environmental Engineering:

It is the application of engineering principles to the protection and enhancement of the quality of the environment and to the enhancement and protection of public health and welfare.

Environmental education:

It is the process of educating the people for preserving quality environment.

Types of environment:

1. Natural environment
2. Man made environment

Natural environment:

All natural things, biotic and abiotic are collectively called natural environment.

(e.g) soil, water, tree and air.

Manmade environment:

- Created by man
- Powerful engineering agent
- Man modifies the environment using modern technologies according to his necessity.

Scope of environmental studies:

1. To get an awareness and sensitivity to the environment.
2. To motivate the active participation in environmental protection and improvement.
3. To develop skills for identifying and solving environmental problems.
4. To know the necessity of conservation of natural resources.
5. to evaluate environmental programmes in terms of social, economic, ecological and aesthetic factors.

Importance of environmental studies:

1. By environmental studies people know the development of environment without destruction of environment.

2. To know different types of environment and the effects of environmental hazards.
3. Environmental study is directly proportional to the quality of the environment.
4. To develop the concern and respect for the environment

Risk and Hazards

Hazard

Hazard is any substance that can hurt you or make you ill. It expressed in degree.

Degree of hazard is the function of risk, exposure, vulnerability and response.

Hazard=f (risk* exposure* vulnerability* response)

Risk

Risk is the frequency of events causing losses.

Important Hazards and their Health effects (or) Deterioration of environment and Health effect

1. Physical hazards and their health effects

Sl. No.	Physical Hazards	Health Effect
1.	Radioactive radiations	(a) Affects the cells in the body and the function of glands and organs. (b) Suffer from cancer.
2.	UV radiations	Skin cancer.
3.	Global warming	Temperature increases cause famine, mortality.
4.	Noise	Painful and irreparable damage to human ear.

2. Chemical hazards and their health effects

A large number of chemicals are introduced in the environment by anthropogenic activities.

Sl. No.	Chemical Hazards	Health effects
1.	**Combustion of fossil fuels:** Liberates SO_2, NO_2, CO_2 and particulate matters.	Asthma, bronchitics and other lung diseases.
2.	**Industrial effluents (toxic)**	Kill cells and cause cancer, and death.
3.	**Pesticides like DDT and Chlorinated pesticides**	Affect the food chain.
4.	**Heavy metals** like Hg, Cd, Pb, fluoride and nitrate.	Contaminate water, cause ill effects.
5.	**Chloro fluorocarbons**	Damage O_3 layer, allows more UV rays, cause skin cancer.

COMPONENTS OF ENVIRONMENT

The environment consists of the following three important components

(i) Abiotic (or) Non- living components

(ii) Biotic (or) Living components

(iii) Energy components

1.Abiotic (or)Non- living components : Air, Water, soil mineral, etc.

On the basis of physical characteristic and state, the abiotic (or)Non- living components are further subdivided into three broad categories:

(a) **Lithosphere** (sphere of rocks / soil / sediment)

Functions : (i) Home for human beings and wildlife

(ii) Store house for minerals and organic matters.

(b) **Hydrosphere** (sphere of water)

Functions : (i) Used for drinking purpose and supports the aquatic life.

(ii) Used for irrigation, power generation, industries and transport.

(c) **Atmosphere** (sphere of gas)

Functions : (i) Maintains the heat balance of the earth.

(ii) Absorbs IR radiation from sun.

(iii) Stabiles weather and climate.

2.Biotic (or) Living components : Animal including humans, plants (flora) and microorganisms (fauna).

3.Energy components :

(i) The components energy flows across the abiotic and biotic components.

(ii) Itplays an important role to maintain the life of living organisms.

Examples : Solar energy, Nuclear energy, Geothermal energy, thermo electrical energy, etc.

SCOPE OF THE ENVIRONMENTAL EDUCATION

Environmental studies has multiple and multilevel scopes. This study is important and necessary to everyone to understand the nature and its conservation.

Environmental education provides knowledge about the following areas,

(i) Natural resources – Their conservation and management.
(ii) Ecology and biodiversity.
(iii) Environmental pollution and control.
(iv) Social issues are related to development and environment.
(v) Human population and environment stopping the use of biological and nuclear weapons for destruction of human race.
(vi) Managing the unpredictable disasters.
(vii) Development of new eco-friendly technologies to various environmental issues.
(viii) These are the basic aspects of environmental science which have a direct relevance to every section of the society.

IMPORTANCE OF ENVIRONMENTAL STUDIES

To solve the environmental problems, the knowledge of environmental education is very important to everyone.

- People can understand the concept of "need of development without destruction of environment" by environmental studies.
- People can gain the knowledge of different types of environment and the effects of different environmental hazards through environmental studies.

- Environmental laws inform to people about their effective role in protecting the environment.
- Environment engineering is emerging as new carrier opportunities for environmental protection and management.

NEED FOR PUBLIC AWARENESS

1. People should be made to know how our environment gets polluted and what are the ways and means by which environment can be protected.
2. Any government at its own level cannot achieve the goals of sustainable development until the public has a participatory role in it. Public participation is possible only when the public is aware about the ecological and environmental issues.
3. Nearly 30 to 40% of the public of the developing country are really aware of the ill-effects of so many anti-environmental activities, but the remaining 60 to 70% does not consider it as a serious concern. Hence, public awareness is very essential to help understand the environmental problems.
4. Each and every one of us should know the importance of unpolluted air, land and water.
5. The environmental awareness among the people needs to be promoted to enable proper implementation of the rules and regulations.
6. There is no doubt that unless people have awareness about all these things, it will not be possible to form a healthy society.

Major causes for the environmental problems we face:

(i) Rapid population growth
(ii) Poverty
(iii) Lack of awareness of ecosystems
(iv) Unsustainable resource use.

ECOSYSTEM

ECOLOGY

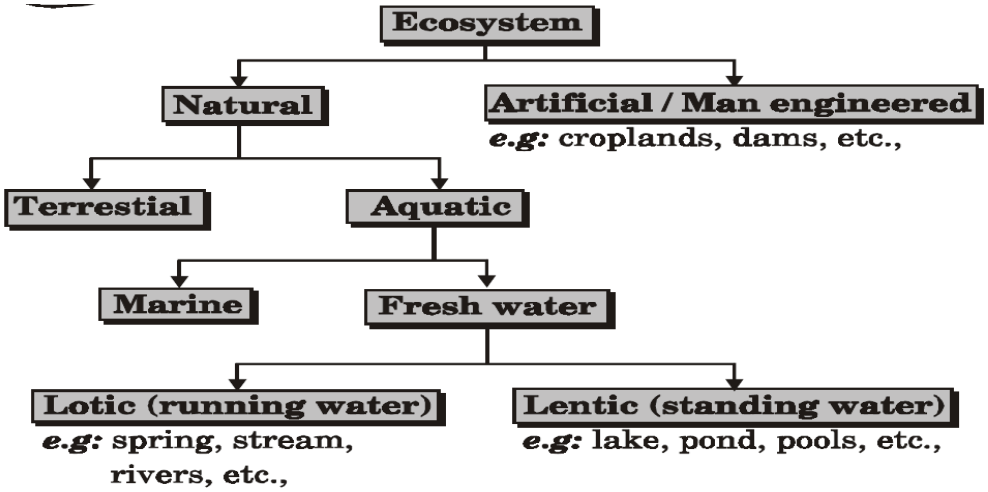
- Study of interactions among organisms or group of organisms with their environment.
- The environment consists of both biotic and abiotic components.

ECOSYSTEM

- A group of organisms **(Plants, animals, and microorganisms)** interacting among themselves and with environment.
- Term of ecosystem first coined by A.G Tansely in 1935.
- Derived by two words 'eco' means environment and system implies a complex of co-ordinated units.

Types of Ecosystem

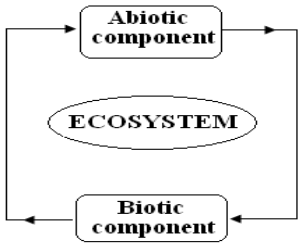
Ecosystems are classified into various types as follows:



Micro Ecosystem such as those made in laboratories for a **planned study.**

Structure of an Ecosystem

- Structure of an ecosystem explains the relationship between the **abiotic** (nonliving) and the **biotic** (living) components.



1. Biotic components

- Living organisms (Plants, animals and microorganisms) in an ecosystem form the biotic components.
- The above living members are grouped into different types based on how they get their food.

(a) Producers (Autotrophs – self-felling)

- Producers and organisms which can produce their food themselves through photosynthesis or chemical reaction.

(i) **Photoautotrophs :** They are mainly the **green plants,** which can synthesize their food themselves by making use of CO_2 present in the air and water in the presence of sunlight by chlorophyll, through the process of **photosynthesis.**

(ii) **Chemo-autotrophs (or) Chemosynthetic organisms:**
In the **ocean depths,** where there is no sunlight, **chemoautotropic sulphur bacteria** produces organic compounds from dissolved H_2S and CO_2 in the water using the heat generated by the decay of radioactive element in the earths core. They are known as chemo-autotrophs (or) chemosynthetic organisms.

(b) Consumers

- Consumers are organisms which **can not prepare its own** food and depends directly or indirectly on the producers.

The consumers are classified into

(i) **Herbivores (Plant Eaters):**
They feed directly on plants and hence also known as **primary consumers.**
Examples : Cattle, Elephant, Rabbit, Insect

(ii) **Carnivores (Meat-Eater):** They feed on flash of animals. If they feed on herbivores they are called **secondary consumers** (e,g.) Fox and Frog
If they feed on other carnivores (Snake, Big Fish) they are known as **tertiary consumers/carnivores.**

(iii) **Omnivores:** They feed on **both plants and animals.**
Examples : Humans, Many Birds, Dog, Rat.

(iv) **Detritivores:** They feed on the **parts of dead organisms** andwastes of living organisms.
Examples : Beetles, Ants, Earthworms.

Grass rabbit → Fox → tiger → →
(Producer) [Primary consumer] [Secondary consumer] [Tertiary consumer]

(c)Decomposers

- These include microorganisms like **bacteria and fungi** which attack the **dead bodies** of animals and plants and decompose them into **simpler compounds.**
- During the decomposition inorganic nutrients are released.

- These nutrients are utilized by the producers for the synthesis of their own food.

(ii) Abiotic Structure

- Physical and chemical compounds of an ecosystem constitute its structure.
  (a) **Physical factors:** The sunlight and shade, intensity of solar flux, duration of sun hours, average temperature, annual rainfall, wind, soil type, water availability, etc., are strong influence on the ecosystems.
  (b) **Chemical factors:** Availability of major essential nutrients like carbon, Nitrogen, Phosphorus, Potassium, Hydrogen, Oxygen and Sulphur, toxic substances, salts and various organic substances, soil, water largely influence the function.

Function of an Ecosystem

1. Primary function

- The primary function of all ecosystems in **manufacture of starch.**
- In the presence of sunlight, chlorophyll containing plants use CO_2 and $H_2O$to manufacture starch through a process called **photosynthesis.**

2. Secondary function

- The secondary function of all ecosystems is **distributing energy in the form of food to all consumers.**
- All aspects concerning this function form the subject matter of **energy flow** through ecological system.

3. Third function (Decomposition)

- The dead bodies of plants and animals are decomposed by the activity of bacteria and fungi.

ENERGY FLOW IN AN ECOSYSTEM

- Energy is needed for every biological activity.
- The solar energy is transformed from radiant to chemical energy in photosynthesis by plants called as primary producers.
- **Flow of energy** in an ecosystem takes place **through** the **food chain.**
- The energy flow in an ecosystem is **unidirectional** or one-way flow.
- Only **1% of the sunlight is utilized** by the green plants in **photosynthesis.**

- This small amount of light energy is sufficient to maintain all life on this earth.

The flow of energy through an ecosystem follows the laws of **thermodynamics.**

1. **First law of thermodynamics:**
   - It states that energy can neither be created nor be destroyed but it can be transformed from one form to another.

   Illustration :
   - **Solar energy** is converted into **biochemical** energy by the green plants.
2. **Second law of thermodynamics:**
   - It states that whatever energy is transformed, there is a loss of energy through the release of heat.

   Illustrations :
   - The loss of energy occurs when energy is **transferred** between tropic levels.
   - The loss of energy takes place through respiration, loss of energy in locomotion, running, hunting and other activities.

Energy ↓ Flow	Green plants [i.e., producers]	Tropic level – 1
	Herbivores [i.e. primary consumers]	Tropic level – 2
	Carnivores [i.e. secondary consumers]	Tropic level – 3
	Higher carnivores [i.e. tertiary consumers]	Tropic level – 4

NUTREINT FLOW (or) BIOGEOCHEMICAL CYCLE IN THE ECOSYSTEM

Nutrients

Elements which are essential for the survival of both plants and animals are called nutrients.

1. **Macronutrients:** The elements needed in large amounts are called macronutrients. Eg.: Oxygen, nitrogen, carbon, calcium, magnesium, phosphorous.
2. **Micronutrients:** The elements needed in small amounts are called macronutrients. Eg.: Boron, cobalt, strontium, zinc, copper.

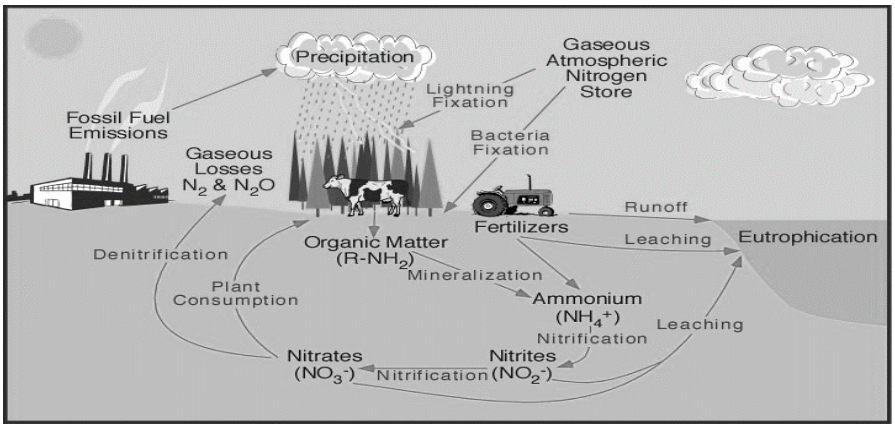
NUTRIENT CYCLE

Cyclic flow of nutrients between the biotic and abiotic components is known as nutrient cycle or biogeochemical cycles.

1. NITROGEN CYCLE

Nitrogen is present in the atmosphere as N_2 in large amounts (78%). The nitrogen is present in all biotic components in different forms as food.

Eg.: Proteins, vitamins, amino acids



Process:

- Nitrogen from the atmosphere is taken up by the green plants as a raw material for biosynthesis of different foods - Proteins, vitamins, amino acids.
- These food move through the food chain and used in metabolism.
- After death of the plants and animals, the organic N_2 in dead tissues is decomposed by several micro organisms in ammonia, nitrites and nitrates.
- These nitrates are again used by the plants.
- **Nirtrification:** It is the conversion of ammonia into nitrates. It is brought about by nitrifying bacteria. Eg: nitrobacter, nitrosomonas
- **Denitrification:** It is the conversion of nitrates into nitrogen (N_2). This process is brought about by denitrifying bacteria. Eg: Pseudomonas, fluorescence

2. OXYGEN CYCLE

The oxygen cycle is the biogeochemical cycle that describes the movement of oxygenwithin its three main reservoirs: the atmosphere (air), the biosphere (the sum of all ecosystems), and the lithosphere (Earth's crust).

1. The atmosphere :

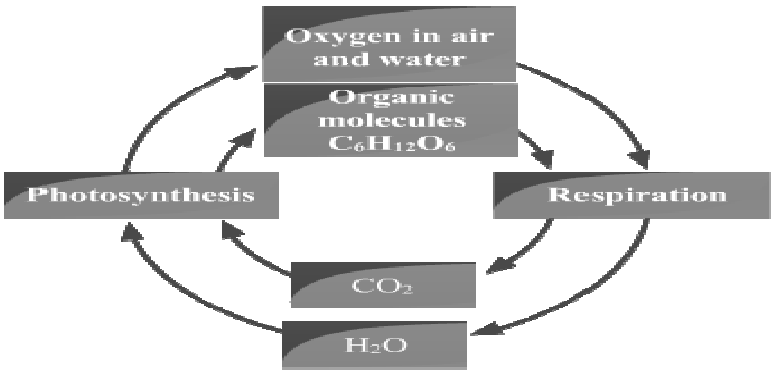
The main source of atmospheric free oxygen is photosynthesis, which produces sugars and free oxygen from carbon dioxide and water:

Photosynthesis: $6\ CO_2 + 6H_2O + \text{energy} \longrightarrow C_6H_{12}O_6 + 6\ O_2$

2.The Biosphere:

The main oxygen cycles are respiration and photosynthesis. Animals and humans breathe in O_2 and breath out CO_2.

Respiration : $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{energy}$



3. The Lithosphere:

It is the largest reservoir of earth's oxygen in the form of silicates and oxide minerals (99.5%).Only a small portion has been released as free oxygen to the biosphere (0.01%) and atmosphere (0.36%). Plants and animals extract nutrient minerals from rocks and release oxygen in the process.

ECOLOGICAL SUCCESSION

- An ecosystem is **not static** in nature.
- It is **dynamic** and changes its structure as well as function with time.
- It is observed that **one type of a community** is totally replaced by **another type of community** over a period of time and simultaneously several changes also occur. This process is known as ***ecological succession.***
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The characteristics of any ecosystem in succession / development are:

1. An increase in biodiversity.
2. A continuous change in the kinds of flora and fauna.
3. Increase in organic matter and biomass and energy flow.

Types of Ecological succession:

1. Primary Succession

- It involves the **gradual establishment of biotic communities** which are known as **pioneers** on nearly lifeless ground.

2. Secondary Succession

- The secondary succession is the **sequential development of biotic community after the complete or partial destruction of an existing community.**

PROCESS OF ECOLOGICAL SUCCESSION:

1. Nudation :

It is the development of a bare area without any life form.

2. Invasion:

It is the establishment of one or more species on a bare area through migration followed by establishment.

3. Competition:

As the number of individual species grows, there is a competition with the species for water, nutrients and space.

4. Reaction:

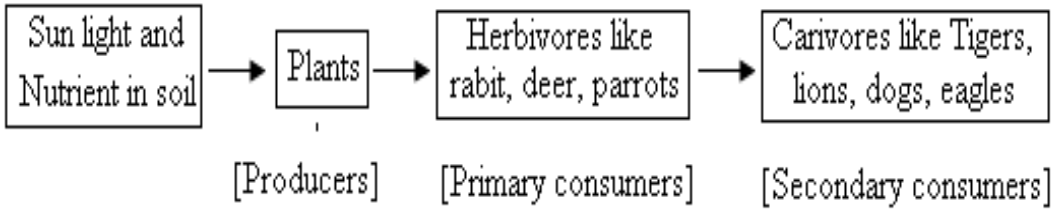
The living organisms, take water, nutrients and grow, and modify the environment is called reaction. This modification becomes unsuitable for the existing species and favour some new species, which replace the existing species.

5. Stabilization (or) Climax:

The final stabilized community after ecological succession is known as climax. The climax community is in balance with the environment and is subject to minimum changes.

FOOD CHAINS

- "The sequence of eating and being eaten in an ecosystem is known as food chain".



FOOD WEB

The**interlinking patterns of food chains are** called food web.

MAJOR ECOSYSTEM TYPES

1. FOREST ECOSYSTEM

These are the ecosystems having a predominance of trees that are interspersed with a large number of species of herbs, shrubs, climbers, lichens, algae and a wide variety of wild animals and birds.

Depending upon the climate conditions, forest may be **classified** as,

(a) Tropical Rain Forests

- They are **evergreen broadleaf forests** found near the equator.
- They are characterized by **high temperature, high humidity** and **high rainfall** all of which favour the growth of trees.
- They are the richest in biodiversity.
- Temperature is on average 20 – 25ºC and varies little throughout the year.
- Precipitation is evenly distributed throughout the year; with annual rainfall exceeding 2000nm.
- Soil is nutrient poor and acidic.
- The **Silent valley in Kerala is** the only tropical rain forest lying in India which is the natural habitat for a wide variety of species.

(b) Tropical Deciduous Forests

- They are found a little away from the equator and are characterized by **a warm climate** the year round.
- Rain occurs during monsoon.
- Different types of deciduous trees are found here, which **lose their leaves during dry season.**

(c) Tropical Scrub forests

They are found in areas where the dry season is even longer. Here there are small deciduous trees and shrubs.

(d) Temperate Rain Forests

- They are found in **temperate areas** with **adequate rainfall**
- They also consist of some evergreen broadleaf trees.

(e) Temperate Deciduous Forests

- It can be found in the eastern half of North America and the middle of Europe.
- They are found in areas with **moderate temperatures i.e. 31ºC (56ºF).**
- Well defined seasons of about equal length.
- **High annual rainfall** (75 – 150cm)
- The major trees include **broad leaf deciduous trees** like oak, hickory, popular etc.,
- Trees loose leaves in winter (deciduous)
- Animals: deer, rabbit, foxes, squirrels, frogs.

(f) Evergreen coniferous forests (Boreal forests – tundra – treeless plain)

- They are found just **south of arctic tundra.**
- Extremely **cold climate.**
- **Sunlight** is available for a **few hours only.**
- The major trees include pines, spruce, fir, cedar etc., which have tiny, needle shaped leaves having a waxy coating so that they can withstand severe cold and drought.
- The soils are acidic and prevent other plants from growing.
- Low biodiversity.
- Energy and nutrients are available in the form of dead organic material.

Some of the general characteristic features of forest ecosystems are as follows:

1. **Warm temperature** and **adequate rainfall** make the formation of number of ponds, lakes, and other adequate features.

2. Tall and girthed trees will support many wild animals within the ecosystem.
3. The soil is rich in organic matter
4. Penetration of light is so poor that conversion of organic debris to nutrients is very fast
5. They **occupy more space in globe** than any other ecosystems.
6. The abiotic environment is rich in dead and decaying organic matter.

Producers

Producers are mainly big trees, some shrubs and ground vegetation.

Primary consumers Insects like ants, spiders, flies, beetles and animals like elephants, deer, rabbit etc.

Secondary consumers

Snakes, Lizards, Foxes, Birds, etc.

Tertiary consumers

Tiger, Lion etc.

Decomposers

Decomposers are bacteria and fungi which are found in soil on the forest floor. Rate of decomposition in tropical or sub-tropical forests is more rapid than that in the temperature zones.

Food chains

(i) Plants → Deal → Fox → Tiger.

(ii) Plants → Rabbit → Fox → Lion.

2. GRASSLAND ECOSYSTEM

1. The grassland ecosystem **occupies about 10% of the earth's surface.**
2. Grasslands are found on every continent except Antarctica.
3. Grass lands are filled with **grass.**
4. The **annual rainfall** ranges between **25 to 75cm** and is usually seasonal, while the **temperatures** and **moderate.**
5. The dominant plant species are short and tall grasses and other flowering plants.
6. The **soils** of these grasslands often have a **deep organic layer.**
7. The highest abundance and the greatest diversity of **large mammals** are found in these ecosystems.
8. Limited grazing helps to improve the net primary production of the grasslands

9. Overgrazing leads to degradation of these grasslands resulting in desertification.

Three types of grasslands:

(a) Tropical Grasslands

1. They occur near the borders of tropical rain forests in regions of **high average temperature**and**low to moderate rainfall.**
2. In Africa, these are typically known as **Savannas.**
3. The Savannas have a wide diversity of animals including zebras, giraffes, gazelle, antelopes etc.,
4. During dry season, fires are quite common.
5. Tropical Savannas have a highly efficient system of photosynthesis.

(b) Temperate Grasslands

1. They are usually found on **flat, gentle sloped hills.**
2. **Winters** and **very cold** but **summers** are **hot and dry.**
3. Intense grazing and summer fires do not allow shrubs or trees to grow.
4. The amount of rainfall is less in temperate grasslands than in Savannas. The average annual rainfall is about 50 to 89cm.
5. The soil of the temperate grasslands is deep and dark with fertile upper layer.
6. The fauna include gazelles, zebras, wild horses, lions, wolves, jack rabbits, dear, mice, foxes, blackbirds, meadow larks, quails, sparrows, hawks, owls, snakes etc.
7. The soils are quite fertile and therefore, very often these grasslands are cleared for agriculture.

(c) Polar Grasslands (Arctic Tundra)

1. They are found in **arctic region** where **severe cold and strong, cold winds**along with ice and snow create too **harsh climate** for trees to grow.
2. In summers the sun-shines almost round the clock and hence several small annual plants grow in the summer.

Structure of the Grassland Ecosystem

1. Producers

Grass, some herbs, shrubs and few scattered trees.

2. Primary consumers

They are mainly grazing animals such as cow, sheep, deer, horse, kangaroo, antelopes, etc. some insects, millipedes and spiders have also been included as primary consumers.

3. **Secondary consumers :**Fox, jackals, snakes, lizards, frogs and birds.
4. **Tertiary consumers :**Fox, jackals, snakes, lizards, frogs and birds.
5. **Decomposers :**Bacteria, fungi.

Food chain

(i) Grass → Grasshopper → Lizard → Hawk.

(ii) Grass → Rabbit → Fox → Lion

3. DESERT ECOSYSTEM

1. These ecosystems occur in regions where evaporation exceeds precipitation (rainfall, snow etc.,)
2. The average **rainfall** is less than **25cms.**
3. They **occupy** about **17%** of the total **land.**
4. Deserts are found throughout the world and **Sahara** is the **largest desert** which is almost equivalent to an area of united states.
5. Deserts have **little species diversity**
6. The **atmosphere is very dry** and hence it is a **poor insulator.**
7. The soil is very poor in nutrient and organic matter.
8. Desert plants and animals are having most **typical adaptations** for **conservation of water.**
9. Many **desert plants** are found to have reduced, **scaly leaves** so as to cut down loss of water due to transpiration or have **succulent (juicy) leaves** to store water.
10. Some plants show very **deep root** to tap the groundwater.
11. Many plants have a **waxy, thick layer over the leaf** to reduce loss of water through transpiration.
12. **Desert animals** like insects and reptiles have **thick outer coverings** to minimize loss of water.
13. They usually live inside burrows (holes in the earth) where humidity better and heat is less.

Types of Desert

Deserts are of three major types, based on climatic conditions

(a) **Tropical deserts** like **Sahara** and **Namib** in Africa and **Thar Desert,** Rajasthan, India are the driest of all with only a few species. Wind blown sand dunes are very common.

(b) **Temperate deserts** like **Mojave** in Southern California where day time temperature are very hot in summer but cool in winters.

(c) **Cold deserts** like the **Gobi desert** in China have cold winters and warm summers.

Structure of desert ecosystem

The different components of a desert ecosystem are:

(a) Abiotic Components

The abiotic component includes the nutrient present in the soil and the aerial environment.

(b) Biotic Components: The various biotic components are;

(i) Producers

The producers are mainly **Shrubs or bushes, some grasses and a few trees.**Low plants such as lichens, mosses and blue green algae are minor producers.

(ii) Primary consumers

They are **animals like rabbits** which get water from succulent plants. They do not drink water even if it is freely available. **Camel** is also a primary consumer of the desert ecosystem.

(iii) Secondary consumers

Secondary consumers are carnivores like **reptiles** having **impervious skin** which minimize loss of water from the surface of body.

(iv) Tertiary consumers

The tertiary consumers are mainly birds which conserve water by excreting **solid uric acid.**

(v) Decomposers:

Due to poor vegetation the amount of dead organic matter is very less. As a result the decomposers are very few. The common decomposers are some bacteria and fungi most of which are **thermophillic.**

Food Chain

Shrubs ⟶ Rabbits ⟶ Reptiles ⟶ Birds

4. AQUATIC ECOSYSTEM - 2 types - Freshwater and Saltwater ecosystem

(A) Pond Ecosystem

1. It is a small **freshwater aquatic ecosystem** where water is stagnant.
2. Ponds may be seasonal in nature
3. Ponds are usually shallow water bodies.
4. The ponds are however, very often exposed to tremendous anthropogenic (human – generated) pressures.
5. They are used for washing clothes, bathing, and swimming. Cattle bathing and drinking etc, and therefore get polluted.

Structure

1. Abiotic components

Abiotic components of pond ecosystem include **Water, solar energy** and **mineral components** such as calcium, phosphates,. nitrogen components and physical factors like temperature, light etc.

2. Biotic components

(a) Producers

The producers are **phytoplankton** and **microphytes.**

(i) **Phytoplankton** includes small floating plants such as volvox, algae like spirogyra, charazygnema and vlothrix etc.

(ii) **Microphytes**are large plants which may be floating plants, submerged plants and amphibious plants.

(b) Consumers

The consumers of pond ecosystem include (i) **Zooplankton (ii) Nekton.**

(i) **Zooplankton** comprises the primary consumers such as ciliate, flagellates and protozoans etc.,

(ii) **Nekton** comprises the secondary and tertiary consumers. The **Secondary consumers** include insects like water beetles and small fish, which feed on zooplankton. **The tertiary consumers** are large fish which feed on smaller fish.

(c) Decomposers

The decomposers in pond ecosystem are **aquatic fungi. Bacteria and also the flagellates.** They are distributed throughout the pond but are found especially at the bottom where dead plants and animals accumulate.

Food chain

Phytoplankton ⟶ Zooplankton ⟶ Fishes ⟶ Snakes.

Phytoplankton ⟶ Zooplankton ⟶ Small fishes ⟶ Big fishes

(B) Lake Ecosystem

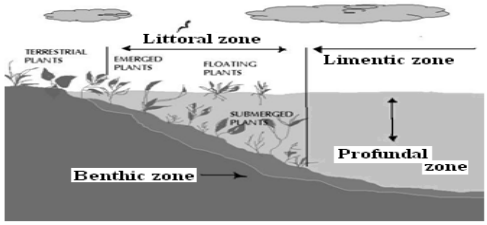
1. Lakes are large natural bodies of **standing fresh water** which are formed during precipitation. Runoff or ground water seepage fills depressions in the earth's surface.
2. **Zones of Lake Ecosystem:**

(i)Littoral zone: The top layer is the littoral zone. It consists of the shallow sunlit waters near the shore to depth at which rooted plants stops growing and has a **high biological diversity.**

(ii)Limnetic zone: The next to the littoral zone is limnetic zone. The open sunlit water sunlight water surface layer away from the shore that extends to the depth penetrated by sunlight.

(iii) Profundal zone: The deep open water where it is too dark, for photosynthesis. Without sunlight and plants, oxygen level is low.

(iv) Benthic zone: This zone is found at the bottom of the lake.



Zones of lake ecosystem

The **Dal Lake** in Srinagar (J&K), **Naini Lake** in Nainital (Uttaranchal) are **Loktak Lake** in Manipur are some of the **famous lakes** of our country.

Organisms: The lakes have several types of organisms.:

(a) **Planktons** that float on the surface of waters.
Examples :Phytoplanktons like algae and zooplanktons like rotifers.

(b) **Nektons** that swim. Examples : fishes.

(c) **Neustons**that rest or swim on the surface.

(d) **Benthos** that are attached to the bottom sediments.
Examples : Snails.

(e) **Periphytons** those are attached or clinging to other plants or any other surface. Examples :Crustanceans.

Types of Lakes:

Some important types of lake are:

(a) **Oligotropic Lake** which have low nutrient concentration.

(b) Eutropic Lakes which are over nourished by nutrients like nitrogen and phosphorus, usually as a result or agricultural run-off or municipal sewage discharge. They are covered with "**algae blooms".**

(c) Dystropic Lakes that have low pH, high humic acid content and brown waters.

Examples : Bog Lakes

(d) Endemic Lakes that are very ancient, deep and having endemic fauna .

(e) Desert Salt Lakes that occur in arid (i.e., dry) regions and have developed high salt concentrations as a result of high evaporation

Examples : great salt lake, Utah.

(f) Volcanic Lakes that receive water from magma after volcanic eruptions

Examples : Many lakes in Japan.

(g) Meromictic Lakes that are rich in salts and are permanently stratified.

Examples : Lake Nevads.

(h) Artificial Lakes (or) Impoundments that are creates due to construction of dams. Examples :Govindsagar Lake at Bhakra – Nangal.

C. Streams and Rivers Ecosystem

1. Small streams join to form rivers.
2. No oxygen deficiency under natural conditions.
3. Their dissolved oxygen level is higher than that of ponds even though the green plants are much loss in number.
4. fresh and free flowing water systems
5. Oxygen content is more due to mixing of water
6. Deposits large amount of nutrients.
7. The number of animals are living low in river and stream.
8. The longest river is the **Nile River** in Africa, and the **Amazon River** in South America carries the most water. The muddiest river is the yellow River in China.

Structure and function:

(i) Producer :Phytoplankton, algae, water grasses and amphibious plants

(ii) Primary consumers :Water insects, snails, fishes.

(iii) Secondary consumers :Birds and mammals

(iv) Decomposers : Bacteria and fungi

D. Estuary Ecosystem

1. An estuary is an area where freshwater meets salt water as a bay, the mouth of a river, a salt marsh.
2. Transition zones between rivers and the sea
3. Rivers and streams drain into estuaries, bringing in nutrients from uplands.
4. Estuaries are affected by the tides. So, there can be changes of salinity, temperature and other physical properties in an estuarial system.
5. Salinity remains highest during the summer and lowest in winter.
6. Estuaries are among the most **productive ecosystem** in nature.
7. Rivers and streams drain into estuaries, bringing in nutrients from uplands.
8. Estuaries have a **rich biodiversity** and many of the species are endemic.
9. Snook, trout, mullet, jack, redfish, spot, catfish, sleeps heed, spiny lobster, shrimp, crabs, oysters and clams are examples of the diverse marine animals dependant upon healthy estuaries.
10. Estuaries also provide **breeding and nesting areas,** for many **coastal birds.**
11. Estuaries are of much use to human beings due to their **high food potential.**However these ecosystems need to be protected from pollution.

E. Ocean Ecosystem

1. About **70% of the world is covered by water** and 97% of this water lies in the oceans.
2. The oceans have a major effect upon the weather, and they **moderate the world's climate.**

3. The world's oceans contain about **2, 50,000 known species** of marine plants and animals and provide a huge variety of sea-products and drugs.
4. Oceans provide us iron, phosphorus, magnesium, oil, natural gas, sand and gravel.
5. Oceans are the major sinks of CO_2 and play an important role in regulating many biogeochemical cycles and hydrological cycle. Thereby regulating the earth's climate.
6. The oceans have to **major life zones:**
   i. **Coastal zone** with relativity warm, nutrient rich shallow water. Due to high nutrients and ample sunlight, this is the zone of high primary productivity.
   ii. Open sea: It is the deeper part of the ocean, away from the continental shelf [The submerged part of the continent]. It is vertically divided into three regions.

(a) Euphotic zone: The euphotic zone is the **lighted upper zone** of the open sea where photosynthesis occurs, mostly in phytoplankton.

(b) Bathyal zone: It receives **dim light** and is usually geologically active. It does not contain photosynthesizing producers because of the lack of sunlight. Various types of zooplankton and smaller fish populate this zone. Many of which migrate to feed on the surface at night.

(c) Abyssal Zone: It is the **dark zone,** 2000 to 5000 metres deep. The abyazal zone has no solar light. It is very cold and has little dissolved oxygen. It is the **world's largest ecological unit** but it is an **incomplete ecosystem.**

7. Atlantic, Pacific, Indian, Arctic and Antarctic are the main oceans of the world.

8. The ocean represents a very large and stable ecosystem.

9. Structure of ocean ecosystem:

1. Abiotic components

It is a more stable in chemical composition due to being saline [35 parts of salts by weight per 1000 parts of water]. Marine water contains Na, Ca, Mg and K salts.

2. Biotic components

(i) Producers

Phytoplanktons (diatom, algae, sand dinoflagilltes) and larger marine plants.

(ii) Consumers (or) Heterotropic macro consumers

(a) Primary consumers:

These are herbivores and feed directly on producers.

Examples : Crustaceans, mollusks, fish etc.

(b) Secondary Consumers:

Carnivores fishes (Herring, sahd, mackerel]

(c) Tertiary consumers:

Fishes (Cod, Haddock)

(iii) Decomposers:

Bacterial and some fungi.

BIODIVERSITY

It is defined as the variety of plants and animals and other living things in a particular area or region. (Or)

It refers to the variety and variability among living organisms and ecological complexes in which they occur.

Types of Biodiversity:

The concept of biodiversity may be analyzed in three different levels.

1. Species diversity
2. Genetic diversity
3. Ecosystem diversity

1. Species diversity

- Species diversity is the sum of the **variety of all living organisms at the species level.**
- Species diversity is a concept of the variety of living organisms on earth and is measured by the total number of species in the world. It includes plants, animals, and microorganisms on the plant.
- There are about 10 to 80 million species on the earth, out which only 1.4 million species were studied.
- The **richness of the species in an ecosystem** is usually referred to **species diversity.**
- There are two popular indices of measuring species diversity known as Shannon – Wiener index and Simpson index.

2. Genetic diversity

- Genetic diversity is a concept of the **variability within a species.**
- It is measured by **the variation in genes within a particular species,** variety, subspecies or breed.
- For example :**all rice, apple, mango, and tomato varieties,** which show variations at the genetic level and differ in their colour, size, shape, aroma and nutrient content.

3. Ecosystem diversity

- Ecosystem diversity is the **variation of habitats present** in a given area.
- The ecosystems also show **variations with respect to physical parameters** like moisture, temperature, altitude, precipitation etc.
- It includes ecosystem like forest ecosystem, grassland ecosystem, marine ecosystem, aquatic ecosystem, etc. etc.

- Ecosystem diversity is the aggregate of different environmental types in a region.

VALUES OF BIODIVERSITY

- **Biosphere is a life supporting system** to the human race. Each species in the biosphere has its own significance.
- Biodiversity is must for the **stability and proper functioning** of the biosphere.
- The value of biodiversity in terms of its commercial utility, ecological services, social and aesthetic value is enormous.
- The value of biodiversity is **classified into 6 values – Consumptive use, Productive use, Social use, Ethical or moral, Aesthetic and Optional values.**

1.Consumptive use value

- These are direct use values where the biodiversity product can be harvested and consumed directly.
- Examples : Fuel, Food, Drugs, Fiber etc.

(i) Food

- About **80,000 edible plant** (eatable) species have been reported from wild.

(ii) Drugs and Medicines

- About **75% of the medicines** depends upon plant extracts or plants for medicines.

For example

- **Germany** alone uses more than **2,500 species of plants** for medicinal purposes.
- **India** uses **3000 species** of plants for medicinal purposes.
- 1) Penicillin -antibiotic- from the fungus like penicillium
- 2) Tetracyclin –antibiotic –from a bacterium
- 3) Quinine –antimalarial –from bark of cinchona tree
- 4) Aspirin –pain killer –from willow tree
- 5) Vinblastin, vincristin –anticancer –from rosy periwinkle plant

2. Productive use values

- These are the **commercially usable values** where the product is marketed and sold.

- These may include the **animal products** like**tusks**of elephants, **musk** from musk deer, **silk** from silk-warm, **wool** (hair) from sheep, for of many animals, lac from **lac** insects etc, all of which are traded in the market.
- **Many industries** are dependent upon the productive use values of biodiversity Examples : the paper and pulp industry, plywood industry, railway sleeper industry, silk industry. Textile industry, ivory – works, leather industry, pearl industry etc.
- Just three crops – **Wheat, rice and maize** account for about **60% of the calories** and about **55% of the protein** that humans consume come directly from plants.
- Global fish production exceeds that of cattle, sheep, poultry and even eggs.

3. Social value

- These the values associated with the **social life, traditions, religion and phycho-spiritual aspects of the people.**
- **Many of the plants** are considered **holy and sacred** in our country like Tulsi, Peepal, Mango, Lotus etc.
- Many animals like Cow, Snakes, Bull Peacock, Owl etc, also have significant place in our society.
- Thus biodiversity has distinct social value, attached with different societies.

4. Ethical value

- It is also sometimes known as **existence value.** It involves ethical issues like **"all life must be preserved".** It is based on the concept of "Live and let live".
- If we want our human race to survive, then **we must protect all biodiversity,** because biodiversity is valuable.
- The ethical value means that we may or not use a species, but knowing the very fact that this species exists in nature gives us pleasure.
- Small animals play an important role in ecological balance.

For examples:

- We all feel sorry when we learn that **"Passenger pigeon" or "dodo"** is not more on this earth.
- We are not deriving anything direct from **Kangaroo, Zebra** or **Giraffe,** but we all strongly feel that these **species should exist in nature.**

5. Aesthetic value

- Wild plants and animals are a source **beauty, wonder, joy and recreational pleasure for many people.**
- People can enjoy the **aesthetic value of biodiversity** and this type of tourism is now known as **eco-tourism.**
- Ecotourism is estimated to generate about **12 billion dollars** of revenue annually that roughly gives the aesthetic value of biodiversity.
- Wild game species provide recreation in the form of **hunting and fishing.**

6. Option value

- These values include the potentials of biodiversity that are **presently unknown and need to be known.**
- Eg. Taxol (cancer drug obtained from yew tree)

BIOGEOGRAPHICAL CLASSIFICATION OF INDIA

- India has **different types of climate and topography** and these variations have induced enormous variability of flora and fauna.
- India occupies the **tenth position** among **plant rich nations** of the world.
- It has been classified into **ten biogeographic zones.** Each of these zones has its own characteristic climate, soil, topography and biodiversity.

India's major biogeographical habitats:

1. Himalayan ranges and valleys of Kashmir, HP, Uttrakhand, Assam, etc.
2. Trans Himalayan region of Ladakh
3. Terai-lowland where the Himalayan rivers flow into the plains
4. The Gangetic and Brahmaputra plains
5. The Thar desert of Rajasthan
6. Semi-arid grassland of Deccan, including Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu.
7. The NE states (*Arunachal Pradesh*, *Assam*, *Manipur*, *Meghalaya*, *Mizoram*, *Nagaland*, and *Tripura*)
8. The Western ghats in Maharashtra, Karnataka and Kerala
9. The Andaman and Nicobar Islands
10. The long western and eastern coast belt with sandy beaches, forests and mangroves.

BIODIVERSITY AT GLOBAL, NATIONAL AND LOCAL, LEVELS

1. Global Level

- Roughly **1.4 million species are known** till date which may be just 2% of the actual number.
- **Terrestrial biodiversity** of the earth is best described as biomass, which are the **largest ecological units** present in different areas.
- Examples: the tropical rainforests, tall grass prairies (plains), savannas, desert, tundra etc.,
- The **tropical rainforests** are populated by millions of species of plants, birds, amphibians insects as well as mammals.
- They are the **earth's largest storehouse of biodiversity.**
- About 50 to 80% of global biodiversity lives in the rainforests.
- These are an estimated 1,25,000 flowering plant species in tropical forests.
- **Globally,** we have roughly **1,70,000 flowering plants, 30,000 vertebrates** and about **2,50,000 other groups of species.**
- It is interesting to know that **marine diversity** is even much higher than terrestrial biodiversity and ironically, they are still less known and described.

2. National Level (India)

- Every country is characterized by its own biodiversity depending mainly on its **climate.**
- India has a **rich biological diversity** of flora and fauna. Overall **6% of the global species** are found in India.
- It is estimated that India **ranks 10th** in terms of number of **endemic species** of higher vertebrates and **6th**among the **centers of diversity** and origin or agricultural crops.
- The total number of living species identified in our country is **1,50,000.**
- India possesses **two,** one in the **north-east region** and one in the **Western Ghats.**
- India is also **one of the 12 mega-biodiversity countries** in the world.
- Based on the available data, India ranks **fourth in Asia in plant diversity.**

Biodiversity in India

- **Himalayas** - This majestic range of mountains is the home of a diverse range of flora and fauna. **Eastern Himalayas** is one of the two **biodiversity hotspots** in India.
- **Chilika**– This wetland area is protected under the **Ramsar convention.**
- **Sunderbans –** The **larges mangrove** forest in India.
- **Western Ghats** – One of the two **biodiversity hotspots** in India.
- **That desert** – The climate and vegetation in this area is a contrast to the Himalayan region.

3. Regional or Local Biodiversity (Tamilnadu):

- **Tamilnadu** has a **rich biological diversity** which consist of **5 national parks, 20 wild life sanctuaries** and **2 biosphere reserves.**
- Some of the **important locations** in Tamilnadu are
    a. Anaimalai wild life sanctuary
    b. Mudumalai wild life sanctuary
    c. Mundanthurai wild life sanctuary
    d. Point calimere wild life sanctuary
    e. Vedanthangal wild life sanctuary
    f. Guindy national park
    g. Chennai crocodile bank
    h. Kunthakulambirds sanctuary
    i. Viralimalai peacock sanctuary
    j. Mukkurti national park
    k. Kazlakkadu wild life sanctuary
    l. Srivilliputhur grizzled squirrel sanctuary
    m. Gulf of mannar marine national partk
    n. Parambikulam sanctuary
- **The Nilgiris** has most of its area under forests, a little more than half of its area.
- There are also **dense forests in Salem district.**
- Tamilnadu has a total geographical area in 4% of the India's land surface.
- **Western ghats**has 1600 species of higher plants, 54 species of mammals, 91 reptiles and 84 amphibians.

Various measures of biodiversity

Biodiversity at regional level is better understood by categorizing **species richness into four types,** based upon their spatial distribution as discussed below.

(i) **Point richness** refers to the number of species that can be fount at a single point in a given space.

(ii) **Alpha (α) richness** refers to the number of species found in a small homogeneous area.

(iii) **Beta (β) richness** refers to the rate of change in species composition across different habitats.

(iv) **Gamma (γ) richness** refers to the rate of change across large landscape gradients.

INDIA AS A MEGA-DIVERSITY NATION:

- India is **one of the 12 mega diversity countries** in the world.
- The Ministry of Environment and Forests, Govt. of India (2000) records **47,000 species of plants** and **81,000 species of animals** which is about **7% of global flora** and **6.5% of global fauna.**
- India has **ten biogeographic** regions including the Trans-Himalayan, the Himalayan, the Indian desert, the semi arid zone, the western ghats, Deccan peninsula, the Genetic plain, North – East India, the islands and coasts.
- India has **5 world heritage sites, 12 biosphere reserves,** and **6 Ramsar wet lands.** Amongst the protected areas, India has **88 national parks** and **490 sanctuaries** covering an area of 1.53 lakh sq.km.
- The following table shows that the distribution of species in some major groups of flora and fauna in India.

Group – Wise species Distribution

Plants	Number	Animals	Number
Bacteria	850	Lower groups	9,979
Fungi	23,000	Mollusca	5,042
Algae	2,500	Anthropoda	57,525
Bryophyte	2,564	Pisces (Fishes)	2,546
Pteridophyte	1,022	Amphibia	428
Gymnosperms	64	Reptiles	1,228
Angiosperms	15,000	Birds	204
		Mammals	372

- **Endemism :**Species which are restricted only to a particular area are known as **endemic.** India shows a **good number of endemic species.**

- About **62% of amphibians** and **50% of lizards** are endemic to India.
- **Western Ghats** are the site of **maximum endemism.**

Centre of origin

- A large **number of species** are known to have originated to India. Nearly 5000 species of flowering plants had their origin in India.
- India has been the center of origin of 166 species of crop plants like rice, sugarcane, jute, mango, citrus etc, and 320 species of wild relatives of cultivated crops.

Marine diversity

- Along **7500 km long coastline** of our country in the mangroves, estuaries, coral, reefs, back water etc. there exists a rich biodiversity.
- More than **340 species of corals** of the world are found here.
- The **marine diversity is rich** in mollusks, crustaceans (gabs), polychaetes, and corals.
- **Mangrove plants** and**sea grasses** (marine algae) are also found in our country.

HOT-SPOT OF BIODIVERSITY:

- A **biodiversity hot-spot** is biogeographic region with a significant reservoir of biodiversity that is under threat from humans.
- (or) The Hot spots are geographic area which possess high endemic species
- About 40% of terrestrial plants and 25% of plant species as endemic and found in these hotspots
- There are **25 such hot spots of biodiversity** on a global level out of which two are present in India, namely the **Eastern Himalayas** and **Western Ghats.**
- These hotspots covering less than **2% of the world's land** area are found to have about 50% of the terrestrial biodiversity.
- About **40% of terrestrial plants** and **25% of plant species** as endemic and found in these hotspots.

Criteria for recognizing hot spots:

- Richness of the endemic species.
- Should have a significant % of specialized species.
- Site under is under threat.
- Should contain gene pools of potentially useful plants.

Global hotspots of biodiversity :

1. Tropical Andes 2. Mesoamerican forests 3. Caribbean 4.Brazil's Atlantic forests

5. Choc / Darien of panama western Ecuador 6. Brazil's cerrado 7. Central Chile.

8. California Floristic province 9. Madagascar 10. Eastern Arc and Coastal, Forest of Tanzania / Kenya 11. Western African forests. 12. Cape floristic province 13. Succulent karoo

14. Mediterranean Basin 15. Caucasus 16. Sunderland 17. Wallacea. 18. Philippines.

19. Indo-Burma Eastern Himalayas 20. South-central china 21. Western-ghatsSrilanka

22. South-western Australia 23. New Caledonia 24. New Zealand 25. Polynesia / Micronesia

ENDANGERED SPECIES OF INDIA

- A species is said to be endangered, when its number has been reduced to a critical level. unless it is protected and conserved, it is in immediate danger of extinction.
- In India, nearly **450 plant species** have been identified in the categories of endangered, threatened or rare.
- About **150 mammals, 150 species of birds** and unknown number of insects are **endangered.**
- A few species of endangered reptiles, birds, mammals and plants are given below:

(a) Reptiles : Gharial, green sea turtle, tortoise, python.

(b)Birds : Green Indian bustard, Peacock, Pelican, Great Indian hornbill, Siberian white crane.

(c) Carnivores Mammals : Indian wolf, red fox, sloth bear, red panda, tiger, leopard striped, Hyena, Indian lion, golden cat, desert cat, dugong.

(d) Primates (or) [highest order of mammals] :Hoolock gibbon, lion-tailed macaque, Nilgiri langur, capped monkey. Golden monkey.

(e) Plants : A large number of species of orchids, medicinal plants like RauvolfiaSerpentina and Sandal wood tree.

ENDEMIC SPECIES OF INDIA:

- "The species which are only found in a particular region are known as **endemic species".**
- India has **two biodiversity hot spots** and thus possesses a large number of endemic species.
- Out of about **47,000 species of plants** in our country **7000 are endemic.**
- Thus, Indian subcontinent has about **62% endemic flora,** restricted mainly to **Himalayas, Khasi Hills** and **Western Ghats.**
- A large number of a total **81,000 species of animals** in country is **endemic.**
- **The Western Ghats** are particularly rich in amphibians (frogs, toads etc) and reptiles (lizards, crocodiles etc). About 62% of amphibians and 50% of lizards are endemic to Western Ghats.

RED data book (or) Red list:

Red book is a catalogue of taxa (group of organisms) facing risk of extinction. The purpose of preparation of red list is to :

1. Provide awareness to the degree of threat to biodiversity
2. Provide global index on already decline of biodiversity
3. Identification of species at high risk of extinction
4. Help in conservation action
5. Information about international agreements
   - India's biodiversity is threatened due to habitat destruction, degradation, fragmentation and over exploitation of resources
   - According to RED data book, 44 plant species are critically endangered, 54 endangered and 143 are vulnerable (exposed to damage)
   - India ranks 2nd in terms of the number of threatened mammals
   - India ranks 6th among the countries with the most threatened birds

THREATS TO BIODIVERSITY:

- **'Extinction'** means the elimination of a particular species. Extinction process shall natural or human caused.
- Except few cases like spreading of diseases, extinction is human caused.
- **Major biodiversity threats**includes,
  i. Habitat destruction
  ii. Poaching

iii. Man and wild life conflicts
iv. Extension of rich biodiversity site for human settlement and industrial development
v. Destruction of coastal area.
vi. Uncontrolled commercial exploitation.
vii. Excessive use of pesticide

- Habitat destruction, over exploitation, pollution and species introduction are the **causes of biodiversity loss** in India.
- Other factors include fires, which adversely affect regeneration in some cases, and such **natural calamities** as droughts, diseases, cyclones and floods.

(a) Loss of Habitat

- **Destruction and loss of natural habitat** is the single largest cause of biodiversity loss.
- These **natural forests and grasslands** were the natural homes of thousands of species which destroyed due to loss of their natural habitat.
- The unique rich biodiversity of the **wetlands, estuaries** and **mangroves** are under the most serious threat today
- **Indirect human impacts on habitat –** Human activities that result in pollution can also result in habitat loss even without coming into contact with an area.
- For example, industrial wastes, acid rain, photochemical smog, excessive heat from thermal electric plants, rapid changes in climate due to enhanced green house effect have an impact on both plants and animals.
- The rate of **disappearance of tropical forests** in our country is **0.6% per year.**
- With the **current rate of loss** of forest habitat, it is estimated that **20, 25% of the global flora** would be **lost within a few years.**

(b) Poaching

- **Illegal trade** of wildlife products by killing endangered animals i.e., "**poaching"** is another threat to wildlife.
- Animals are **killed illegally** for their meat, skins and internal organs.

- One of the driving forces behind the illegal killing of wildlife species is the **illegal trade in animal parts** which is a world-wide problem and multimillion dolor markets.
- Many of the species illegally killed are **tiger** for **tiger bones, rhinos** for **their horns, bears** for a variety of **body parts, elephants** for **tusks** and **plants** for **herbal products,** etc.
- In India, **Bengal tigers** face extinction, since a coat made from their fur sells for up to 1,00,000 dollars in the East.
- **Fish stocks** have been seriously depleted by **over harvesting** in many parts of the world, because of huge increase in fishing efficiency in recent years.
- There are **several different** reasons for hunting.
  (i) **Subsistence hunters** kill animals for food.
  (b) Sport hunting is when hunters kill animals for recreation.
  (c)Commercial hunting is when hunters kill for profit.

(c) Man-Wildlife Conflicts

- Rapidly **growing human populations** often interferes with wildlife, creating man-wildlife conflicts.
- The reasons are,
  1. The domestic cattle compete with wild animals for grass and water.
  2. **Dwindling habitats** of tigers, elephants, rhinos and bears due to shrinking forest cover compels them to move outside the forest and attack the filedof sometimes even humans.
  3. Agriculturists, especially in the temperate high lands, hill slopes and river beds encroach in wildlife area.
  4. **Human encroachment** into forest area raises a conflict between man and wildlife.
  5. Many **tourists** in the wildlife areas disturb the wild animals by transport, resorts and hunting.
  6. The **glamour products** obtained from wildlife such as skin, horns, etc.
  7. Due to **lack of food,** the animals move out of the forest in search of food.
  8. *Loss of food* and *water* in their habitat due to the *shrinking of forest* cover and *loss of biodiversity*

CONSERVATION OF BIODIVERSITY

The **enormous value of biodiversity** due to their genetic, commercial, medical, aesthetic, ecological and optional importance emphasizes the need to conserve biodiversity.

- Biological diversity is one of the important **tools for sustainable development.**
- It includes:
- Protection of all *critically endangered*, *endangered*, *vulnerable*, *rare* and other species of life present in the ecosystem
- Preservation of all varieties of *old* and *new flora*, *fauna* and *microbes*
- Protection and preservation of *critical habitats*, *unique ecosystems*
- Regulation of *international trade in wildlife*
- Reduction of *pollution*
- Increase in *public awareness*

There are **two approaches** of biodiversity conservation:

(a) In Situ Conservation (within habitat)

- Here the species are protected in **their own natural** or a **slightly modified** man made ecosystems.
- (or) Conservation of flora and fauna **within natural habitat** is called **in-situ conservation.**
- Examples : Biosphere Reserves, National Parks, Sanctuaries, Reserve forests etc.
- At present we have **13 biosphere reserves, 88 National parks, 490 sanctuaries** and **120 Botanical gardens** in our country.
- **Biosphere reserves:**
    1. It covers large area (>5000 sq.km).
    2. Long time protection,
    3. It protects endangered species.
    4. Site of recreation and tourism.
    5. Used for educational and research activities.
- **National Park:**
    1. It is an area dedicated for the wildlife conservation along with its environment.
    2. It protects , propagates and develops the wild life.
    3. Site of recreation and tourism.
- **Wildlife sanctuaries:**
    1. It is an area which is reserved for animals conservation only.

2. Killing, hunting, shooting of animals should be prohibited inside.
3. Harvesting of timber, forest products

- **Gene sanctuary:**
  1. It is an area where the plant are conserved.

Advantages:

1. Cheap & convenient method 2. Species get adjusted to the natural disaster

Disadvantages:

1. It *requires a large area* for the complete protection of bio diversity
2. Maintenance is not proper due to shortage of staff & pollution

(b) Ex-situ conservation

- Here the species are protected **outside their habitats** and increase their population in a planned way.
- (or) Ex-situ conservation means that the flora and fauna are preserved outside natural habitat.
- This is done by establishment of gene banks, seed banks, zoos, botanical gardens, culture collections etc.

Methods:

1. National Bureau of Plant Genetic Resources (NBPGR) in Delhi - To preserve crops (agricultural and horticultural)
2. National Bureau of Animal Genetic Resources (NBAGR) in Haryana, KARNAL - To preserve animals.
3. National Facility for Plant Tissue Culture Repository (NFPTCR) - To conserve crop plants or trees by tissue culture.

Advantages:

- Long life conservation
- Assured food, water, shelter and security
- Endangered species may survive longer due to special care.
- Better process of breeding due to modern facilities.

Disadvantages:

- Expensive method
- Wild life freedom is lost
- Animals cannot survive in natural environment.

UNIT-II

ENVIRONMENTAL POLLUTION

Definition

Environmental pollution may be defined as, "the unfavorable alteration of our surroundings". It changes the quality of air, water and land which interferes with the health of humans and other life on earth.

Types of pollution

(i) Air Pollution

(ii) Water Pollution

(iii) Soil Pollution

(iv) Marine Pollution

(v) Noise Pollution

(vi) Thermal Pollution and

(vii) Nuclear hazards.

AIR POLLUTION

Defintion

Air Pollution is defined as the presence of one (or) more contaminants like dust, smoke, mist and odour in the atmosphere which causes damage to plants, animals and human beings.

Composition of air:

N- 78%, O_2 – 21%, Argon <1%, CO_2, 0637%, Tracer of O_3, He, NH_3.

SOURCES:

(i) National Source:

Volcanic eruption, forest fires, biological decay, radioactive materials.

(ii)Man-made:

Thermal power plants, Automobile emission, forest fires , fuel burning, agricultural activities.

CLASSIFICATION OF AIR POLLUTANTS

Primary pollutions, secondary pollutions

Primary Pollutants

Pollutants emitted directly into the atmospheres in harmful form.

E.g.: CO, NO, SO_2 etc.

Secondary Pollutants

Some of primary pollutants react with one another (or) with basic Components of air to form new polluants. **E.g.:** NO/No_2 Moist HNO_3/NO_3 etc.

Indoor Air Pollutants

These are primary air pollutants. Important indoor air pollutant is radon gas.

Sources of I.A. Pollutants

Radon gas in emitted by the building materials like bricks, concrete, tiles which are derived from soil containing radium.

Burning fuel in the kitchens, cigarette smoke liberates pollutants like CO, SO_2.

Common Air pollutants sources and their effects

(i) CO :

It is formed by the incomplete combustion of carbon containing fuels.

$$2C + O_2 \text{ ----------> } 2CO$$

Human Sources – Cigarette smoking, burning fossil fuels. 77% Co comes from motor vehicle exhaust.

Health Effect- Reacts with hemoglobin and reduces the ability of to carry O_2 to body cells and tissues, which causes headaches and anemia.

(ii) NO_2:

It gives photochemical smog. In atmosphere it reacts with moisture to form HNO3. No_2 + Moisture ------> HNO_3

Human sources: Fossil fuel burning in motor vehicles and power industrial plants.

Effect Health, Lung irritation and damage

Environment effect: HNO_3 corrode metals and eat away stone on buildings, statues, NO_2 damages fabrics.

(iii) SO_2:

Formed mostly by the combustion of sulphur containing fossil fuels like coal and oil. It is converted to H_2SO_4 in the atmosphere. It is major component of acid deposition.

Human Source- Coal burning in power plants and industrial process.

Health effects- Breathing problems.

Environment effect – Reduce visibility, H_2So_4 damages trees, soil and aquatic life.

(iv) Suspended particulate Matter (SPM):

It includes varieties of particles and droplets.

Human Sources – Burning coal in power and industrial plants. Burning diesel and other fuels in vehicle, agriculture, unpaved roads construction.

Health Effect – Nose and throat irritation, lung damage, asthma, reproductive problems and cancer.

Environment effect – Reduce visibility, acid deposition & H_2SO_4 droplets damage trees.

(v) Ozone O_3 :

Highly reactive irritating gas in the troposphere. It is major component of photo chemical smog.

Human Source- Chemical reactions with volatile organic compounds and nitrogen oxides.

Environment effect – Moderates the climate.

(vi) Photochemical smog:

Any chemical reaction activated by light is called photochemical reaction. Photochemical smog is a mixture of more than 100 primary and secondary pollutants formed under the influence of sunlight. Its formation begins inside automobile engines and the boilers in coal burning power and industrial plants.

Health Effect – Breathing problems, cough, ENT irritation, heart diseases etc.,

Environment effect – Smog can reduce visibility.

(vii) Lead:

Solid toxic metal and its components emitted into the atmosphere as a particulate matters.

Human Source- Paint, lead manufacture, storage batteries, leaded petrol.

Health Effect – Mental retardness (in children) digestive and other health problems. Some lead containing chemicals causes cancer in test animals.

Environment effect – Can harm wild life.

Controlling air Pollution

Controlling at the sources:

1. Use only unleaded petrol

2. Use fuels that have low sulphurs and ash containing.

3. Plant trees along busy streets because they remove particulates and CO and absorb noise

4. Industries and waste disposal should be outside the city area.

5. Use catalytic converters to control the emission of CO and hydrocarbon.

Control Measures in industries:

1. Emission rates should be restricted to permissible levels in all industries.

2. Air pollution control equipment should be incorporated in plant layout

3. Monitoring of the atmosphere for the pollutants should be carried out continuously to know the emission levels.

4. Scrubber, cyclone separator, bag house filter and electrostatic precipitators must be used in manufacturing process to retain harmful materials that must be disposed of safely.
5. The disposal of the collected air pollutants are equally important for controlling air pollution.

CHEMICAL AND PHOTOCHEMICAL REACTIONS IN THE ATMOSPHERE

Formation of smog

Smog is a mixture of smoke and fog in suspended droplet form. The brownish smoe like appearance that frequently forms on clear, sunny days over large cities with significant amounts of automobile traffic.

Types of smog :There are two types of smog.

1. London smog

2. Los Angles smog (or) Photochemical smog.

1. London Smog

It is a coal smoke plus fog. Fog mainly consists of mixture of SO_2 + SO_3 + humidity. It is bad in morning hours and becomes worse after sun rise. This is due to sunlight induced oxidation of SO_2 + SO_3, followed by reaction with humidity giving sulphuric acid and aerosd.

$SO_2 + (O) \rightarrow SO_3$

$SO_3 + H_2O \rightarrow H_2SO_4$

2. Photochemical smog

It is not related to smoke (or) fog. It is formed by the combination of NO, NO_2, CO_2, H_2O, CO, SO_2 and unburnt hydrocarbon particles. The important reaction is dissociation of NO_2 in sunlight.

$$N_2 + O_2 \longrightarrow 2\,NO$$

$$2NO + O_2 \longrightarrow 2NO_2$$

$$NO_2 \xrightarrow{\text{sunlight}} NO + [O]$$

$$O_2 + [O] \longrightarrow O_3$$

Hydrocarbon + O_2, O, O_3, NO_2, NO $\rightarrow$Oxidized hydrocarbons.

These oxidized hydrocarbons with ozone in the presence of humidity causes photochemical smog.

Health effects of smog

1. It causes irritation to eyes and lungs.
2. It damages plants.
3. It irritates nose, throat, etc.,
4. It also causes bronchial irritation.

Remedial measures of smog

1. By decreasing nitrogen oxides and hydrocarbon levels in the air.

2. By using unleaded petrol in automobiles**.**

PAN (peroxy acetyl nitrates)(Lachrymatory substance)

Peroxy acetyl nitrates is a secondary pollutant present in photochemical smog. It is a lachrymatory substance. It is thermally unstable and decomposes into peroxyethanoyl radicals and nitrogen dioxide gas. It is an oxidant and more stable than ozone.

Production of PAN

They are formed by the photochemical reaction between hydrocarbons, nitrogen oxides and light. It occurs in two steps

Step 1

Unburnt hydrocarbons undergo oxidation to give aldehydes, ketones and dicarbonyl compounds, which creates peroxyacyl radicals.

$$\text{Hydrocarbons} + O_2 + \text{light} \longrightarrow CH_3 - \overset{\overset{O}{\|}}{C} - O - O^{\bullet}$$

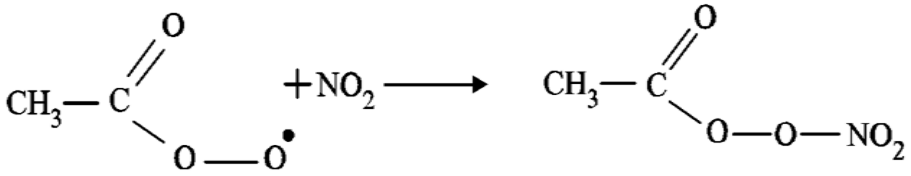
ie.,

$$CH_3CHO + OH^- \longrightarrow CH_3CO^{\bullet} + H_2O$$

$$CH_3CO^{\bullet} + O_2 \longrightarrow CH_3COOO^{\bullet}$$

Step 2

Peroxyacyl radicals combine with nitrogen dioxide to form peroxyacyl nitrates.



Environmental effects

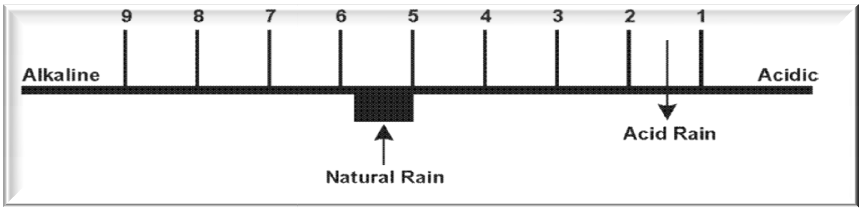
1. Damages plants and art. 2. React explosively. 3. Plays a very large role in photochemical smog.

Health effect

1. At low concentration, it is a powerful respiratory and eye irritants, toxic in nature.
2. At high concentration, cause extensive damage to vegetation, causing skin cancer.

ACID RAIN

Normal rain water is always slightly acidic (pH 5-5.6) because of CO_2 present in the atmosphere gets dissolved in it.Because presence of SO_2 and NO_2 gases as pollutants in the atmosphere.The pH of the rain is further lowered.This type of precipitation of water is called acid rain.



The pH scale

Formation:

Acid rain means the presence of excessive acids in the rain water. The thermal power plants industried and vehicles release NO_2 and SO_2 in to the atmosphere due to the burning of coal and oil.These gases reacts with water

vapour in the atmosphere and from acids like HNO_3,H_2SO_4.These acids descends on to the earth as acid rain through rain water.

$SO_x + H_2O \rightarrow H_2SO_4$

$NO_y + H_2O \rightarrow HNO_3$

EFFECTS:

1. Human nervous system respiratory system and digestive system are affected by acid rain.It cause premature death from heart and lung disorder like asthma, bronchitis.
2. At present Taj mMahal in Agra is suffering due to SO_2 and H_2SO_4 fumes from Madura refinery.Acid rain corrodes houses, monuments ,statues ,bridges and fences.
3. Acid rain causes corrosion of metals.
4. Reduce the rate of photosynthesis and growth in terrestrial vegetation.
5. Acid rain retards the growth of crops like beans potatoe ,carrot ,spinach. Acid rain rduces fish population ,black flies,mosquitoes ,deer flies occurs largely which causes number of complications in ponds rivers and lakes.
6. Activity of bacteria and other microscopic animals is reduced in acidic water. The dead materials are not rapidly decomposed.Hence the nutrients like N,P are locked up in dead matter.

Control of acid rain:

1. Emission of NO_2 and SO_2 from industries from power plants should be reduced by using pollution control equipments.
2. Liming of lakes and soils should be done to correct the adverse effect of acid rain.
3. In thermal points low sulphur content coal should be used.

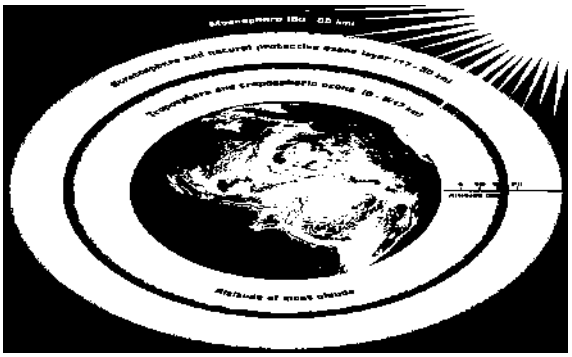
OZONE LAYER DEPLETION

Ozone gas is present in the atmosphere. It is highly concentrated at the stratosphere.Between10to 50 Km above the sea level and is called as ozone layer.

Importance

O_3 protects us from damaging UV radiation of the sun.It filters UV- B radiation. Now a days certain parts of O_3 layer is becoming thinner and O_3 holes are formed. Because of this more UV –B radiation reaches the earth surface. UV –B radiation affects DNA molecules, causes damages to the outer cell of plants and animals.It causes skin cancer and eye disease in human beings.

Ozone layer



depletion

Formation of O_3

It is formed in the atmosphere by photochemical reaction

$$O_2 + hv \rightarrow O^* + O^*$$

The atomic oxygen reacts with molecular O_2 to form O_3

$$O^* + O_2 + M \rightarrow O_3 + M$$

Where M = third body like nitrogen.

Causes of O_3 layer depletion

Refrigerators, air conditioners, aerosol sprays and cleaning solvents release CFC s into the atmosphere. CFCs releases chlorine which breaks O_3 to O_2

$$Cl + O_3 \rightarrow Cl O + O_2 (g)$$

$$Cl O + O^* \rightarrow Cl + O_2$$

Each chlorine atom is capable of breaking several O_3molecules . It is a chain reaction.

1% loss of O_3 results in 2% increase in UV rays reaching the earth surface.

Ozone depletion chemicals

CFC , HCFC , BFC. Sometimes atmospheric sulfur dioxide is converted in to H_2SO_4 which increases the rate of O_3 layer depletion.

Effects ozone layer depletion

Effects on human health

1. UV rays cause skin cancer.
2. Increases the rate of non melanin skin cancer in fair colored people.
3. Prolonged expose to UV rays leads to actinic keratitis.

Effects on aquatic system

1. UV rays affects phytoplankton , fish , larval crabs
2. Pytoplankton consumes large amounts of CO_2. Decrease in phytoplankton results in more amount of CO_2 in atmosphere. This contributes to global warming.
3. Ozone depleting chemicals can cause global warming.

Control measures

1. Manufacturing and using of O_3 depleting chemicals should be stopped.
2. Use of methyl bromide which is a crop fumigant should be controlled.
3. Replacing CFC s by other materials which are less damage.

PROPERTIES OF TERRESTRIAL AND MARINE WATER

Terrestrial (or) Surface water

The water, which is coming out directly through precipitation and does not percolate down into the ground or does not return to the atmosphere by evaporation is called terrestrial (or) surface water.

Types of terrestrial water

Terrestrial water (or) surface water exists in two forms.

1. Standing water bodies e.g Lakes, ponds 2. Flowing water bodiesE.g River.

WATER QUALITY PARAMETERS

The quality of water is an important parameter to be determined in order to decide the type of application or treatment required. The quality of water varies to place to place and seasons.

The followings are some important parameters of qualityof water.

1. Physical parameters. 2. Chemical parameters. 3. Biological parameters.

Physical Parameters

1. Colour

Colour is a shade imparted by organic or inorganic material, which changes the appearance of the water. Colour is found mostly in surface water.

Sources

1. Organic sources => Algae, tannins, humic compounds organic dyes, etc.
2. Inorganic sources => Fe and Mn compounds, chemicals and inorganic dyes from various industries.

2. Tastes and Odours

Disagreeable odours and tastes are objectionable for various industrial processes such as food products, beverages, textiles, paper, pulp. Most of the odours in natural waters are organic in nature, except H_2S.

Sources : Organic sources: Algae and decaying vegetation, etc.

Inorganic sources: Mercaptans, amines and sulphides, etc.

Removal of Tastes and Odours

1. Organic tastes and odours may be removed by aeration (or) activated carbon treatment.

2. Inorganic tastes due to H_2S (or) Iron may be removed by chemical methods like oxidation, chlorination (or) precipitation.

3. Turbidity and sediments

Turbidity is the reduction of clarity of natural water due to the presence of finely divided, insoluble impurities suspended in water.

Sources

1. Inorganic sources: Clay, silt, silica, ferric hydroxide, calcium carbonate, sulphur, etc.,

2. Organic sources: Finely divided vegetable or animal matter, oils, fats, greases, micro-organisms, etc.,

Removal of Turbidity and Sedimentsition

Turbidity of water may be removed by sedimentation followed by

1. Coagulation and filtering 2. Coagulation and settling 3. Coagulation, settling and filtering.

Chemical Parameters

1. p^H

The hydrogen ion concentration is represented by the pH value, which is defined as

$$p^H = -\log_{10}[H^+]$$

pH is defined as negative logarithm of hydrogen ion concentration.

2. Acidity

Acidity of water is a measure of its base-neutralizing ability. The acidity in water is usually imparted by the dissolved carbondioxide (or) by the mineral acids.

Sources

1. Mineral acids

Mineral ores like iron pyrites (FeS_2), (or) sulphur compounds.

These are oxidised to acids by bacteria in the presence of O_2 and H_2O

$$2S + 3O_2 + 2H_2O \longrightarrow 2H_2SO_4$$

$$2FeS_2 + 7O_2 + 2\,H_2O \longrightarrow 2FeSO_4 + 2H_2SO_4.$$

Carbondioxide

Industrial smoke, smoke from vehicles.

3. Alkalinity

Alkalinity of water is a measure of its acid-neutralizing ability. Natural alkalinity in waters is imparted by the hydroxides, carbonates and bicarbonates.

Sources :Hydroxides, carbonates and bicarbonates of alkali metals, borates silicates, phosphates.

4. Fluoride

Fluoride is found in ground water as a result of dissolution from geologic formulations. Surface waters generally contain much smaller concentration of fluoride.

Sources: Fluoride containing minerals

5. Nitrogen

Nitrogen is a inert gas, which is relatively unimportant as far as water treatment is concerned.

Sources: Plant materials, fertilizers.

6. Chlorides

Although chlorides are not considered as harmful as such their concentrations over 250 mg/lit impart peculiar taste to water, which is unacceptable for drinking purposes.

7. Sulphates

When sulphates are present in excess amount in drinking water, they may produce a cathartic effect on the people consuming such water.

8. Nitrates

Excessive concentrations of nitrates are undesirable especially for infants. The maximum contaminant level for nitrate is 10 mg/lit.

9. **Arsenic**

Arsenic is a toxic heavy metal even a very small dose can result in severe poisoning. Only 0.05 mg/lit has been recommended for arsenic in drinking water.

Biological Parameters

1. Biochemical Oxygen Demand (BOD)

BOD is the amount of oxygen required for the biological decomposition of organic matter present in the water.

2. Dissolved oxygen (DO)

Dissolved oxygen (DO) is the amount of oxygen dissolved in a given quantity of water at a particular pressure and temperature.

3. Chemical Oxygen Demand (COD)

COD is the amount of oxygen required for chemical oxidation of organic matter using some oxidizing agent like $K_2Cr_2O_7$ and $KMnO_4$.

WATER POLLUTION

Definition

The alternation in physical, chemical & biological characteristics of water which causes harmful effects on humans and aquatic life.The major pollutants are sewage, effluents, bacteria.

Infections Agents: Bacteria, viruses, protozoa, parasitic worms.

Human Source- Human and animal works

Health Effect – Variety of diseases.

Oxygen demanding wastes:

Organic wastes, such as animal manure & Plant debris that are decomposed by aerobic bacteria.

Human Source- Sewage, animal feedlots, paper mills, food processing facilities.

Health Effect – Depletion of dissolved O_2 in water. This causes death of aquatic life.

Inorganic Chemical Waste:

Water soluble chemicals like acids. Compounds of toxic metals likeLead, arsenic and selenium. Salts like NaCl in sea water and fluorides found in some soils.

Human Source- Industrial effluents, street wash, household waste.

Health Effect – Causes skin caner& neck damage. Damage nervous system, liver &Kidney.harm fish and other aquatic life.

Organic Chemical Plastics, pesticides, detergents

Human Source- Industrial effluents, household waste.

Health Effect – Damages nervous system, causes some cancers

Plant Nutrients- Water soluble compounds containing Nitrates, (NO_4^{-3}) phosphates

(PO_4^{-3}) and NH_4^+ions.

Human Source- Sewage, manure, runs off of agriculture, urban fertilizer.

Health Effect – Drinking water with high levels of nitrate lowers the O_2 carrying capacity of

Blood and kills urban children and infants

Sediment – Soil, silt

Human Source- Land Erosion

Health Effect – Clouds water and reduces photosynthesis. Disturbs aquatic food web carry

Pesticides, bacteria and other harmful substances.

Radio active materials – Radio isotopes of I_2, radon, uranium and thorium.

Human Source- I^{131}, Co^{60}, Fe^{55} Nuclear power plants, miningand processing of thorium.

Health Effect – Genetic mutation, birth defects and certain cancers.

Thermal Pollution Excessive heat

Human Source- Water cooling of electric power plants and some types of industrial plants.

Hence the temperature of water increases. The rise in temperature decreases the dissolved O_2 and affects the aquatic organisms.

Controlling of water pollution:

1. All domestic and municipal effluents be drained to water bodies only after treatment

2. Use of pesticides in agriculture should be limited. Only standard quality pesticides should be used.

3. Chemicals like potassium permanganate should be sprayed regularly to protect water from micro organisms.

4.Radio active substances can be removed by Ion-exchange method.

5. Plants, trees and forests control pollution and they act as natural air conditions.

6. Bacteria are killed by passing chlorine gas into water bodies.

7.Highly qualified and experienced persons should be consulted from time to time for effective control of water pollution.

8.Inorganic wastes can be treated chemically.

9.Acids and bases are removed by neutralization

10.Sewage is treated by biochemical oxidation. The chemicals retards the growth of plants and retard reproduction process.

WASTE WATER (OR) SEWAGE TREATMENT

Objectives of waste water treatment

The main objectives of waste water treatment are

(i) to convert harmful compounds into harmless compounds.

(ii) to eliminate the offensive smell.

(iii) to remove the solid content of the sewage.

(iv) to destroy the disease producing microorganisms.

Treatment Process

The sewage (or) waste water treatment process involves the following steps.

I. Preliminary Treatment

In this treatment, coarse solids and suspended impurities are removed by passing the waste water through bar and mesh screens.

II. Primary treatment (or) Settling process

In this treatment, greater proportion of the suspended inorganic and organic solids are removed from the liquid sewage by settling. In order to facilitate quick settling coagulants like alum, ferrous sulphate are added.

These produce large gelatinous precipitates, which entrap finely divided organic matter and settle rapidly.

$$Al_2(SO_4)_3 + 6H_2O \longrightarrow 2Al(OH)_3 \downarrow + 3H_2SO_4.$$

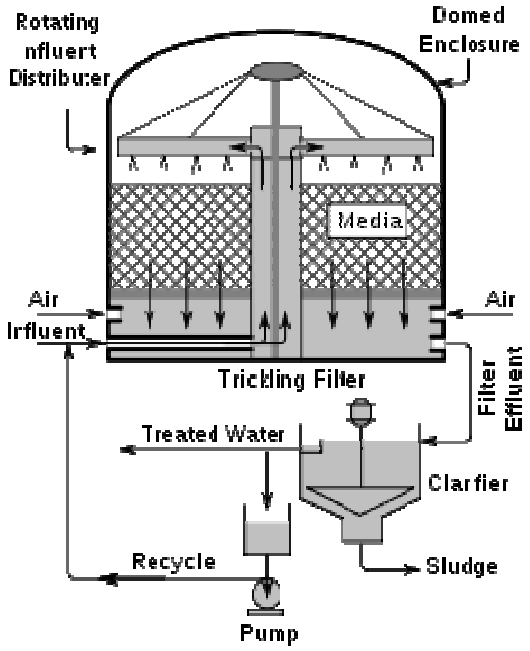
III. Secondary (or) Biological treatment

In this treatment, biodegradable organic impurities are removed by aerobic bacteria. It removes upto 90% of the oxygen demanding wastes. This is done by trickling filter or activated sludge process.

1. Trickling filter process

Trickling filter is a circular tank and is filled with either coarse or crushed rock. Sewage is sprayed over this bed by means of slowly rotating arms.When sewage starts percolating downwards, microorganisms present in the sewage

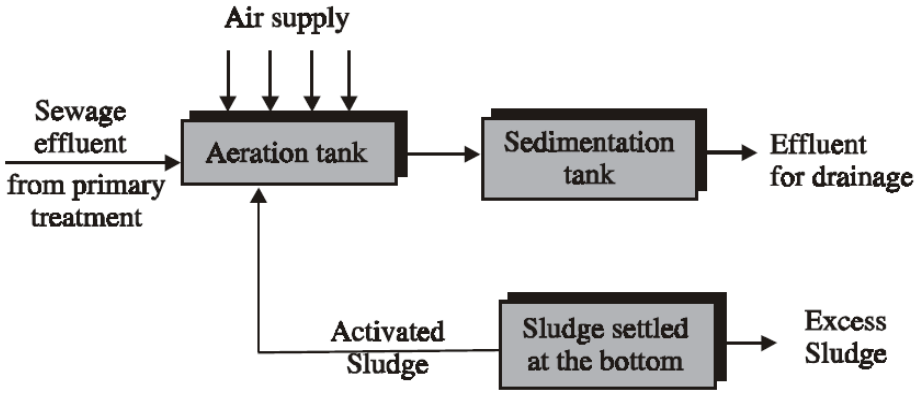
grow on the surface of filtering media using organic material of the sewage as food.After completion of aerobic oxidation the treated sewage is taken to the settling tank and the sludge is removed. This process removes about 80-85% of BOD.



Trickling filter

2. Activated sludge process

Activated sludge is biologically active sewage and it has a large number of aerobic bacterias, which can easily oxidize the organic impurities. The sewage effluent from primary treatment is mixed with the required amount of activated sludge. Then the mixture is aerated in the aeration tank. Under these



condition,

ABSORPTION OF HEAVY METALS

Heavy metals are chemical elements with a specific gravity that is at least 5 times the specific gravity of water(sp.gr. of water is 1 at 4^0C). Heavy metal includes most metals with an atomic number greater than 20.

Sources of heavy metals in theenvironment

There are a number of heavy metals in the environment. Some of them are toxic and the rest non-toxic.

e.g. Mining industry, chemical and leather industries and thermal power plants contribute heavy metals in the atmosphere.

Removal of heavy metals by absorption

Heavy metals present in water may be removed by the following absorption process.

1. Using coconut shell carbons

Coconut - based carbon was found to remove 94% of Cr (VI) solution after a 4 hrs contact time during equilibrium batch tests.

2. Using Rice - Husk carbon (RHC)

Rice hulls (or) Rice husk is a better and low cost adsorbent used in water treatment process. The activated form of rice husk adsorbent can be used for the adsorption of Cr and Zn metal ions.

3. Using Fly ash

Fly ashes like pulverized - fuel (fly) ash, combustion of powdered coal are used as an very good adsorbents in water purification. Fly ash (or) fly ash and coal fly ash blends are used for the removal of heavy metals such as copper and chromium ions from waste water.

4.Using Clay and coal - based adsorbents

(a)Fuller's earth and calcined kaoline have been investigated for the removal of Pb and Cd from the water.

(b) China clay was used for the removal of As (III) and Zn (II) from distilled water.

Water treatment process

Zeolite (or) Permutit Process

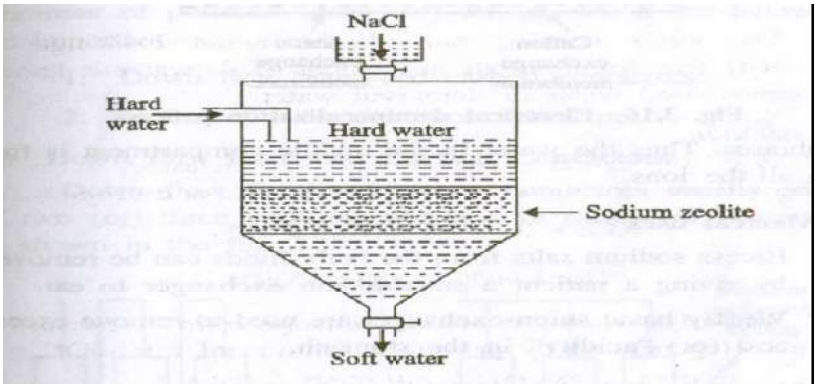
Zeolites are naturally occurring hydrated sodium aluminosilicate. Its general formula is $Na_2O \cdot Al_2O_3 \cdot xSiO_2 \cdot yH_2O$. (x = 2 - 10 , y = 2 – 6) .

Natural zeolites are green sand and non-porous. The synthetic form of zeolite is known as permutit, which is porous and possess gel structure, hence it is generally used for water softening.Synthetic zeolite is represented by Na_2Ze. The sodium ions which are loosely held in Na_2Ze are replaced by Ca^{2+} and Mg^{2+} ions present in the water.

$$Ca(HCO_3)_2 + Na_2Ze \longrightarrow CaZe + 2NaHCO_3$$

$$MgSO_4 + Na_2Ze \longrightarrow MgZe + Na_2SO_4$$

$$CaCl_2 + Na_2Ze \longrightarrow CaZe + 2NaCl$$



Zeolite (or) Permutit process

The softened water is enriched with large amount of sodium salts, which do not cause any hardness, but cannot be used in boiler.

Regeneration

After some time zeolite gets exhausted. The exhausted zeolite is again regenerated by treating with 10% solution of NaCl.

$$CaZe + 2NaCl \longrightarrow Na_2Ze + CaCl_2$$

$$MgZe + 2NaCl \longrightarrow Na_2Ze + MgCl_2$$

Advantages of Zeolite process

1. Water obtained by this process will have onlyhardness of 1-2 ppm.

2. This method is cheap, because the regenerated zeolite can be used again.

3. No sludge is formed during this process.

4. The equipment used is compact and occupies a small space.

5. Its operation is easy.

2. Ion Exchange (or) Demineralisation process

This process removes almost all the ions (both anions and cations) present in the hard water.The soft water, produced by lime-soda and zeolite processes, does not contain hardness producing Ca^{2+} and Mg^{2+}ions, but it will contain other ions like Na^{+}, K^{+}, SO_4^{2-}, Cl^{-} etc. On the other hand DM. (Demineralised) water does not contain both anions and cations.

Thus a soft water is not demineralised water whereas a demineralised water is soft water.

Types of ion exchange resins

This process is carried out by using ion exchange resins,which are long chain, crosslinked, insoluble organic polymers with a microporous structure. The functional groups attached to the chains are responsible for the ion exchanging properties.

1. Cation exchanger

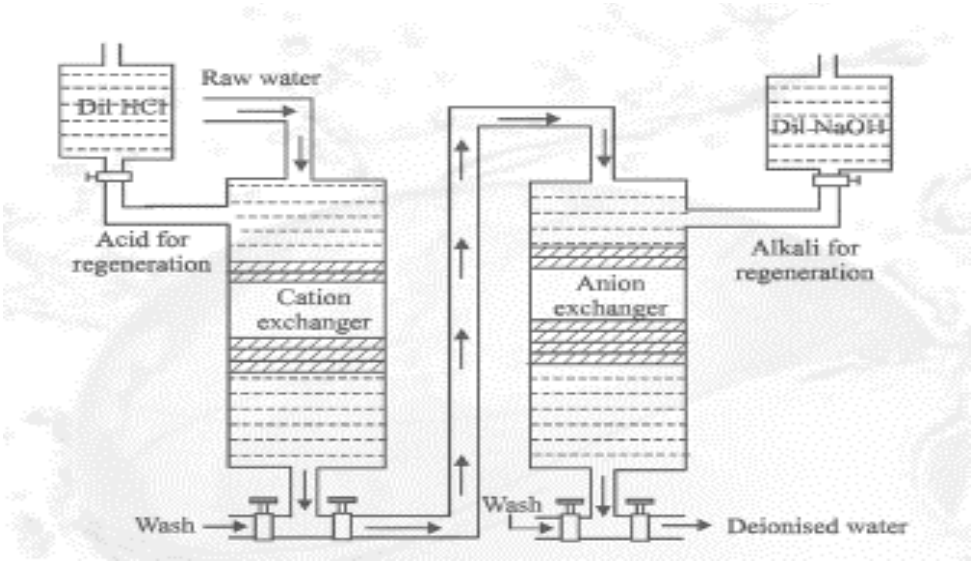
Resins containing acidic functional groups (-COOH, $-SO_3H$) are capable of exchanging their H+ ions with other cations of hard water. Cation exchange resin is represented as RH_2.

2. Anion Exchanger

Resins containing basic functional groups ($-NH_2$, -OH) are capable of exchanging their anions with other anions of hard water. Anion exchange resin is represented as $R(OH)_2$.

Process

The hard water first passed through a cation exchange column, which absorbs all the cations like $Ca^{2+,}$ Mg^{2+}, Na^{+}, K^{+}, etc., present in the hard water.



Ion Exchange (or) Demineralisation process

The water coming out of the anion exchanger is completely free from cations and anions. This water is known as demineralised water or deionised water.

Regeneration

When the cation exchange resin is exhausted, it can be regenerated by passing a solution of dilHCl or dil H_2SO_4.

$$RCa + 2HCl \longrightarrow RH_2 + CaCl_2$$

$$RNa + HCl \longrightarrow RH + NaCl$$

Similarly, when the anion exchange resin is exhausted,it can be regenerated by passing a solution of dilNaOH.

$$R'Cl_2 + 2NaOH \longrightarrow R'(OH)_2 + 2NaCl$$

Advantages of ion-exchange process

1. Highly acidic or alkaline water can be treated by this process.

2. The water obtained by this process will have very low hardness (nearly 2 ppm).

Disadvantages of ion-exchange process

1. Water containing turbidity, Fe and Mn cannot be treated, because turbidity reduces the output and Fe, Mn form stable compound with the resin.

2. The equipment is costly and more expensive chemicals are needed.

SOIL POLLUTION

Defintion

Soil pollution is defined as contaminations of the soil by human and natural activities which may cause harmful effecs on living beings.

Sources and effects of soil pollution

(i) Industrial wastes:

Industries are the major causes for soil pollution Textiles, steel, paper, Cement, oil, dyeing and other industries are responsible for soil pollution. Toxic organic compounds and phenol destroy the fertility of the soil.

(ii) Biological agents

Fungi, protozoa, bacteria are important Biological agents for soil pollution. The human and animal wastes, garbage, waste water generates heavy soil pollution.

(iii) Radio active pollutants

Atomic reactor, nuclear radio active devices releases radio active pollutants. These pollutants enter the land and accumulate there by causing soil pollution.

(iv) Pesticides

Pesticides pollute the soil. There are of two types (i) chlorinated hydrocarbon insecticide (2) Organic phosphorous pesticides. Common chlorinated hydrocarbon insecticides are DDT, BHC.

Organo phosphorous insecticides are synthetic chemicals like Malathion and parathion.

DDT reduces the activity of sex hormones of male and female. The land with fungicides insecticides causes diseases to human beings.

Fertilizers

These discharge N, Na, K, S, Nitrates etc., into the soil. The nitrate causes cancer.

Polymer, Plastics & other water

These materials appear as garbage. Solid wastes and their quantities increase day by day. They pollute the atmospheres, land and also water badly.

Agricultural practices

Modern agriculture practices pollute the soil to a large extent. Today huge quantities of fertilizers, pesticides, weedicides are added to increase the crop field. Apart from these farm wastes, manure debris, soil erosion containing inorganic chemicals are causing soil pollution.

Effect of soil pollution

1. Organic wastes enter the soil pores and decompose. Pathogenic bacteria spread infection.

2. Compounds containing As, Hg, Cr, Ni, Zn and Fe are toxic to life.

3. Fluorides affect plant development

4. Water logging and salinity increase the dissolved salt content in the soil. Some plants are very sensitive to soil PH and salinity.

Thus land becomes unfit for irrigation.

Control of soil pollution

1. Treat the sewage before land disposal.

2. Rotate the crop pattern to allow the soil replenish the nutrients.

3. Preserve and protect top fertile soil, control soil erosion by tree plantation.

4. Fertilizers may be applied only after estimating the soil and crop measures.

5. Production of natural fertilizers Excessive use of chemical fertilizers and insecticides should be avoided. Bio pesticides should be used instead of toxic chemical pesticides.

6.Proper hygienic condition- People should be trained regarding the sanitary habits.

7. Recycling and reuse of waster – The wastes such as paper, plastic, metals, glasses

should be recycled and used.

SOLID WASTE MANAGEMENT

Management of solid waste is very important to minimize adverse effect of solid waste.

Types of solid waste

Urban waste and industrial waste.

Sources :

Sources of urban waste: domestic waste like food waste, waste paper, glass bottles, polythene bags etc .Commercial waste like packing materials cans, bottles, polythene bags etc Construction wastes like concrete, wood, debris etc .Biomedical waste like Anatomical waste, infectious waste etc

Classification of urban waste:

1. Biodegradable wastes – urban solid waste materials that can be degraded by micro organisms are called biodegradable waste. E.g. food, vegetables, Tea leaves, dried leaves etc.

2. Non biodegradable waste. Urban solid wastes that cannot be degraded by microorganisms are called non biodegradable wastes.

SOURCES OF INDUSTRIAL WASTES

The main source of industrial waste is chemical industries, metal and mineral processing industries. E.g.

1. Nuclear power plants generate radioactive wastes2. Thermal power plants produce fly ash in large quantities3. Chemical industries produce toxic and hazardous materials.4. Other industries produce packing materials acid, alkalis, scrap metals, rubber, plastic, glass wood etc

EFFECT OF SOLID WASTE

1. Biodegradable materials in the disposed municipal waste undergo decomposition. This produces foul smell and breeds various types of insects which spoil land well.2. Industrial waste containing toxic metals and hazardous waste affect soil characteristics.3. Toxic substances name percolate into the ground and contaminates the ground water.

4. Burning of some industrial waste or domestic waste produces furan, dioxins and poly chlorinated biphenyls which are harmful to human beings.

STEPS INVOLVED IN SOLID WASTE MANAGEMENT

Reduce, reuse and recycle: if the usage of raw materials is reduced the generation of waste also gets reduced. Reuse of waste materials: discarded refillable containers can be reused. Waste generation during manufacture of rubber bands is reduced by making rubber bands from discarded cycle tubes.Recycling of materials Recycling is the reprocessing of discarded materials into new useful products. E.g. Old aluminum cans glass bottles are melted into new cans and bottles.

Preparation of cellulose insulations from paper.

Preparation of fuel pillets from kitchen wastes.

METHODS OF DISPOSAL OF MUNICIPAL SOLID WASTES

Land Fill:

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

Waste disposal is dumping in sanitary land fill which is employed in Indian cities. This method involves spreading the solid waste on the ground. Compacting it and then covering it with soil at suitable intervals.

Advantages: Simple and economical. Segregation is not required. Natural resources are returned to soil and reclyed .Converts low lying, marshy waste land into usefull areas.

Diadvantages: Large area needed. Bad odour. High transportation cost. Sources of mosquito, flies. Insecticides and pesticides are to be applied at regular intervals. Causes fire hazard due to methane formation in wet weather

INCINERATION

In this method the municipal solid wastes are burnt in a furnace called incinerator. The combustible substances such as rubbish, garbage, and dead organisms and non combustible matter such as glass, metals are separated before feeding into incinerator. The non combustible can be left out for recycling and reuse. The left out ashes and clinkers from the incinerator may be about 10-20 % which is disposed by land fill or some other methods.

The heat produced in the incinerator during burning is used as steam power for generation of electricity through turbines. The wet solid waste is dried in pre heaters and then taken into large incinerating furnaces called destructors which incinerate 100- 150tons per hour. The temperature maintained is about 700 ˚ C and increase to 1000˚ C when electricity is to be generated.

Advantages:

1. Requires little space2 .Hygienic point of it is safest.

3. Incinerated plants of 300 tons per day capacity generate 3 MW of power.

Disadvantages:

1. Capital and operational cost is high. 2. Needs skilled persons.

3. Formations of smoke, dust and ash causes air pollution.

COMPOSTING:

In this method bulk organic waste is converted in to manure by biological action. Compost able waste is dumped in underground trenches in layer of 1.5

meters and is finally covered about 20 cms and left for decomposition. Microorganism like actinomycetes is added for active decomposition.

Within two to three days biological action starts .The organic matter decomposed by actionomycetes and lot of heat is liberated. The temperature of the compost increases by 75˚C and finally the refuse is converted to a brown coloured powder known as humus and is used in agricultural fields. The compost contain N,P and other minerals.

Advantages:

Recycling occurs.

MARINE POLLUTION

Definition

The discharge of waste substances in to the sea resulting in harm to the living resources, hazards to the human health hindrances to the fishery and impairment of quality use of sea water.

Sources:

1. Dumping wastes:

Dumping of untreated wastes and sewages in the oceans by coastal towns, cities and industries. Rivers on the way to sea carry huge amount of sewage garbage agricultural discharge pesticide heavy metals. Huge quantity of plastic dumped in to the sea.

Effects:

Many marine birds ingest plastic that causes gastrointestinal disorders.

2. Oil:

This is discharged in to the sea as crude oil and as separate fraction. Oil and it's fractions are used in houses automobiles and industries. This causes devastation of marine environment.

Effects:

Oil spills inhibit photosynthesis and the growth of planktons. All aquatic animals depend either directly of indirectly on planktons the basis of trophic chain.

3. Radio active materials enter the ocean from nuclear weapon testing.

4. Toxics:

Toxic waste is the most harmful form of marine pollution. Once toxic wastes affects an organism it quickly passes along the food chain and as sea food which cause various problems.

5. Marine Debris:

Garbage like plastic bags, ropes helium balloons

Effects of marine pollution:

1. Heavy metals and organic pollutants damages birds by thinning of egg shells and tissue damage of egg.

2. Oil pollution causes damage to marine animals and plants including algae bird, fish etc.

3. Oil spilling in the sea causes abnormal low body temperature in birds resulting in hypothermia. During Exxon Valdez accident 150 rare species of bald eagles are affected by ingested oil.

4. Oil films are able to retard the rate of oxygen uptake by water.

5. Hydrocarbon and benzpyrene accumulate in food chain and consumption of fish by man may cause cancer.

Control of marine pollution:

Nature and world conservation union suggest the principles

1. The industrial unit on the coastal lines should be equipped with pollution control instrument.

2. Urbon growth near the coast should be regulated.

Methods of removal of oil

Physical methods.

a) skimming the oil off the surface with suction device
b) Floating oil can be absorbed using absorbing materials like ploy urethane foam. Chopped straw and saw dust also used to absorbed oil from the sea water.
c) Chemical methods like dispersion , emulsification and using chemical additives are used to coagulated the oil

Protective method:

1. Municipal and industrial waste should be treated before disposing in to sea

2. Coastal waste are periodically analyzed for detecting pollution level

3. Soil erosion in the coastal land should be arrested be suitable techniques

4. Recreation beaches should be maintained to meet hygienic and aesthetic standard.

NOISE POLLUTION

Definition

It may be defined as unwanted sound which gets dumped in to the atmosphere without regarding to it' adverse effects.

Causes:

Industrial noise

Most affonding noise sources are compressors, generators power looms, grinding mills, furnaces. These are used in many industrial processes and installed partially in closed and open sheds.

Domestic noise

Transistors radio, TV, other musical instruments, Air conditioners, washing machines. They affect users as well as the neighbors.

Traffic noise

Continuous movement of vehicles causes traffic noise. It affects not only those who are moving but also those who live near the roads, railwaylinks, and airports

Effects of noise pollution

1. Physiological effects

Headache increase in the rate of heart beat, pain in heart, emotional disturbances, hearing loss.

2. Annoyance

A noise is said be annoying if the exposed individual or groups of individuals reduce the noise avoid or leave the noisy area if possible. Both loudness and annoyance increase with increasing sound levels.

3. Recently it has been reported that the blood also thickened by excessive noise

4. Impulsive noise also causes psychological and pathological disorders.

5. Ultrasonic sound can affect digestive respiratory cardiovascular system and semi circular canals of internal ear.

6. It causes muscle to contract leading to nervous breakedown,tension etc.

Control measures:

Source Control

1. Modification of source such as acoustic treatment to machine surface designed changes limiting the operational timings.

2. Oiling: Proper oiling will reduce the noise from the machine.

3. Transmission path intervention:

Containing the source inside a sound insulating enclosure, construction of noise barrier or provision of sound absorbing material along the path.

4. Planting of trees:

Planting of trees like neem, tamarind, coconut etc near schools hospitals reduce the noise to the extent of 8 to 10 db.

5. Selection of machinery:

Careful selection of machine tools and equipments to be used may help to lower the noise levels in machine shop.

THERMAL POLLUTION

Definition

Pollution due to heat which changes the physical and chemical properties of the water that affects man, animals and the aquatic system.

Sources of thermal pollution

1. Industrial waste water

Industries generating electricity like coal powered and nuclear power plants need huge amount of cooling water for removing heat. Industries like textile, paper and pulp release heat in water to lesser extent. The discharged water will have higher temperature of 6 to 9˚ C. than the receiving water.

2. Nuclear power plant

Nuclear explosion, nuclear experiments discharged large amount of heat with toxic radio nuclides in to receiving water sources. A leakage of radiation from nuclear power plant raises the temperature water bodies.

3. Domestic sewages

The domestic which contains high BOD, COD and low dissolved oxygen when discharged in to rivers and others water with out treatment raises the temperature of water bodies.

4. Hydro electric power

An electric power industry with cooling arrangements also causes thermal pollution in receiving water bodies.

5. Coal fired power plants

These constitute the major sources of thermal pollution. Their condenser coil are cooled with water froe near by lake from river are discharged hot water back in to the stream. This increases the temperature by 15˚C. This decreases the dissolved oxygen and killing the aquatic life.

Effects of thermal pollution

1. Reduction in dissolved 0_2 as the temperature of water increases,increase in toxicity

Increase in temperature increases the toxicity of the poison present in water

Ex; a rise of 10˚ C doubles the toxic effect of KCN. A rise of 80˚ C triples toxic effects of orthoxylene causing massive death of fish.

2. Change in water properties

Rise in temperature changes physical and chemical properties of water, Food shortage for fishes; Change in temperature alters the seasonal variation in type and abundance of lower organisms. Thus fish may lack right food at right time.

3. Interference with reproduction:

In fishes the activities like nest building, hatching, migration and reproduction depend upon optimum temperature. Change in temperature affects the above process.

4. Direct mortality:

The increase in the temperature exhausts the micro organisms and shortens their life span. Above a particular temperature a fish dye due to the failure in respiratory and nervous system.

Control of Thermal pollution:

Cooling towers:

Cooling towers transfers some of the heat from hot water to the surrounding atmosphere by the process of evaporation. Cooling towers are used to spread the recovered waste heat to eliminate the problems of thermal pollution.

Types of cooling towers:

Wet cooling Towers:

Hot water coming from the reactor is allowed to spray over baffles .Cool air with high velocity is passed from the sides which takes away the heat and cools water.

Dry cooling tower:

Hot water is allowed to flow in long spiral pipes. With the help of fan cool air is possible over these hot pipes thereby cooling water.

Cooling Points:

Heated effluents on the surface of water in cooling points maximize dissipation of heat to the atmosphere and minimize water area and volume. Thus warm water wedge acts like cooling points.

Spray Points:

The water from the condenser is allowed to pass in to the ponds through sprayers. Water is sprayed through nozzles as fine droplets. heat from the fine droplets gets dissipated to the atmosphere.

Artificial lakes:

The heated effluents from the thermal power industries are discharged in to the artificial lakes at one end while cool water is transferred back from the other end. Heat is evaporated through dissipation in this method.

RADIOACTIVE POLLUTION

Radioactive pollution is the physical pollution of air water and soil by radioactive materials.

Sources:

Natural source:

The important natural source is space which emits cosmic rays. Soil rocks, air radioactive Rd ^{222}also contain one or more radioactive substances.

Man made resources:

Nuclear power plants X-rays, nuclear accidents, nuclear bombs. Mining and refining of plutonium, thorium and preparation of radioactive isotopes.

Effects:

1. Damages to enzymes, DNA, RNA through ionization, cross linkings within and between two affected molecules.

2 .Damage to cell membranes, chromosomes such as fragmentation mitochondria etc.

3.Disruption of central nervous system ,loss of sight, inactivation of bone marrow activity resulting in blood cancer, malignance and ulcerisation in intestinal tract.

4. Death or shortening of life span due to radiation changes in chacteristics due to mutation.

5. Internal bleeding and blood vessel damage may show up as red spots on the skin.

6. Urban children are vulnerable to brain damage or mental retardation if radiation occurs in early pregnancy.

Control Measures:

1Nuclear devices should never be exploded in air. If necessary they may be explode under ground.

2. Leakage of radioactive elements from reactors and labs processing or using them should be totally checked.

3. In nuclear and chemical industries the use of radio isotopes may be carried under a jet of soil or water instead of powder or gaseous form.

4. In nuclear mines wet drilling may be employed along with underground drainage.

5. Nuclear medicines and radiation therapy should be applied when absolutely necessary with minimum dose.

6. Minimum number of nuclear installations should be commissioned.

7. In nuclear reactors closed cycled coolant system with gaseous coolants may be used to prevent extraneous activation of products.

Role of an individual in the prevention of pollution:

A small effort made by each individual at his own place will have pronounced effect at the global level. It is aptly said “Think globally; Act locally”

Each individual change his life style in such a way has to reduce environment pollution.

Individual participation:

Planting more trees.

Use water energy and other resources efficiently.

Purchase recyclable, recycled and environmentally safe products.

Use CFC free refrigerators.

Use natural gas than coal.

Reduce deforestation.

Increase use of renewable resources.

Remove NOx from motor vehicular exhausts.

Use of eco friendly products.

Use office machines in well ventilated areas.

UNIT III

NATURAL RESOURCES

Natural resources:

Natural resources are the source which are useful to man or it can be transformed into a useful product.

Two types

Renewable sources: It can be regenerated.

Non renewable sources: It can not be regenerated.

FOREST RESOURCES:

One of the important renewable natural resource on earth. $1/3^{rd}$ of the world's land surface is covered with forest. Forestcovering the earth like a green blanket. Forest not only produce innumerable material goods, but also provide several environmental services.

Types of forest:

Ever green forest:

Found in equatorial region. Where temperature and rain fall is high, due to heavy rain the forest are ever green. (e.g) silent valley in kerela

Important trees teak and rosewood.

Deciduous forest:

These forest receive only seasonal rainfall. Therefore they loose their leaves during summer season. Trees sandal wood.

Coniferous trees:

Trees contain needle shaped leaves (e.g) pine tree, spruce tree

Functions of forest:

1. It performs very important function both to human and to nature.
2. They are habitats to millions of plants, animals and wild life.
3. They recycle rain water.
4. They remove pollutant from air.

5. They control water quality.
6. They moderate temperature and weather.
7. They influence soil condition and prevent soil erosion.
8. They promote tourism.

Uses of forest:

1. Commercial uses
2. Ecological uses

Commercial uses:

1. Wood – used as a fuel
2. Supply wood for various industries – Raw materials as pulp,paper, furniture timber etc.
3. Minor forest products – gum, dyes, resins
4. Many plants – Medicines
5. Supply variety of animal products – honey. Ivory, horns etc.
6. Many forest lands are used for - Mining, grazing, for dams and recreation.

Ecological uses:

Forest provides number of environmental services.

1. Production of oxygen:

Photosynthesis produces large amount of oxygen which is essential for life.

2.Reducing global warming:

Carbon dioxide main green house gas. It is absorbed by plants for photosynthesis. Therefore the problem of global warming caused by CO_2 is reduced.

3.Soil conservation :

Roots of trees bind the soil tightly and prevent soil erosion. They also act as wind breaks.

4.Regulation of hydrological cycle:

Watershed in forest act like gaint sponges and slowly release the water fore recharge of spring.

5.Pollution moderators:

Forest can absorb many toxic gases and noises and help in preventing air and noise pollution.

6.Wild life habitat:

Forest are the homes of millions of wild animals and plants.

Over exploitation of forest:

Due to over population, there is a demand fort medicine, shelter, wood and fuel increases. Hence exploitation of of forest material going on increases.

Reason for deficiency of forest :

In India the minimum area of forest required to maintain good ecological balance is about 33% of total area. But at present it is only about 22%. So over exploitation of forest material occur.

Cause of over exploitation:

1. Increasing agricultural production.
2. Increasing agricultural activities.
3. Increase in demand of wood resources.

Deforestation:

It is process of removal of forest resources due to natural or man made activities (i.e) destruction of forests.

Deforestation in India:

In India 1.3 hectare of forest land has been lost.

Causes of deforestation:

1. **Developmental projects:**

   Developmental projects causes deforestation through two ways.

   - Through submergence of forest area.

- Destruction of forest area.

(e.g) big dams, hydro electric projects, ropad construction etc.

2. **Mining operations:**

   It reduces forest areas. (e.g)Mica, coal, Manganese and lime stone.

3. **Raw materials for industries:**

   Wood is an important raw material for various purposes. (e.g) making boxes, furnitures and paper etc.

4. **Fuel requirment:**

   Wood is the important fuel for rural and tribal population.

5. **Shifting cultivation:**

   Replacement of natural forest ecosystem for monospecific tree plantation. (e.g) tea or teak

6. **Forest fires:**

   Forest fire destructs thousands of forest.

7. **Over grazing:**

   Over grazing by cattle reduces the cultivation land.

Effects of deforestation:

Many people dependent on the forest resources.

1. **Global warming:**

   Cutting of trees increase the carbon dioxide content and hence change global climate pattern. It rises the sea level and depletion of the protective ozone layer.

2. **Loss of genetic diversity:**

   Forest is the store house for genetic diversity which gives food and medicine for the entire world. Deforestation decreases the genetic diversity.

3. **Soil erosion:**

   Deforestation causes soil erosion and land slides. Natural vegetation acts as a natural barrier which reduce wind velocity and soil erosion.

4. **Loss of bio diversity:**

   Some animals depend upon some specific plants. Therefore destruction of plants leads to the destruction of some animals.

5. **Loss of food grains:**

As a result of soil erosion the countries loose the food grains.

Preventive measures:

1. Steps should be taken by the government to discourage the migration of people from island to mainland.
2. Tree plantation should be increased.
3. Education and awareness program must be increased.
4. Strict implementation of law of forest and conservation act.

Case study:

Deforestation in the Himalayan region, involves clearing of natural forests and plantation of monoculture like eucalyptus. Nutrient in the soil is poor, therefore soil losing their fertility. Hence Himalayan area facing the serious problem of deforestation.

OVER EXPLOITATION OF FOREST

Due to over population the materials supplied by the forest like food, medicine, shelter, wood and fuel are not sufficient to meet the people's demand. Hence exploitation of forest materials is going on increasing day by day.

With growing civilization, the demand for raw materials like timber, pulp, minerals, fuel wood, etc., increases resulting in large scale logging, mining, road building and cleaning of forests.

REASON FOR OVER EXPLOITATION

It has been estimated that in India the minimum area of forests required to maintain good ecological balance is about 33% of total area. But, at present it is only about 22%. So over exploitation of forest materials occur.

CAUSES OF OVER EXPLOITATION

(a) Increasing agricultural production.

(b) Increasing industrial activities.

(c) Increase in demand of wood resources.

EFFECTS OF OVER EXPLOITATION

1. Over-exploitation of the forest resources led to migration of the farmers.
2. Environmental damage caused by over-exploitation is heavy.
3. The tropical forests are destroyed at very fast rate.
4. Countless plant species and animals are endangered.
5. Marine populations will go into extinction.

MINING

The process of extracting mineral resources and fossil fuels like coal from the earth.

Types of mining

1. Surface mining: mining of minerals from shallow deposits
2. Underground mining: mining of minerals from deep deposits

Steps involved in mining:

1. Exploration
2. Development
3. Exploitation
4. Ore processing
5. Extraction and purification of minerals

The extent of damage by under ground mining is less than that of surface mining, which needs enormous amount of land area for it's operation and management.

Effects of mining:

1. Pollute soil, water and air.
2. Destruction of natural habitat.
3. Continuous removal of minerals leads to the formation of trench where water is logged which contaminate the ground water.
4. Vibrations causes earth quakes.
5. Produces noise pollution

6. Reduces shape and size of the forest.
7. Some timesland slides may also occur.

DAMS AND THEIR EFFECTS ON FORESTS AND TRIBAL PEOPLE:

Dams are the massive artificial structure built across the river to storewater for many beneficial purpose.

Dam – "Temple of modern India" – Nehru

Dams destruct vast area of forest area. India has more than 1600 large dams.

Effects of dams on forest:

1. Thousands of hectares of forest have been cleared.
2. Killing of wild animals and destructrion of aquatic life.
3. Spreading of water borne diseases.
4. Water logging reduces the salinity of the soil.

(e.g) Narmadhasagar project It has submerged 3.5 lakhs hectares of forest.

Effects of dam on tribal people:

1. Construction of big dam leads to the displacement of tribal people.
2. Displacement and cultural change affects the tribal people both mentally and physically.
3. They do not accommodate the modern food habits and life style.
4. Tribal people are ill treated by the modern society.
5. Many of the displaced people were not recognised and resettled or compensated.
6. Body condition of tribal people will not suit with new areas and hence they will be affected by many diseases.

WATER RESOURCES:

Water is essential component of all living things. 80% of earth surface is covered with water. All organisms are made up of mostly by water.

(e.g) Tree 60% by weight of water

Animals50 – 65% by weight of water

Water exist in three phases solid, liquid and gases. It is circulated in the hydrological cycle.

Hydrological cycle:

Water from various water bodies

↓ Evaporated by solar energy

Enters in to the atmosphere as clouds

↓

Falls again on earth as rain or snow

↓

Ultimately returns to the ocean.

This process is called hydrological cycle.

Distribution of water resources:

Fresh water resources

↓

Surface water **Under ground water**

↓

Standing water bodies **Flowing water bodies**

↓ ↓

1. **Lakes**
2. **Reservoirs**
3. **Estuaries**

1. **Streams**
2. **Rivers**

Surface water:

Water stored on the surface of earth.

Standing water bodies

Lakes:

Oligotrophic lakes:

These lakes are deep and clear. The nutrients amount is deficient. Biological reactions are less.

Eutrophic lakes:

More nutrients and more turbid. It supports more life.

Dystrophic lakes:

Shallow coloured lakes and low $_{P}$H.

Reservoirs:

Generally larger than lakes.

Estuaries:

These are deltas formed at the mouth of rivers, where they join the ocean. The mixing of fresh and salt water gives estuaries.

Flowing water bodies:

Water flows in streams and rivers. It carries sedimentary materials and dissolved minerals.

Under ground water:

Water available deep in the ground due to percolation of surface water. It is the major source. It is very pure and used for almost all purposes in the world.

Under ground water

Aquifer:

Layers of highly permeable rock containing water is called an aquifer. Layer of sand and gravels are good aquifers. Clay and crystalline rocks are not good aquifers.

Effects of over utilisation of water:

1. **Decrease of ground water:**
   - Increased usage decreases the ground water.
   - Insufficient rain fall
   - Building construction activities sealing the permeability of the soil.
2. **Ground subsidence:**

   Ground water withdrawal is greater than it's recharge rate, the sediments in the aquifers get compacted. As a result shrinkage of land surface takes place.

Problems:

a. Structural damages in the builkdings
b. Fracture in pipes.
c. Reversing the flow of cfanals.

3. **Lowering of water table:**

Over utilisation of ground water in arid and semi arid regions for agriculture disturbs the state of equilibrium of the hydrological cycle.

Problem:

a. lowering of water table
b. decrease the number of aquifers
c. change the speed and direction of water.

4.**Intrusion of salt water:**

In coastal area over exploitation of ground water leads to the intrusion of salt water from sea. Therefore that water cannot be used for drinking and agriculture.

5.Over utilisation of water causes earth quakes, land slides and famine

6.Drying up of wells:

due to over utilisation, ground water level decreases much faster than can be regenerated. It leads to drying up of dug well and bore wells.

7. pollution of water:

Near the agricultural land ground water decreases therefore water containing nitrogen enters into the ground and pollute the ground water.

Problem:

Water which contains excess nitrate content is not suitable for drinking.

The benefits and problems of constructing dams

Dams are built across the river inorder to store water for irrigation, hydroelectric power generation and flood control. Most of the dams are built to serve for more than one purpose called "multi purpose dams". These dams are called as the Temples of modern India by the country's first Prime Minister, Jawaharlal Nehru.

Benefits of dam construction

1. Dams are built to control flood and store flood water.
2. Sometimes dams are used for diverting part or all of the water from river into a channel.
3. Dams are used mainly for drinking and agricultural purposes.
4. Dams are built for generating electricity.
5. Dams are used for recreational purposes.
6. Navigation and fishery can be developed in the dam areas.

Problems of constructing dams

(i) Upstream Problems

(a) Displacement of tribal people

(b) Loss of non-forest land.

(c) Loss of forests, flora and fauna.

(d) Landslips, sedimentation and siltation occurs.

(e) Stagnation and waterlogging around reservoirs retards plant growth.

(f) Breeding of vectors and spread of vector-borne diseases.

(g) Reservoir induced seismicity (RIS) causes earthquakes.

(e) Navigation and aquaculture activities can be developed in the dam area.

(ii) Downstream problems

(a) Water logging and salinity due to over irrigation.

(b) Reduced water flow and silt deposition in rivers.

(c) Salt water intrusion at river mouth.

(d) Since the sediments carrying nutrients get deposited in the reservoir, the fertility of the land along the river gets reduced.

(e) Sometimes, due to structural defects the dam may collapse suddenly and destroy many living organisms.

(f) Salt water intrusion at river mouth.

MINERAL RESOURCES:

Naturally occurring substances with different physical and chemical properties.

Ores:

These are mineral or combination of minerals from which metal can be extracted. Concentration of minerals at one particular spot is called mineral deposit.

Classification of mineral resources:

U.S geological survey divides a non renewable mineral resources into 3 categories.

1. **Identified resources:**
   Location, existence, quality and quantity known by direct geological evidence and measurement.

2. **Undiscovered resources:**
   Assumed to exist on the basic of geological knowledge, but their specific location, quality and quantity are unknown.

3. **Reserves:**
   Minerals are identified. Usable materials can be extracted profitably.

Uses and exploitation of minerals:

1. Development of industrial plants and machinery. - Fe, Al & Cu
2. Construction work – Fe, Al &Ni
3. Generation of energy - coal, lignite, uranium
4. Designing defence equipments like weapons and ornaments
5. Agricultural purposes – fertilisers and fungisides – Zn &Mn
6. Jewellery –Au, Ag & Pt
7. Making alloys for various purposes – phosphorites
8. Communication purposes – telephone, wires, cables and electronic devices
9. Medicinal purposes, particularly in ayurvedic system – sulphur pyrites

Classification of minerals:

Metallic minerals:

From which metals can be extracted. e.g Fe, Al & Cu

Non metallic minerals

Non metallic compounds can be extracted.e.g Quartz and feldspar

Mineral wealth of India

S.No	Mineral	Available state
1	Iron	Tamil nadu
2	Coal	Orissa, west bangal
3	Manganese	M.P
4	Copper	Bihar
5	Gold	Karnataka
6	Aluminium	Tamilnadu

7	Lime stone	M.P
8	Mica	Bhar
9	Monozite	Kerela
10	Lead and zinc	Gujarat &rajasthan
11	Precious stones	Rajasthan
12	Magnesite	Tamil nadu
13	Petroleum	Assam
14	Magnesite	Tamilnadu, sikkim
15	Gypsum	Rajasthan

MINING:

The process of extraction of minerals from the earth.

Types of mining:

1. Surface mining 2. Under ground mining

Types of under ground mining

a. Open pit mining:

Machines dig holes and remove the ores.

b. Dredging:

Chained buckets are used to extract minerals.

c. Strip mining:

Bulldozers are used to extract minerals.

Environmental damages caused by mining activities:

1. **Devegetation :**
   - topsoil and vegetation are removed
   - deforestation leads to several ecological losses
   - land scape badly affected
2. **Ground water contamination:**

   Mining pollutes ground water , sulphur is converted into sulphuric acid which enters into the soil.

3. **Surface water pollution:**

   Radioactive wastes and other acidic impurities affect the surface water, which kills many aquatic animals.

4. **Air pollution:**

   Smelting and roasting are done to purify the metal whih emits air pollutants and damage the nearby vegetation. It causes many health problems.

5. **Subsidence of land:**

   Mainly underground mining results in cracks in houses, tilting of buildings and bending of rail tracks.

Effects of over exploitation of minerals:

1. Rapid depletion of mineral deposits
2. Wastage
3. Environmental pollution
4. Needs heavy energy requirements.

Management of mineral resources:

1. The efficient use and protection of mineral resources.
2. Modernisation of mining industries

3. Search for new deposit
4. Reuse and recycling of the metals.
5. Environmental impacts can be minimised by adopting eco friendly mining technology.

Case studies;

Mining and quarrying in udaipur:

200 open cast mining and quarrying in udaipur. But 100 minings are illegal. 150 tonnes of explosives are used per month. It pollutes air, soil and water. It affects irrigation and wild life.

FOOD RESOURCES:

Food is an essential requirement for survival of life. Main components are carbohydrates, fats, proteins, minerals and vitamins.

Types of food supply:

1. **Crop plants:**
   Mostly produce grains about 76% of the world's food.
   e.g rice, wheat and maize
2. **Range lands:**
   It produces 17% of world's food from trees and grazing animals.
   e.g fruits, milk and meat
3. **Ocean:**
   Fisheries – 7% of world's food

World food problem:

1. In the earth's surface 79% water out of total area. 21% land(forest, desert, mountain and barren land) . Less % cultivated land, at the same time population explosion is high therefore world food problem arises.

2. Environmental degradation like soil erosion, water logging , water pollution, salinity affect agricultural land.
3. Urbanisation affect agricultural land. Hence production of rice, wheat, corn and other vegetable is difficult.

Types of nutrition:

1. **Nutritious nutrition:**

   To maintain good health and disease resistant, we need large amount of carbohydrate, proteins, fats and smaller amount of micronutrients such as vitamins and minerals such as Fe, Ca and iodine. Food and agricultural organisation (FAO) of united nations estimated that on an average, the minimum calorie intake on a global state is 2500 calories/day.

2. **Under nutrition;**

   People who can not buy enough food to meet their basic energy needs suffer from under nutrition. They receive less than 90% of these minimum dietry calorie.

   Effect of under nutrition:

   Suffer from mental retardation and infectious diseases.

3. **Mal nutrition:**

   Besides minimum calorie intake we also need proteins, minerals, vitamins, iron and iodine. Deficiency leads to malnutrition resulting in several diseases.

Effect of mal nutrition:

S.No	Deficiency of nutrients	Effects
1	Protein	Growth
2	Iron	Anemia
3	Iodine	Goiter
4	Vitamin – A	Blindness

India 3rd largest producer of crops, nearly 300 million Indians are still under nourished.

World food summit 1996:

The world food summit, 1996 has set the goal to reduce the number of under nourished and mal nourished people to just half by 2015.

Over grazing:

It is a process of eating the forest vegetation without giving a chance to regenerate.

Effects of over grazing:

1. **Land degradation**
   - over grazing removing the cover of vegetation
   - exposed soil gets compacted
   - soil moisture is not available
   - OG leads to poor, dry and compacted soil.
   - Land can not be used for further cultivation.
2. **Soil erosion:**

   When the grasses are removed the soil becomes loose and gets eroded by the

   action of wind and rain fall.

3. **Loss of useful species:**

   OG affects the plant population and their regenerating capacity. OG replace the plant of high nutritive value with plant of low nutritive value.

Agriculture:

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

Types of agriculture:

1. Traditional agriculture
2. Modern (or) industrialised agriculture

Traditional agriculture:

Small plot, simple tools, surface water, organic fertilizer and a mixture of crops are enough. They produce enough food to feed their family and to sell it for their income.

Modern agriculture:

Hybrid seeds of single crop variety, high tech equipments, lot of fertilisers, pesticides and water to produce large amount of single crops.

Effects of modern agriculture:

1. **Problems in using fertilisers:**
   a. **Excess of fertilisers causes micronutrient imbalance**. (e.g) Punjab and Haryana deficiency of nutrient znic in the soil affect the productivity of the soil.
   b. **Blue baby syndrome**(nitrate pollution)
   Nitrate present in the fertiliser causes blue baby syndrome, when the amount exceeds the limit leads to death.

   c. Eutrophication:
   Nitrogen and phosphorus in the crop fields washed out by run off water in the water bodies, which increases the nourishment of the lakes called eutrophication. Hence algal species increases rapidly. Life time of the species is less and they decompose easily and pollute the water which affects the aquatic life.

2. **Problems in using pestcides**:
   First generation pesticide:

   Sulphur, arsenic, lead and mercury.

   Second generation pesticide:

   DDT

   Number of side effects:

   1. Death of non target organism.
   2. Producing new pest – super pest

3. Bio magnification – Most of the pesticides are non bio degradable, keep on concentrating in the food chain and it is harmful to human beings.
4. Risk of cancer:
    a. It directly acts as carcinogen
    b. It indirectly supports immune system.

3.Water logging:

Land where water stand for most of the year.

Causes of water logging:

1. Excessive water supply
2. Heavy rain
3. Poor drainage

Remedy:

1. Preventing excessive irrigation
2. Subsurface drainage technology
3. Bio drainage like trees like Eucalyptus

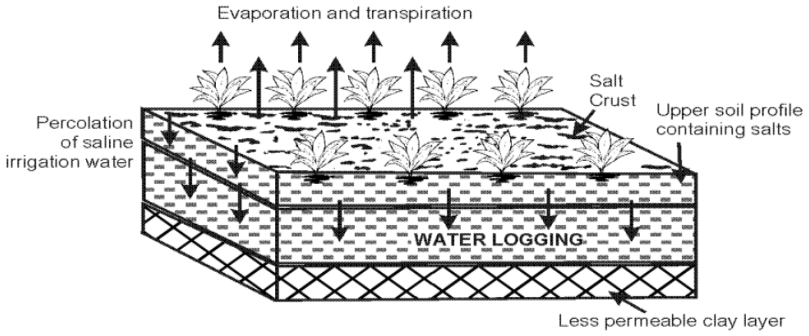
Case study:

Pesticides in India:

In Delhi the accumulation of pesticide in the body of mother causes premature delivary and low birth weight infant.

Pesticides in pepsi and coca cola:

India has reported that pepsi and coca cola companies are selling soft drinks with a pesticide content 30-40 times higher than EU limits. This damages the nervous system,.

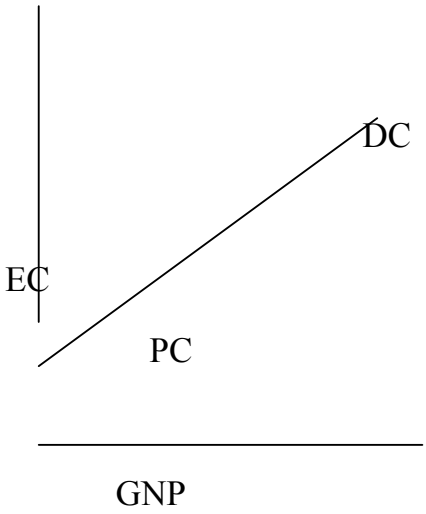


Water logging and salination

ENERGY RESOURCES:

Energy distribution in the world:

Developed countries like USA and Canada constitute only 5% of the world's population but consume 25% of the world's available energy. Energy consumed by a person in a developed country for a single day is equal to energy consumed by a single person in a poor country for one year. Developed country GNP increases and energy consumption increases. In the poor country GNP and energy consumption are less.



Types of energy resources:

1. Renewable energy resource (or)Non conventional energy resources
2. Non renewable energy resources (or) Conventional energy resources

Merits of renewable energy resources:

1. Unlimited supply
2. Provides energy security.
3. Fits into sustainable development concept.
4. Reliable and the devices are modular in size.
5. Decentralised energy production.

Renewable energy sources:

Energy which can be regenerated

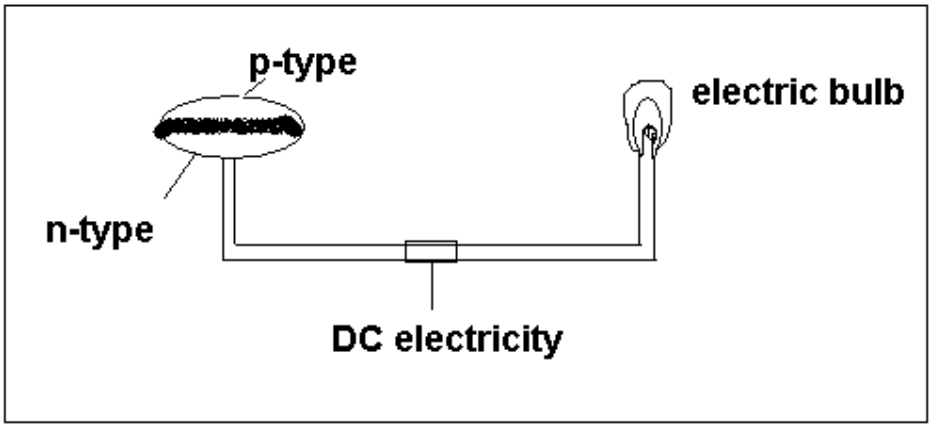
Solar energy:

Nuclear fusion reaction of sun produces enormous amount of energy. Several techniques are available for collecting, storing and using solar energy.

Solar cell (or) Photovoltaic cell (or) PV cell:

Solar cell consist of p- type semi conductor (Si doped with B)

And n-type semi conductor(Si doped with P). p-type forms top layer and n-type forms bottom layer.. solar rays fall on the top layer , the electrons fron valence band promoted to the conduction band which crosses the p-n junction into n-type semi conductor. Potential difference between the two layers is created which causes flow of electrons.



Solar cell

Uses:

It is used in calculators, electronic watches, street light, water pumps etc.

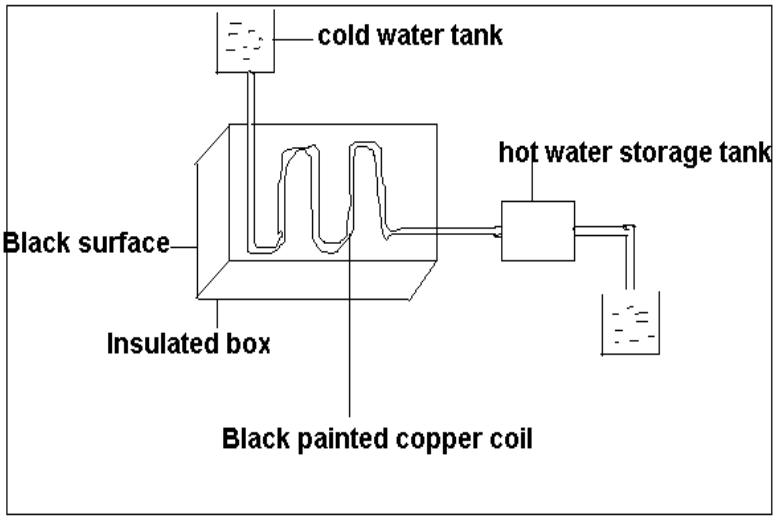
Solar battery:

Large number of solar cells connected in series is called solar battery. It is used in remote areas where continuous power supply is a problem.

Solar water heater:

It consist of insulated box painted with black paint with glass lid. Inside the box black painted copper coil is present. Cold water is allowed to flow, it is

heated up and flows out into a storage tank from which water is supplied through pipes.

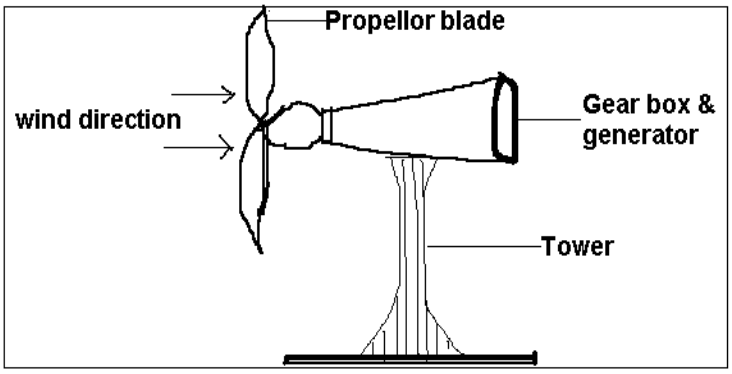


Wind energy:

Moving air is called wind. The energy recovered from the force of the wind is called wind **energy It's speed is high.**

Wind mills:

When a blowing wind strikes the blade of the wind mill, it rotates continuously. And rotational motion of the blade drives number of machines like water pump, flour mills and electric generators.



Wind farms:

When a large number of mills are installed and joined together in adefinite pattern – it forms wind farm. It produces large amount of electricity.

Condition:

Minimum speed for wind generator is 15 Km/hr

Advantages:

1. It does not cause air pollution
2. Very cheap

Ocean energy:

Tidal energy (or) Tidal power:

Ocean tides are due to gravitational force of sun and moon which produce enormous amount of energy. High tides – rise of water in the ocean. Low tides – fall of water in the ocean. Tidal energy can be used by constructing a tidal barrage. During high tides sea water enters into the reservoirs and rotate the turbine, produce electricity. During low tides water from reservoir enters into the sea rotate the turbine produce electricity.

Ocean thermal energy:

Temperature difference between surface water and deeper level water in ocean generates electricity. The energy available due to the difference in temperature of water is called ocean thermal energy.

Condition:

Temperature difference should be 20^0C.

Process:

Ammonia is converted into vapours on the surface of warm water, it increases the vapour pressure which rotate the turbine and generates electricity. Deeper level cold water is pumped to cool and condense the vapour in to liquid.

Geo thermal energy:

Temperature of the earth increases at a of 20 –75^{0}C per/km when we move down the earth. The energy utilised from the high temperature present inside the earth is called geothermal energy.

Natural geysers:

Hot water or steam comes out of the ground through cracks naturally is called natural geysers.

Artificial geysers:

Artificially a drill hole up to the hot region and by sending a pipe into it. The hot water or steam is used to rotate the turbine and generate electricity.

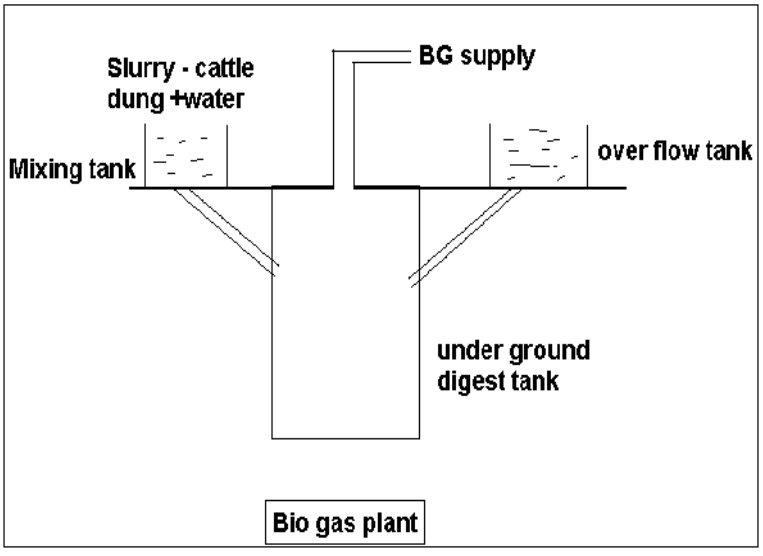
Bio mass energy

Bio mass

Organic matter produced by plants or animals used as source of energy

Bio gas

Mixture of methane, carbondioxide and hydrogen sulphide. Methane is the major constituent. It is obtained by anerobic fermentation of animal dung (or) plant wastes in the presence of water.



Bio-gas plant or Gobar gas plant consists of a well like under ground tank (called digester) covered with dome shaped roof with a gas out let pipe. The dome of the digester acts as gas holder. On the left hand side of the digester there is a sloping inlet chamber through which cattle dung + water slurry is introduced. On the right hand side, there is a outlet chamber, through which spent dung slurry gets collected.

Working

Slurry (Animal dung + water) is fed into the digester, is left for about two months for fermentation caused by anerobic micro organisms. As results of anerobic fermentation, biogas is collected in the doom. When sufficient amount of biogas is collected, it exerts a large pressure on the slurry and this in turn forces the spend slurry to the overflow tank through the outlet chamber. Once the biogas plant starts functioning, more and more slurry may be fed into the digester to get continuous supply of biogas.

Uses of Biogas

1. It is used for cooking food and heating water.
2. It is also used to run engines.
3. It is mainly used as an illuminant in villages.
4. It is used in gas turbines and fuel cells for producing electricity.

Bio fuels:

Fuels obtained by the fermentation of biomass.

Eg ethanol, methanol

Ethanol :

Produced from sugar cane. Calorific value is less.

Methanol:

Obtained from ethanol Calorific value too less.

Gasohol: Mixture of ethanol and gasoline India trial is going on to use gasohol in cars and buses.

Hydrogen fuel:

Hydrogen produced by pyrolysis, photolysis and electrolysis of water. It has high calorific value. Non polluting one because the combustion product is water.

Disadvantages:

1. Hydrogen is highly inflammable and explosive.
2. Safe handling is required.
3. Difficult to store and transport.

Non renewable energy sources:

Energy which can not be regenerated.

Coal:

It is a solid fossil fuel.

Disadvantages:

1. when coal is burnt large amount of CO_2 is released. Which causes global warming.
2. S, N produces toxic gases during burning.

Petroleum:

Crude oil is a liquid consists of more than hundreds of hydrocarbons and small amount of impurities. The petroleum can be refined by fractional distillation. In the world level 25% of oil reserves are in Saudi Arabia. At present rate of usage, the world crude oil reserves are expected to get exhausted in just 40 years.

Liquefied petroleum gases(LPG):

Petroleum gases obtained during FD and cracking can be easily converted into liquid under high pressure as LPG. It is colourless and odourless gas, but during cylindering mercaptans are added to detect leakage.

Natural gas:

These are found above oil in oil wells. It is a mixture of methane and other hydrocarbons. Calorific value is high. There are two types. Dry gas and wet gas.

Nuclear energy

Dr.H.Bhabha is a father of nuclear power development in India. 10 nuclear reactors are present in India. It produces 2% of India's electricity. Nuclear energy can be produced by two types of reactions. Nuclear fission and nuclear fusion.

Nuclear fission

It is a nuclear change in which heavier nucleus split into lighter nuclei on bombardment of fast moving neutrons. Large amount of energy is released through chain reaction.

E.g

Uranium with fast moving neutron gives barium and krypton in addition to three neutrons, in the second stage it gives nine neutrons and so on. This process of propagation of the reaction by multiplication is called chain reaction.

Nuclear fission

It is a nuclear change in which lighter nucleus are combined together at extremely high temperature (1 billion ^{0}C) to form heavier nucleus and a large amount of energy is released.

E.g

Isotopes of hydrogen combine to form helium molecule.

Case Study:

Wind energy in India:

India generating 1200 MW electricity using the wind energy. Largest wind farm situated near Kanyakumari in Tamil nadu. It produces 380 MW electricity.

Hydrogen fuel car:

General motar company of china discovered a experimental car (fuel H_2) can produce no emission only water droplets and vapours come out of the exhaust pipe. This car will be commercially available by 2010.

LAND RESOURCES

Land is the most important valuable resource for mankind,

- It provides food, fibre, medicine.
- It is a mixture of inorganic materials and organic materials.
- To construct building
- Acts as a dustbin for most of the wastes created by the modern society.

Land degradation

It is a process of deterioration of soil or loss of fertility.

Effects of land degradation:

1. Soil texture and soil structure are destructed.
2. Loss of soil fertility.
3. Loss of valuable nutrients.
4. increase in water logging, salinity, alkalinity and acidity problem.
5. Loss of economic social and biodiversity.

Causes of land degradation:

1. **Population:**
   More land is needed for producing food, fibre and fuel wood. So land is degraded due to over exploitation.
2. **Urbanisation:**
   Urbanisation reduces the agricultural land. Urbanisation leads to deforestation, which inturn affects millions of plants and animals.
3. Fertilizers and pesticides:
   It affects fertility of the soil and causes land pollution.
4. **Damage of top soil:**
   Increase in food production generally leads to damage of top soil through nutrient depletion.
5. Water logging, soil erosion, salination and contamination of the soil with industrial wastes and cause land degradation.

Soil erosion

The process of removal of superficial layer of the soil from one place to another is called soil erosion.

Harmful effects of soil erosion:

1. Soil fertility decreases due to the loss of top soil layer.
2. Loss of it's ability to hold water and sediments.

3. Sediments run off can pollute water and kill aquatic life.

Types of soil erosion:

1. **Normal erosion:**

   It is caused by gradual removal of top soil by the natural process. The rate of erosion is less.

2. **Accelerated erosion:**

   It is caused by man made activities. The erosion is much faster than the rate formation of soil.

Causes of soil erosion:

1. **water**

   water causes soil erosion in the form of rain, run off, rapid flow and wave action.

2. **wind:**

   It is an important climatic agent, which carry away the fine particles of soil creates soil erosion.

3. **Biotic agent:**

   Over grazing, mining and deforestation are the major biotic agent cause soil erosion. 35% of soil erosion is due to over grazing and 30% is due to deforestation.

4. **Land slide:**

   It causes soil erosion.

5. **Construction:**

   Construction of dams, buildings, roads removes protective vegetal cover and leads to soil erosion.

Control of soil erosion (or) Soil conservation practices:

The art of soil conservation is based on following basic principles

1. To slow down the water for concentrating and moving down the slope in a narrow path.
2. To slow down the water movement when it flows along the slope.
3. To encourage more water to enter into the soil.
4. To increase the size of soil particles.
5. Reduction in the wind velocity near the ground by growing vegetation.

Conservational tillage:

The process of mixing the residues from previous crops into the soil by ploughing is called conservational tillage. It improves soil permeability and increase organic matter, which in turn improve soil moisture and nutrients.

Organic farming :

Process of increasing organic input to the soil. E.g bio fertilizer

Crop rotation:

Process of growing different crops in successive year on the samew land. It prevents the loss of fertility of the soil.

Contour Ploughing:

It is very useful areas with low rain fall, i.e placing some furrows to store water, which reduces runoff and erosion.

Mulching:

Soil is covered with cropl residues and other form of plant litters.

Strip cropping:

Planting of crops in rows to check flow of water.

Terrace farming:

Conversion of steep slopes in to a series of broad terraces which run across the contour. It reduces soil erosion by controlling run off.

Agroforestry:

Planting crops in between rows of trees or shrubs, that can provide fruits and fuel wood. After harvesting the crops the soil will not be eroded because trees and shrubs will remain on the soil and hold the soil particles.

Wind break:

Trees are planted in lo0ng rows along the boundaryof cultivated lands, which block the wind and reduces soil erosion.

Desertification:

It is a form of land degradation. It is a progressive destruction or degradation of arid or sen\mi arid lands to destruct.

Causes:

1. Deforestation
2. Over grazing
3. Over utilisation of water
4. Mining and quarrying
5. Climate change
6. Excessive use of fertilizers and pesticides

Effects of desertification:

80% of productive land in the arid and semiarid regions are converted in to desert. Around 600 million people are suffered by desertification.

ROLE OF AN INDIVIDUAL IN CONSERVATION OF NATURAL RESOURCES

Conservation of energy:

1. Switch off light, fan and other appliances when not in use.
2. Use solar heater for cooking.
3. Dry the cloth in the sun light instead of driers.
4. Use always pressure cookers
5. Grow trees near the house to get cool breeze instead of using AC and ai cooler.
6. Ride bicycle or just walk instead of using scooter for ashort distance.

Conservation of water:

1. Use minimum water for all domestic purposes.
2. check the water leaks in pipes and repair them properly.
3. Reuse the soapy water, after washing clothes for washing courtyard, carpets etc.
4. Use drip irrigation.
5. Rain water harvesting system should be installed in all the houses.
6. Sewage treatment plant may be installed in all industries and institution.
7. Continuous running of water taps should be avoided.
8. Watering of plants should be done in the evening.

Conservation of soil:

1. Grow different type plants i.e trees, herbs and shrubs.
2. In the irrigation process, using strong flow of water should be avoided.
3. Soil erosion can be prevented by sprinkling irrigation.
4. Use green manures in the garden.
5. Use mixed cropping.

Conservation of food resources:

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

Conservation of forest:

1. Use non timber product.
2. Plant more trees.

3. Grassing must be controlled
4. Minimise the use of paper and fuel.
5. Avoid the construction of dam, road in the forest areas.

Equitable use of resources for sustainable life style:

Sustainable development:

Development of healthy environment without damaging natural resources.

Unsustainable development;

Degradation of the environment due to over utilisation of natural resources.

Life style in more developed countries:

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

Life style in less developed countries:

78% of world population, 12% of it's natural resources and 15% of total global income. Consumption is less and pollution is less.

Causes of unsustainability:

Main cause – difference between MDCs and LDCs.

Sustainable life style:

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

INTRODUCTION TO ENVIRONMENTAL BIOCHEMISTRY

Xenobiotics

Biochemistry is used in environmental science to understand the effects of environment on living organisms as they interact with environmental pollutants. These pollutants are referred to as xenobiotics.

Xenobiotics can be ingested, inhaled or absorbed through the skin. Using biochemistry it is possible to study how different pollutants behave once if they are in the body.

Definition

Environmental biochemistry involves approaches to treat polluted air, waste water and solid waste using metabolic activities of micro-organisms.

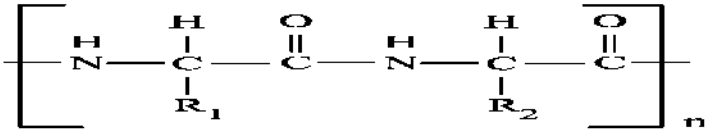
Aims of environmental biochemistry

1. It aims to manufacture of products in environmentally harmonious ways, which allow for the minimization of harmful solids, liquids or gaseous outputs.

2. It also aims to create a cleaner ecosystems.

Proteins

Protein is the principle constituent of animal origin. All raw animals and plant food stuffs contain proteins, but in plants it occurs in lesser extends. Proteins are complex in chemical structure and unstable being subjected to many forms of decomposition. The structure of protein is



(Structure of protein)

UNIT-IV

SOCIAL ISSUES AND ENVIRONMENT

Development :

It brings benefits to all not only to the present generation but also for future generations.

Sustainable development:

Meeting the needs of the present without compromising the ability of future generation to meet their own needs.

True sustainable development aims at optimum use of natural resources with high degree of reusability ,minimum wastage, least generation of toxic by-products and maximum productivity.

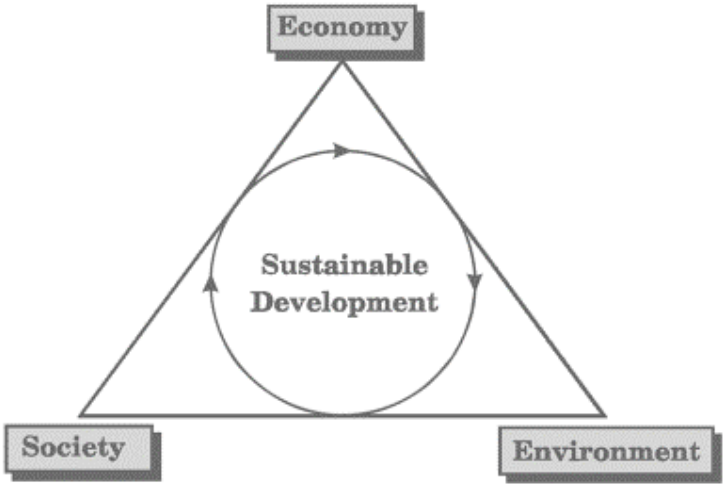
Aspects of sustainable development:

Inter-generational equity:

It states stat we should hand over a safe, healthy and resourceful environment to future generation.

Intra-generational equity:

A technological development of rich countries should support the economic growth of poor countries and help in narrowing the wealth gap and lead to sustainability.



Approaches for sustainable development:

1.Devloping appropriate technology:

Technology which is locally adoptable,ecofriendly,resource efficient and culturally suitable should be adopted.

It uses local labour ,less resources and produces minimum waste.

2.Reduce ,Reuse and Recyle (3Rapproach):

Optimum use of natural resources using it again and again instead of throwing it on wasteland or water and recycling the material in to further products. It reduce waste generation and pollution.

3. Providing environmental education and awareness:

Thinking and attitude of people towards earth and environment should be changed by providing environmental awareness and education.

4.Consumption of renewable resources:

It is very important to consume the natural resources in such a way that the consumption should not exceed the regerneration capacity.

5.Non-renewable resources :

Non renewable resources should be conserved by recycling and reusing.

6.By population control :

We can make suistainable development by controlling the population growth.

URBAN PROBLEMS RELATED TO ENERGY

Urbanisation:

It is the movement of human population from rural; areas to urban areas for want of better education,communication,health, employment etc.

Causes:

Cities are the main centers of economic growth, trade transportation, medical facilities and employment.

Urban sprawl:

The phenomenon of spreading of the cities in to sub-urban or rural areas is called urban sprawl.

Urban growth is so fast and is difficult to accommodate all commercial industrial residential and educational facilities within the limited area.

Energy demanding activities:

Urban people consume lot of energy and materials in comparison with rural people.This is because urban people have high standard of life and their life style demand more energy.

Examples for energy demands:

1. Residential and commercial lightings.

2. Industries using large proportion of energy.

3. Usage of fans fridge, A.C, washing machines.

4. Control and prevention of pollution technologies need more energy.

Solution for urban energy problems:

1. Energy consumption must be minimized in all aspects.

2. Public transportation should be used instead of motor cycles and cars.

3. Using of solar energy and wind energy.

4. Production capacity must be increased.

WATER CONSERVATION

The process of saving water for future utilization is called conservation of water.

Need for water conservation.

1. Better life style require more fresh water.
2. Agriculture and Industrial activities require more fresh water.
3. As the population increases the requirement of water is also more .

Strategies of water conservation

REDUCING evaporation losses

Evaporation of water in humid regions can be reduced by placing horizontal

Barriers of asphalt below the soil surface.

Reducing irrigation losses

Sprinkling and irrigation conserves water by 30- 40%. Irrigation in early morning (or) later evening reduces evaporation losses.

Growing hybrid crop varieties also conserve water.

Reuse of water

Treated waste water can be reused for irrigation. Water from washings, bath rooms etc. can be used for washing cars, gardening.

Preventing of wastage of water

Closing the taps when not in use and repairing any leakage from pipes .

Decreasing run off losses

Run off , on most of the soils can be reduced by using contour cultivation (or)

Terrace farming.

Avoid discharge of sewage

Sewage disposal into natural water resources should be avoided.

Methods of water conservation

1. Rain water Harvesting
2. Watershed management

RAINWATER HARVESTING

It is a technique of collecting and storing rain water for use in non-monsoon periods.

Objectives of rain water harvesting.

1 To raise the water table by recharging the ground water.

2. To minimize water crises and water conflicts

3. To reduce rain water run off and soil erosion.

4. To reduce the ground water contamination from intrusion of saline water

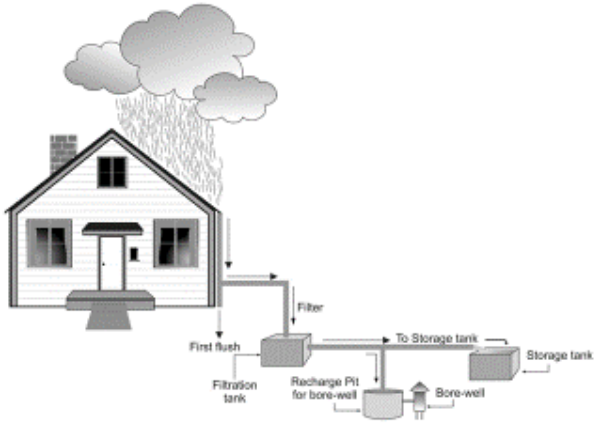
Concept of rain water harvesting

Rain water harvesting involves collecting water that falls on roof of house during rain and conveying water through PVAor Aluminium or steel pipe to a near by covered storage tank.

Method of rain water harvesting

1. Roof top method :

Collecting rain water from roof of the building and storing in theground.It is the low cost and effective technique for urban houses and buildings.The rain water from roofs, road surfaces, play grounds is diverted into the surface tank or recharge pits. The pit base is filled with stones and sand which serves as a sand filter.



Advantages :

1. Rise in ground water level.

2.Minimising the soil erosion and flood hazards

3 . scarcity of water is reduced

WATERSHED MANAGEMENT

Water shed (or) drainage basin:

It is defined as land area from which water drains

Under the influence of gravity into stream , lake ,reservoir (or) other body of surface water.

Watershed management:

Management of rain fall and resultant run off is called watershed management.

Factors affecting watershed :

1. Overgrazing .
2. deforestation
3. mining
4. construction activities affect and degrade watershed.
5. Droughty climate also affects the water shed.

Need or objectives of watershed management

1. To raise the ground water level.
2. To protect the soil from erosion by run off.
3. To minimize the risks of floods, drought and landslides.
4. To generate huge employment opportunities in backward rain fed areas to ensuresecurity for livelihood.

Watershed management techniques

- Trenches (pits) were dug at equal intervals to improve ground water storage.
- Earthern dam or stone embankment must be constructed to check run off water.
- Farm pond can be built to improve water storage capacity of the catchment's area

Maintenance of watershed

1. Water harvesting:

Proper storage of water in water shed can be used in dry season

And in low rainfall areas.

2. Afforestation and agro-forestry:

It helps to prevent soil erosion and retention of moisture in watershed areas

3. Reducing soil erosion :

Terracing , contour cropping minimse soil erosion and run off on the slopes of water sheds.

4. Scientific mining and quarrying:

It minimise the destructive effect of mining in water shed areas

5. Public participation:

It is essential for water shed management.People should be motivated for maintaining water harvesting structures implemented by the government.

6. Livestock population:

Livestock should be reduced in surrounding villages of water shed.

RESETTLEMENT AND REHABILITATION

- It is one the most serious problems caused by the development activities.
- Dam construction has so for ousted 30 million people across the world.
- Ousters are poorer or indigenous people who leave behind productive farm and ancestral homes

Causes of displacement of people

- Developmental activities

It includes construction of dams, roads, railway tracks, Air ports, urban expansion etc...
Eg.Hirakud dam displaced 20000. Tehri dam displaced

10000 in tehri town.

- Disasters:

These may be natural (or) man made.

Natural disasters include cyclones, earthquakes, floods, volcanic eruptions, forest fires etc.

Man made disasters like industrial accidents, nuclear accidents, bomb blasts

- Conservation initiatives

  It includes protection of wild life , forests , water body conservation (projects like natural parks , biosphere reserves, sanctuaries etc)(or) for pollution control purposes like displacement of human population from industrial areas (or) around sewage treatment plants etc.

Resettlement

Resettlement is simple relocation (or) displacement of human population without regard to their individual community (or) social needs.

Resettlement does not focuson their future welfare (like education,employment, health care . safety and social commitments) because of these flaws resettlement schemes have high failure rate around the world.

Rehabilitation :

It involves replacing lost economic assets , rebuilding the community system.

Resettlement and rehabilitation of human population is a dynamic process.Its implementation and execution is flexible.

Case study :

Sardarsarover dam

River Narmada flows through M.P, Maharastra and Gujarat and merges in Arabian sea.

Sardarsarover dam is situated in Narmada valley. As a result of construction of dam 593 villages consisting of 10 lakh people were made homeless 45000 hectares of forest and 2 lakh hectares of cultivated land submerged in Maharastra.

Now the Gujarat government has planned to incrase the height of the dam from 100 to 110.64 meters. This became the a controversial issue as there is no proper rehabilitation scheme for the allotted people.

Narmada BachoAndolan was initiated against the construction of dam and islead by SmtMaedhapatkar , who is constantly working for the affected ousted tribal.

Their Dam project :

This dam is being constructed across Bhagirathi andBhilanganga close to Gashwal town of Tehri .This would submerge 100 villages,

Including Tehri , 85000 families will have to be relocated.

Pong dam :

It was constructed on Beas river in H .P .and Punjab.The water

Is used to irrigate in Rajastan. 30000 families were uprooted due to PONG DAM.

Only 16000 families were rehabilitated.

ENVIRONMENTAL ETHICS

It refers to issues ,principles and guidelines related to human interactions with their environment**.** **(OR)**

Ethics is a branch of philosophy. It deals with morals and values. An ethic is aprinciple or value that we use to decide whether an action is good or bad.

Ethics differs from country to country.

Functions of Environment:

- It moderates climate conditions of the soil.
- A healthy economy depends on healthy environment.
- It is the life supporting medium for all organisms.
- It provides food , air , water and other important natural resources to the human beings

Environmental problems :

- Deforestation activities , population growth and urbanization

- Pollution due to effluents and smoke from industries, water Scarcity.

Solution to environmental problems:

- Reduce the waste matter and energy resources.

- Recycle and reuse as many of our waste product and resources as possible.
  - Avoid over exploitation of natural resources.
  - Minimse soil degradation.
  - Protect the biodiversity of the earth.
  - Reduce population and increase the economic growth our country.

Ethical guidance :

- We should love and honour the earth since it blessed you with life and governs your survival.
- You should not waste your resources on destructive weapons.
- You should not steal from future generation their right to live in a clean and safe planet by polluting it.
- You should consume material goods in moderate amounts, so that all may share earth' resources.

GREEN CHEMISTRY

Green chemistry is the chemistry that involves designing and production of chemicals without polluting the environment. ie., Green chemistry is the pollution free chemistry.

1. **Prevention of wastes**

➢ It is better to prevent wastes than to treat or clean up wastes after they have been created.

2. **Atom economy**

➢ Synthetic methods should be designed to maximize the incorporation of all materials used in the process of formation of final product.

3. **Less hazardous chemical synthesis**

➢ Synthetic methods should be designed to use and generate materials, which possess no toxicity or little to human health and the environment.

4. **Designing safer chemicals**

➢ Chemical substances should be designed to affect their desired functions during minimizing their toxicity.

5. **Safer solvents and auxiliaries**

➢ The use of auxiliary substances (eg., toxic solvents, separation agents, etc.,) should be made unnecessary wherever possible and not harmful when used.

6. **Design for energy efficiency**

➢ Energy requirements, during the chemical processes, should be minimized. If possible, synthetic methods should be carried out at ambient temperature and pressure.

7. **Use of renewable feedstock**

➢ Raw materials or feed stocks used should be renewable rather than depleting.

8. **Reduce derivatives**

➢ Unnecessary derivatives should be minimized or avoided if possible, because such steps require additional reagents and generate wastes.

9. **Catalysis**

➢ Catalytic reagents are superior to stoichiometric reagents.

10. **Design for degradation**

➢ Chemical products should be designed in such a way that at the end of their function they break down into harmless degradation products and do not persist in the environment.

11. **Real time analysis for pollution prevention**

➢ Analytical methodologies need to be developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.

12. **Inherently safer chemistry for Accident prevention**

➢ Substances and some form of a substance, used in a chemical process, should be chosen to minimize the chemical accidents, including releases, explosions and fires.

NUCLEAR ACCIDENTS AND HALOCUST

Nuclear energy:

Energy releasedduring a nuclear reaction is called nuclear energy.

Nuclear fission andNuclearfussion are used to prepare nuclear energy.

During nuclear accidents large amount of energy and radioactive products are released into the atmosphere.

Types of nuclear accidents :-

Nuclear Test:

Nuclear explosions –release radioactive particles and radioactive rays into

The atmosphere.

Nuclear power plant accidents :

Nuclear power plants located inseimic vulnerable area may cause nuclear accidents which releases radation .

Improper disposal of radioactive wastes:

Drums with radioactive wastes, stored underground rust and leak radioactive wastes into water , land and air.

Accidents during transport:

Trucks carrying radioactive wastes (or) fuels in accidents.

The major accident at a nuclear power plant is a core melt down.

Effects of nuclear radiation

1.Radiation affects DNA in cells.

2.Exposure to low dose of radiation (100to 250 rds) people suffer from fatigue, vomiting ,and loss of hair.

3. Exposer to high radation (400- 500 rds) affect bone marrow ,blood cells , natural resistance fail of blood clot.

4. Exposure to very high dose of radiation (10000rds) kills organisms by damaging the tissues of heart and brain.

Nuclear Holocaust :

Destruction of Biodiversity by nuclear equipments and nuclear bombs is called nuclear holocaust.

Effects of nuclear holocaust.

Nuclear winter:

Nuclear bombardment will cause combustion of wood , plastics , forests etc. Large quantity of soot will be carried out into the atmosphere .

Black soot absorb all UV radiation and will not allow the radiation to reach the earth . There fore cooling will result. This reduces evaporation of water .In stratosphere there won"t be significant moisture to rain out the black soot. Due to nuclear explosion a process opposite to global warming will occur . This is called Nuclear winter.

Effects of nuclear winter :

1. Lower the global temperature.
2. Crop productivity will be reduced causing famines and human sufferings.

Examples of nuclear holocaust:

- Nuclear war in Japan. Hiroshima and Nagasaki are examples of holocaust during

Second World War.

- At Chernobyl:

  When the operators lost the control of water cooled graphite moderated reactor during low power tests.

At Chernobyl in Ukraine the nuclear reactor exploded.

Case study : Chernobyl Nuclear disaster.

On April 28th 1986 the world worst nuclear power accident occurred at Chenobyl in Ukrain .

This disaster was caused mainly due to poor reactor design and human error.

Impact :

Chernobyl accident killed more than 80000 people and 35 million people have suffered ill because of The accident. Nearly 135000people have to be evacuated at around Chernobyl.

Nuclear holocaust in Japan

In 1945 two nuclear bombs were dropped in Hiroshima and Nagasaki in Japan . About 100000 people were killed and the cities were badly destroyed. This explosion emitted forceful neutrons and gamma radiation.

Radioactive Strontium liberated in the explosion replaced calcium in the bones .Large scale bone deformities occurred in the people of these cities.

WASTE LAND RECLAMATION

Waste land:

The land which is not in use is called waste land . Waste land is unproductive, unfit for cultivation.

Grazing etc. 20% of the geographical area of India is waste land.

Types of waste land:

1.Uncultivable waste land .

2. Cultivable waste land.

Uncultivable waste land:

Barren rocky areas, hilly slopes, sandy deserts.

Cultivable waste land:

These are cultivable but not cultivated for more than 5 years.Ex Degraded forest land ,

Gullied water logged , marsh lands , saline lands .

Causes of waste land formation:

1.Over exploitation of natural resources.

2. Industrial and sewage wastes.

3. Due to soil erosion, deforestation, water logging, salinity etc.

4.Mining activities destroy the forest and cultivable land.

Objects of waste land reclamation:

1. To prevent soil erosion, flooding and land slides.
2. To avoid over exploitation of natural resources.
3. To improve the physical structure and quality of the soil.
4. To conserve the biological resources and natural ecosystem.

Methods waste land reclamation:

- **Drainage:**
  Excess water is removed by artificial drainage. This is for water logged soil reclamation.

- **Leaching:**
  Leaching is a process of removal of salt from the salt affected soil by applying excess amount of water.

  Leaching is done by dividing the field into small plots. In continuous leaching 0.5 to 1.0 cm

  Water is required to remove 90% of soluble salts.

- **Irrigation practices:**
  High frequency irrigation with controlled amount of water helps to maintain better availability of water in the land .
- **Application of green manure and biofertilisers**:
  This improves saline soil.

- **Application of gypsum :**
  Soil sodicity can be reduced with gypsum. Ca of gypsum replaces sodium from the exchangeable sites. This converts clay back into calcium clay.
- **Social Forestry programme:**
  These programmes involve strip plantation on road ,canal sides, degraded forest land etc.

COSUMERISM AND WASTE PRODUCTS

The consumption of resources by the people is called consumerism. It is related to both increases.

In population size as well as increase in our demand due to change in life style. If needs increases.

The consumerism of resources also increases.

TRADITIONAL FAVOURABLE RIGHTS OF SELLERS

1. **T**he right to introduce any product.
2. The right to change any price.
3. The right to use incentives to promote their products

TRADITIONAL BUYERS RIGHTS

1. The right to buy or not to buy.
2. Right to expect a product to be safe. Right to expect the product to perform as claimed.

IMPORTANT INFORMATIONTO BE KNOWN TO BUYERS

1. Ingradiants of the products.

2. Manufacturing date and expiry date .Whether the product has been manufactured against

an established law of nature or involved in right variation.

Objectives of consumerism.: 1.It improves the right and powers of buyers.

2.It involves making manufacturer liable for the entire life cycle of a product

3.It force the manufacturer to reuse and recycle the product after usage.

4. Active consumerism improves human health and happiness and also it saves resources.

Sources of wastes are agriculture, mining, industrial and municipal wastes.

Example for waste products. It includes paper, glass, plastic, garbage, food waste,Scrap, construction and factory wastes.

E- waste :

Electronic equipments like computer, printers, mobile phones, calculator etc after usage thrown as waste.

Effects of waste:

Waste from industries and explosives are dangerous to human life.

Dumped wastes degrade soil and make it unfit for irrigation.

E-wastes contains more than 1000 chemicals which are toxic and causes environmental

Pollution.

Incomputers lead is present in monitors, cadmium in chips and cathode ray tube, pvc in cables. All these cause cancer and other respiratory problems if inhaled for long long periods.

Plastics are non-degradable and their combustion produces many toxic gases.

Factors affecting consumerism and generation of wastes:

People over population:

Over population cause degradation of sources, poverty and premature deaths. This situation occurs in less developed countries (LDC's).In LDC's the percaptia consumption f resources and waste generation are less.

Consumption Over population:

It occurs when there are less people than the available resources due to luxurious life style per captia consumption of resources is very high.

Consumption is more and waste generation is more. Environment is also degraded.

ENVVIRONMENTAL LEGISLATION AND LAWS

ENVIRONMENT (PROTECTION) ACT 1986

This act empowers the central govt. to fix the standards for quality of air, water, soil, and noise.

The central govt. formulates procedures and safe guards for handling of hazard substances.

Important features

1. This act empowers the govt. to lay down procedures and safe guards for

the prevention of accidents which cause pollution and remedial measures if accidents occur.

2 The govt.has the authority to close or prohibit or regulate any industry or its operation if the violation of provisions of the act occurs.

3. Violation of the act is punishable with imprisonment for 5 years or fine of one lakh or both.

4. If violation continues an additional fine of Rs5000 per day may be imposed for entire period of violation of rules.

5 The act empowers the officer of the central govt.to inspect the sight or the plant or machineryfor preventing pollution and to collect samples of air , water, soil and other materials from any factoryor its premises for testing.

AIR PREVENTION ACT 1981

(PREVENTION AND CONTOL OF POLLUTION)

This act was enacted in the conference held at Stock Holm. It envisages the establishments of central and State control boards to monitor air quality and pollution control.

Important features:

1.The central board may lay down the standards for quality of air.

2. The central board co-ordinates and settle the disputes between state boards.

3. The central board provides technical assistance and guidance to state boards.

4. The state boards are empowered to lay down the standards for emission of air pollutants from industries or other resources.

5. The state boards are to examine the manufacturing processes and control equipment for the prescribed standards.

6. The direction of central board is mandatory on state boards.

7. Without the consent of the central board operation of an industrial unit is prohibited in heavily polluted area.

8. Violation of law is punishable with imprisonment for three months or fine of Rs 10000 or both.

This act applies to all pollution industries. This act empowers the state board to order closure of any industrial unit or stoppage of water supply or stoppage of electricity.

WATER ACT.1974

(PREVENTION AND CONTROL OF POLLUTION)

This act provides for maintaining and restoring the sources of water. It also provide for preventing and controlling water pollution.

Features of water act.

1. This act aims to protect the water from all kind of pollution and to preserve the quality of water in all aquifers.
2. The act further provides for the establishment of central board and state boards for prevention of water pollution.
3. The states are empowered to restrain any person from discharging a pollutant(or) sewage or) effluent into any water body with out the consent of the board.
4. The act is not clear about the definition of pollutant, discharge of pollutant toxic pollutant.

The amendment act of 1988 requires permission to set up an industry which may discharge effluent.

State pollution control board

The consent of this board is needed

1. To establish any industry Or any treatment and disposal system or any extension or addition which likely discharge Or trade effluent into a stream or well or river or on land.

2. To use any new or altered outlet for the discharge of sewage.

3. To begin to make any new discharge of sewage.

4. Act also empowers the state board to order closure or stoppage of supply of

Electricity, water or any other service to the polluting unit.

WILD LIFE ACT 1972.

This act was amended in 1983, 1986, and 1991.

This act is aimed to protect and preserve all animals and plants that are not domesticated. India has 350 species of mammals, 1200 species of birds and about 20000 known species of insects. Some of them are listed as endangered species in wild life protection act.

Wild life is declining due to human action. Wild life products like skins, firs, feathers, ivory etc. have decimated the population of many species.

Wild life population monitored regularly and management strategies formulated to protect them.

Important Features:

1. The act covers the rights and non- rights of forest dwellers.

2. It allows restricted grazing in sanctuaries but prohibits in national parks.

3. It also prohibits the collection of non timber forest.

4. The rights of forest dwellers recognized by forest policy of 1988 are taken away by amended wild life act of 1991.

FOREST (COSERVATON) ACT 1980

This act is enacted in 1980. It aims to arrest deforestation. This act covers all types of forests including reserved forests, protected forests and any forest land.

IMPORTANT Features of the act :

1. The reserved forests shall not be diverted or dereserved wit out the permission of central govt.
2. The forest land may not be used nonforest purposes.
3. This act stops illegal activities with in forest area.

Features of amendment act of 1988

1.Forest departments are departments are forbidden to assign any forest land by way of lease orto any private person or NG body for re- afforestation.

2. For re-afforstation clearance of any forest land is forbidden.

3. The division of forest land for non –forest uses is punishable.

BIOMEDICAL WASTES

Biomedical wastes are one types of biowaste generated from health care activities (hospitals, nursing homes, health centres, laboratories, research centre, blood banks, etc.) . These may be solid or liquid in nature and also be hazardous as well as non-hazardous.

Biomedical waste rules 1998 and amendments

Inorder to regulate the disposal of biomedical wastes, MEF (Ministry of Environment and Forest), government of India notified biomedical wastes, (Management and Handling) rules 1998 and amended twice in the year of 2000. This rule is applied to all hospitals, nursing homes and laboratories, etc.

Steps involved in management of biomedical wastes:

Various steps involved in the management and handling of biomedical waste are

1. Generation and accumulation
2. Handling and storage
3. Transport and disposal

Step 1 : Generation and accumulation (segregation)

Biomedical wastes, generated by health care centres should be collected in the containers, which are leak proof and strong to prevent breakage during handling. It should not be mixed with other wastes.

DISASTER MANAGEMENT

Disaster is a sudden calamity which brings misfortune and miseries to humanity.

Types:

1. Natural disaster:
   Floods, Cyclones, earth quakes, landslides. etc
2. Man made disaster:
   Accidents, pollutions, fire accidents, bomb blasts.

FLOOD

It is defined as a situation when the river over flows is banks and the water spreads in the surrounding areas and submerging them. It usually occurs in rainy season.

Causes:

1. Heavy intense rain fall
2. Melting of accumulated snow.
3. Melting of snow combine with rains.
4. Over saturated soil when the ground cannot hold any more water.
5. Urbanization

Control:

1. Forecast, warning and advice should be provided through media to educate aware people about steps to be taken on the event of mishap.

2. Valuable house hold items, animals and materials like food, clothes, medicines etc. should be shifted to safe places.

3. Elderly people and children should be evacuated to safer place on emergency.
4. By the construction of protective works.

Case study: Bangladesh – 1974

Every year large areas are submerged during monsoon season. In 1974 when flooding extended over nearly one half of the country and stagnated for more than a month. Nearly 1200dead in the floods and 2, 75,000 died

from subsequent diseases and starvation. About 4, 25,000houses were damaged. A total of 36 million people suffered hardship and losses due disaster.

EARTHQUAKE

Sudden vibration caused on the earth surface due to sudden release of tremendous amount of energy stored in the rocks under the earth crust is called earthquake. A focus of an earthquake is the point of initial movement. Epicenter is the point on the surface directly above the focus.

Measure of Earth quake-Richter scale:

Magnitude of earthquake is a measure of amount of energy released in the earthquake. Earthquake is recorded by seismograph.

Less than 4 = insignificant.

4 - 4.9 = minor,

5 - 5.9 = damaging,

6 - 6.9 = destructive,

7 - 7.9 = major,

Above 8 = great

Primary effect of earth quake:

Shaking ,Some times a permanent vertical or horizontal displacement of the ground .This affects people bridges, dams, pipe lines.

Secondary effects:

Rocks slides, flood caused by the subsidence of land, coastal areas are severely damaged . Earth quake generated water wave called Tsunami and also called tidal waves that travel as fast as 950km/hr.

Precautionary measures:

1. People should come out of their homes and stay in the open till the tremors subside.

2. People already out of home should stay away from the building electric poles, trees and any tall objects that have chances of falling down.

3. After the earth quake relief camp by the Government or other social groups should be conducted for the affected people.

CYCLONE

An atmospheric closed circulation, rotating anti- clock wise in the northern hemi sphere and clock wise in southern hemisphere .

Cyclone is an area of low pressure in the centre and high pressure outside. Powerful swirling storm that measures from 300- 500 km in diameter. The wind in the centre of cyclone blows in the speed of 120km/hr.

In India cyclone originates from Bay of Bengal are more in number and intensity. Relatively less south-west Indian Ocean and Arabian Sea. In India cyclones occur during October-December or April-May.

EFFECTS:

Damage to human life, crops, roads, transport, and communication could be heavy.

Cyclone slows down developmental activities of the area.

Management:

Meteorological Departments forecast by satellite images the weather conditions which reveal the strength and intensity of the storm.

Radar systems is used to detect cyclone and cyclone warning.

The effect of cyclone is minimized by planting more trees on the coastal belts, constructional dams, wind breaks etc.

Case study:

Cyclone in Orissa 1999- Two cyclone in Orissa occurred in 18^{th} and 29^{th} of October 1999.In the central area in Orissa a powerful cyclone storm hit with the wind velocity of 260km/hr.Nearly 14 of 30 districts of Orissa went in severe damage.

15 million people were affected and 90-95% of crop yield was also affected.11, 500 local schools have been damaged.

LAND SLIDES

A landslide is a sudden collapse of large mass of hill side.

Types:

1. Shallow disrupted land slide
2. Decoherent landslide.

Factors causing landslides:

- Caused by rain forces increasing top material weight, lubricating the material layer or making slope top steep.
- Gravity-gravity works more effectively on steeper slopes
- Weather:
  Most slides occur during or after heavy rains.

Effects:

- Flow deposit blocks the road and diverts the passage.
- Causes of erosion of the soil.

Prevention:

- Re-vegetate the area to prevent the surface erosion .
- Inspect and repair all drainage system.
- Collect runoff from roofs and improved areas
- convey water from the steep slopes in a well designed pipe system.

Case Study:

Landslide In UP 20th August 1998.Malpa Village Pithoragrah district of UP on 18th August 1998 had a land slide. At least 180 people including 60 kailashManasorovar pilgrims and 8 Indo-Tibet border Police personnel were killed.

The state government has announced a grant of 237,905 dollars for relief and rescue operation.

TSUNAMI

It is a Japanese word which means harbour wave."Tsu" means harbour and "nami" stands for wave.

Tsunami is large waves of water generated when the sea flow is deformed by seismic activity, vertically displacing the overlying water in the ocean.

Phenomenon:

Tsunami is not a singular wave but a series of waves like a ordinary waves one can see on a beach. Ordinary eaves have the wavelength of 100 mts. Tsunami have a wavelength of 500 kms and there could be as much as a hairs gap between eaves. The speed of Tsunami waves across deep sea is 1000 km/hr.The energy lost by tsunami waves is inversely proportional to the wavelength. Tsunami was extremely fast moving and high volume of water. The waves are several hundreds of kms of waves and traveling 1000 km/hr.

Effects:

Tsunami attacks mostly the coastal lines damaging property and life. Kills lot of human being and livestock also spread lot of waterborne disease.

Management:

Earthquake under the sea are monitored by sensors on the floor of sea. The sensors send information of floating buoys on the surface whenever they detect the change in the pressure of the sea. The information is relied to satellite which passes it to the earth station. All member nations waning system are warned of the approaching danger .Finally the country make the people alert to make all necessary precautions.

Case study:

Tsunami in India:

Tsunami was formed on 26th December 2004 in Bay of Bengal and in the Indian Ocean. The tidal waves occurred due to massive earthquake under the ocean floor of Indonesian coast. The magnitude of earthquake is 8.9 on Richter scale and striked northern Sumithra and Indonesia at 6.25a.m.Tsunami travels at a speed of jet engine (700-800 km/hr) and hit Tamilnadu and Srilanka coast about

2-3 hrs after the earthquake.Nagapatinam was worst hitted by Tsunami in India. About 6000 people were dead and huge property loss.

PUBLIC AWARENESS

In order to conserve our environment each and every one must be aware about our environment problems and objectives of various environmental policies at natural and local level,

Objectives of public awareness:

1. To create awareness among rural and city people about ecological

Imbalance, local environment and technological development.

2 To organize meetings, tree plantation programmes, group discussion on development, exhibitions.

3. To focus on current environment problems and situations.
4. To train our planners, decision makers, politicians and administrators.
5. To eliminate poverty by providing employment that over comes the basic environmental issues.

Methods To Create Environmntal Awareness

1. Environmental education must be imparted to the students in schools and colleges.

2. Media like TV Radio and cable net work can educate the people on environmental issues throughCartoons, documentaries, street plays.

3. Cinema about environmental education should be prepared and screened in theatres compulsorily .This films may be released with tax free to attract the public.

4. All the news papers and magazines must publish the environment related problems.
5. Special audio visual and slide shows should be arranged in public places.
6. Voluntary organizations like NCC, NSS, and ROTRACT Club should be effectively utilized for creating environmental awareness.

7. Arranging competitions like story and essay writing painting competition on environmental issues for student as well as public.Attreactive prizes should be awarded for the best effort.
8. Public leaders cine actors and popular social reformers can make an appeal to the public about the urgency of environmental protection.

UNIT V

HUMAN POPULATION AND THE ENVIRONMENT

Population:- Group of individuals belonging to the same species which live in a given area at given time.

Population density:- Number of individuals of the population per unit area ® per unit-volume.

Parameters effecting population:-

1. **Birthrate (OR) Nationality:-** Number of live births per 1,000 people in a population in a given year.
2. **Death Rate (OR) Mortality:-** Number of deaths per 1000 people in a population in a given year.

Immigration:- It denotes the arrival of individuals from neighboring population.

Emigration:- It denotes the disposal of individuals from the original population to new areas.

$$\textbf{Birth Rate} = \frac{\text{Number of births}}{\text{O.P.} \times \text{Number of years}} \times 100$$

$$\textbf{Infant Mortality} = \frac{\text{New born of babies died}}{\text{Number of babies born} \times \text{Number of year}} \times 100$$

$$\textbf{Growth rate} = \frac{\text{Change of population}}{\text{O.P.} \times \text{Number of year}} \times 100$$

Population Growth :- Results from the difference between the rate of birth and death.

In 1980 the global population was about 1 billion people. In 1930 it reached 2 billion. In 1975 it reached 4 billion with in 45 years. Now the

population in 6 billion. It reaches 10 billion by 2050 as per the world Bank calculation.

Causes:- 1. Due to decrease in death rate and increase in birth rate.

2. Availability of antibiotics, immunization increased food production, clean water and air, decreases the famine related deaths and infant mortality.

3. The poverty and illiteracy lead controlled growth of population.
4. Child Marriages
5. People's superstitions. People believe that it is because of God's grace.

Characteristics of P.G.:-

Exponential growth:- Population growth occurs exponentially live 10, 10^2, 10^3, 10^4 etc.,

Which shows the dramatic increase in global population in the past 160 years.

Doubling Time:- Time required for the population to double its size at a constant annual rate. It is calculated as follows:-

Td = 70 / r When r = annual growth rate

If a ration has 2 % annual growth its population will double in 35 years.

Infant Mentality:-

Percentage of infant died out of those born in one year. This rate is decreased in the last 50 years. This differs widely in developing and developed countries.

Total fertility rates(TFR):

Average number of children delivered by a woman in her life time. The TFR varies from 2 in developed to 4.7 in developing countries.

This ratio should be fairly balance in the society.

Male – female ratio has been upset in many countries including China - India. In china the ratio of girls and boys is 100 – 140.

Demographic transition:

P.G. is redacted to economic development. The birth rate and death rate full due to improved living conditions. This results in low population growth. This pheromones in called demographic transition.

Variation of population among Nation:

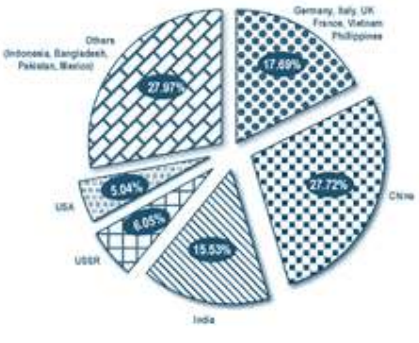
At present the worlds population has crossed 6 billions. Less developed countries (Africa, Asia, S.A) have 80% population while developed countries have only 20%.

In most developed countries like USA, Canada, Australia population increases by less than 1%. But is less developed countries the population increases by more than 1% / year.

Kenya is the fastest population growing countries in the world. When 20 million are residing.

China & India's populate on was above 1000 million in 2000 years. Its share is 1/3 of the world population.

Europe and N.H. accoents for 14% of world population.



Variation of pollution based on Age structure

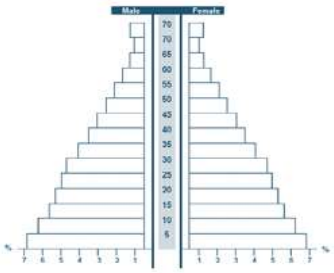
Age structure of population can be classified into 3 classes.

1. Pre- productive population (0 – 14 years)
2. Reproductive population (15 - 44 years)
3. Post reproductive population (Above 45 years)

Variation of population is now explained based on the above three classes.

Pyramid shaped Variation of population (increase)

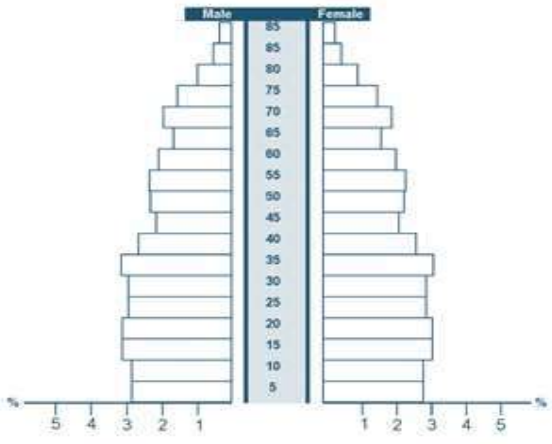
Eg. In India, Bangladesh, Ethiopia, Algerian Reproductive population is more in companion to pre reproductive population and post productive population. Hence the population increases.



Pyramid shaped variation of population

Bell shaped variation of population:

Eg: In France, USA, UK, Canada etc., pre reproductive population and reproductive population is more (OR) less equal. Hence population growth in stable.

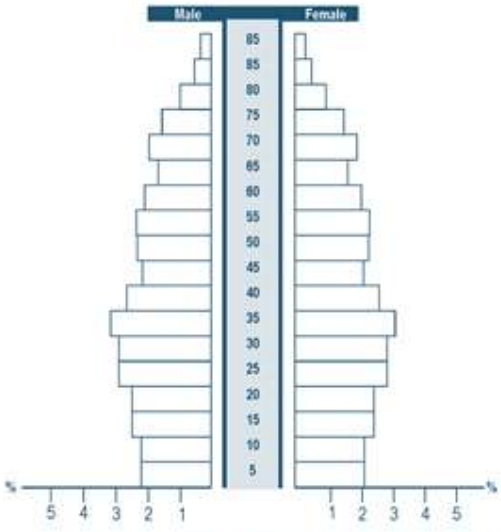


Bell shaped variation of population

Urn shaped variation of populations

Eg: In Germany, Italy, Sweden,

Japan pre productive age group population in smaller than the reproductive age group population. In the next 10 years. The number of people in reproductive age group less than before resulting in decrease of population.



Urn shaped variation of population

Population Explosion:

The enormous increase in population due to low death rate and high birth rate is called as population expansion.

Doubling time: The number of years needed for a population to double in size. The doubling time varies from country to country.

Name of the country	Doubling time
India, Turkey	28 years
Nigeria	27
Pakistan	21
USA	87
UK	231
France	117

Population growth is higher in less developed countries.

Cause of population explosion:

1. Invention modern medical facilities, reduces the death rate and increases birth rate, which leads to population explosion.
2. Increase of life expectancy is another important reason for population explosion. Eg:- In 1956, the average life expectancy of the human beings was 40 years. But now it is 61 years.
3. Illiteracy is one of the reasons for the population explosion.

Effect of population explosion (OR) environmental and social impacts of growing population.

Poverty:

1. Population explosion leads to environmental degradation.
2. Population explosion causes over exploitation of natural resources. Hence there will be a shortage of resources for the futune generation.
3. Increase in population will increases diseases, economic in equity and command wars.
4. Forests, grass lands are under threat.
5. The main reason for the growing unemployment in growing population.
6. Educating vast population is a very big task.
7. Population explosion is the main cause for pollution of air, land, water and noise.
8. Disposal of plastics and wastages is another problem of over population.
9. Scancity of fuel is also due to population explosion.

Remedy:

Fertility rate should be reduced by birth centrol programme.

Family welfare programme

Family welfare programme was implemented by Govt. of India as a voluntary programme. It is a policy of growth coverning human health, family welfare children and women's right.

Objectives:

1. Slow down the population explosion by reducing fertility.
2. Pressure on the environment, due to over exploitation of natural resources is reduces.

Population stabilization Ratio

The ratio is derived by dividing crude birth rate by crude death rate.

Developed countries: The stabilization ratio of developed countries is 1. indicating zero population growth.

Developing countries:

The ratio of developing countries is rearing 3 which in expected to lower down by 2025.

Stabilization in developing countries is possible only through family welfare programmes.

Family planning Programme

If provides educational and clinical services that help couple to choose how many children to have and when to have them. Family planning programme provides information on birth spacing birth control and health care for pregnant woman and infants. It also reduced the number of legal and illegal abortions per year and decreased the risk of death from pregnancies.

Objectives:

1. Reduce infant mortality rate to below 30 / 1000 infants.
2. Achieve 100% registration of births, deaths marriage and pregnancies.
3. Encourages late marriages and late child bearing.
4. Encourages breast feeding.
5. Enables to improve woman's health education, employment.
6. Constrain the spnead& Aids / HIV.
7. Prevent and control of communical diseases.

Fertility control methods

Traditional methods

It includes taboos and folts medicine.

Modern methods

It includes birth control techniques like mechanical barriers, surgical methods, chemical pills and physical barriers to implantation.

More than 100 contraceptive method are on trial.

Family planning programme in India

1. In 1952 India started family planning programme.
2. In 1970 Indian govt. forced FP campain all the over country.
3. In 1978 govt. legally raized the minimum age of marriage for men from 18 to 21 and for women 15 to 18 years.
4. In 1981 census report showed there is no drop in population. Hence funding for FP programme has been increased.

Women and child welfare in India

Women Welfare

The main aim of women welfare is to improve the status of the women by providing opportunities in education, employment and economic independence.

Need of Women Welfare

1. Generally women suffer gender discrimination and devaluation at home, at work place, in matrimony, in public life and power.
2. High number of cases of dowry deaths rape, domestic violence, criminal offences and mental torture to women.
3. The human rights of women are violated in the male dominated society.
4. Generally in policy making and decision making process, women are neglected.

Measures of various organizations towards women welfare

1. NNWM : The National Net work for Women and Mining
2. UNDW :United Nations Decade for Women

3. CEDAW: International Convention on the Elimination of all forms of Discrimination Against Women.
4. MWACD : Ministry for Women And Child Development.

Child Welfare

Children occupy nearly 40% of total population. They are considered to be the assets of a society. Of 21 million children born every year in India. 20 million children to be working as child labours in various industries.

Reason

The main reasons are poverty and want of money.

Measures:

1. MHRD : Ministry of Human Resource Development
2. UNCRCIL : UN Conventions on Rights of Child or International Law.

Environment & human Health

Healthy person:- Physically fit person with out suffering any disease is called a healthy person.

Disease:- Harmful changes in the body's condition by nutritional, biological, chemical (or) psychological factors are called diseases.

Important Hazards and their health effects refer – bort

Chemical Hazards and their health effects refer T.B.

Biological Hazards and their health effects Refers T.B.

Preventive measures:

1. Always wash your hand before eating.
2. Cut short and clean your nails systematic.
3. Drinking chemically treated and filtered water.
4. Eat food always in hot condition.
5. Wash the vegetables and fruits a with clean water before cooking.
6. Avoid plastic containers and Al vessels.
7. Do physical exercise to have proper blood circulation.

Human Rights

Human rights are the fundamental rights possessed by human beings irrespective caste, nationality, sex & language.

The aim of Govt. is to ensure happiness to all the citizen with equal rights.

Under the Indian constitution the following fundamental rights have been guaranteed to human beings.

1. Human right to freedom
2. Human right to property
3. Human right to freedom of religion.
4. Human right to culture and education.
5. Human right to constitutional remedies
6. Human right to Equality
7. Human right to against exploitation.
8. Human right to food and environmental
9. Human right to health

1. Human rights to freedom

1. Every citizen has the freedom to express his view freely.
2. Citizen can assemble at any place to express their views.
3. Freedom to form unions (or) associations.
4. Freedom to slant any profession.
5. Every human being has the right to earn property.
6. Freedom of choosing the religion according to his (views) wish. All religions are equal before the law.
7. All the citizen has equal rights both in culture and education.
8. The minority communities like christens, Muslims have their own rights to conserve the culture, language and to established educational institutions of their own choice.
9. All citizens are equal before the law. There is no discrimination on grounds of religion, caste, sex (or) place of birth.
10. "Every citizen has the right to fight against exploitation."

11. All human beings have the right to get food, safe drinking water and healthy environment.

Indian Constitution

Indian constitution provides for civil, social, cultural, educational and political rights.

Article 14 – equality before law.

Article -15

Prohibits discrimination on the ground of race, religion caste, sex (or) place of birth.

Article 16

Provides equal opportunity for all citizens in regarding to employment.

Article 19

Provides for freedom of speech and expression, forming association and union.

Article – 20

Protection from connection except in accordance with the law of the land.

Article – 22 – lays down the rights of a person in custody.

Article – 24 – prohibits exploitation of labour children.

Article – 25 – grantees freedom to profess, practice and propagate a religion of one's choice.

Value education

Education is nothing but learning through which knowledge about a particular thing can be acquired with the help of our knowledge and expedience we can identify our value to understand ourselves and our relationship with other and their environment.

Types of Education:

1. **Format Education**:- (In this all leaning process are self related). All people will read write, will get good jobs and take with any problem with the help of formal education.

2. **Value Education**:- It is an instrument used to analyse our behavior and provide proper direction to our youth. It teacher the youth the distinction between right & wrong, to be helpful loving, generous and tolerant.
   Eg:- If a person is highly, Qualified and well settled in life, something he does not know how to behave with his environment.

Value based environmental education

The provides knowledge about the principle of ecology, fundamental of environment and biodiversity. It creates sense of duty to care for natural resources and to mange them in sustainable key.

Objectives:

1. Improve integral growth of human being.
2. To create altitudes and improvement towards sustainable life style.
3. To increase awareness about our national history, cultural heritage, constitutional rights, national integration.
4. To understand (about the our) natural environment in which how land, air and water are interlinked.
5. To know about various living and non living organism and their interaction with the environment.

Types of values:

1. **Universal values (or) social values:**
   These values tells about the importance of the human conditions. These are reflected in life, joy, love, tolerance, truth etc.

2. **Cultural values:**
   These values various with respect to time and place. These are concerned with rights & wrong, good & bad true & false and behavior of human beings. It is reflected in language, education, law, economics, philosophy etc.

3. **Individual values:**

   These are personal principles and the result of individual personality and experience parents & teachers are the main key to shape and individual values. I t is reflected in individual goods, relationship, commitments.

4. **Global values:**

   Human civilization is a part of the planet. Nature and natural pheromone on the earth are interconnected and inter-linked with special bonds of harmony. If this harmony disturbed any where leads to catastrophic results due to ecological imbalance.

Methods and strategies of imparting value education

1. **Telling**
   It is a process of developing values to enable a pupil to have a clear picture of a value – ladder situation by means of his own narration of the situation.
2. **Modelling**
   It is a method in which certain a individual perceived as ideal values is presented to the learners as a model.
3. **Role playing**
   Acting out the true feelings of the actor / actress by taking the role of another person but without the risk of reprisals.
4. **Problem solving**
   It is a method wherein a dilemma is presented to the learners asking them what decision they are going to take.
5. **Studying biographies of great man**
   This method makes use of the lives of the great man as the subjects matter for trying to elicit their good deeds and thoughts worthy for emulations.

AIDS / HIV

– Discover in 1983. source of the virus is not beer identified spread through African monkey.

Through vaccine programme – spread by small pox vaccine programme of Africa.

Hepatitis – B Viral vaccine legmy and new York.

World scenario

90% from developing countries. 13% of world's population live is Africa. Almost all states & African countries were affecters HIV.

India ranks 2nd in the world with 5 million affects people.

Scenario in India:

Large number of infected people are in Maharastra& Tamil Nadu followed by Delhi, UP, Karnataka & Goa. Till sept. 2003 24,667 cases are found in Tamil Nadu.

Smog:- Mixture of smoke from coal combustion and fog in suspended droplets form photochemical smog cause irritation to eyes and lungs (ii) many damage plants (iii) Irritation to nose & throat (iv) asthma

ENVIRONMENTAL IMPACT ASSESMENT (EIA)

EIA is defined as a formal process of predicting the environmental consequences of any development projects. It is used to identify the environmental, social and economic impact of the projects prior to decision making.

Objectives of EIS

1. To identify the main issues and problem of the parties.
2. To identify who is the party.
3. To identify what are the problems of the parties.
4. To identify why are the problem arise.

Benefits of EIA

1. Cost and time of the project is reduced.
2. Performance of the project is improved.
3. Waste treatment and cleaning expenses are minimized.
4. Usages of recourses are decreased.
5. Biodiversity is maintained.
6. Human health is improved.

Process of EIA or Key elements of EIA

1. **Scoping**
   It is used to identify the key issues of the concerns in the planning process at an earlier stage.
   It is also used to aid sites selection and identify any possible alternatives.
2. **Screening**
   It is used to decide whether an EIA is required or not based on the information collected.
3. **Identifying and evaluating alternatives.**
   It involves knowing alternative sites and alternative techniques and their impacts.
4. **Mitigating measures dealing with uncertainty.**
   It reviews the action taken to prevent or minimize the adverse effects of a project.
5. **Environmental statement.**
   This is the final stage of the EIA process. It reports the finding of the EIA.

ROLE OF IT IN ENVIRONMENT

IT plays a vital role in the field of environment education. IT means collection, processing, storage and dissemination of information. The internet facilities, information through satellites, www and geographical information provides up to date information various aspects of environment, weather.

Remote sensing

It refers to any method which can be used to gather information about an object without coming in contact with it. Gravity, magnetic, electro magnetic forces could be used for remote sensing. Remote sensing covers various disciplines from laboratory testing to astronomyS. Now remote sensing is used to denote identification of earth feathers by detecting the characteristic electro magnetic radiation. That is reflected by the earth.

Components of a remote sensing system

The system consists of a **sensor** to collect radiation. Other important parts are a **platform**, an **aircraft**, a **balloon, rocket and satellite.**

The information received by the sensor is suitably manipulated and transported back to earth. The data's are reformed and processed on the ground to produce photographs, computer compatible magnetic taps and digital storage medium.

Functions

1. Origin of electro magnetic energy.
2.Transmission of energy from the source to the surface of the earth and its interaction with the intervening atmosphere.
3.Interaction of energy with the earth surface.
4.Transmission of reflected or emitted energy to the remote sensor an a suitable platform through intervening atmosphere.
5.Transmission or recording of the sensor output.
6. Collection of ground truth and other information.
7.Data analysis and interpretation.

Applications

1 Agriculture:

In India agriculture provides livelihood of 70% of population and contributes to about 35% of net nation product. We require optimal management of land and water resources along with high yielding variety seeds, fertilizer input.

Remote sensing can provide valuable information for land and water management.

2.Forests:

Remote sensing provides information clearly on the type, density and extent of forest cover, wood volume and biomass, forest fire, encroachment etc.

3.Land cover:

Spatial information on land is required at different scales depends upon use remote sensing data is converted to map. The spatial resolution plays a role on the scale of mapping.

4.Water resources:

Remote sensing data has been used in many application related to surface water body mapping, ground water targeting, wet land, flood monitoring, reservoir sedimentation, water quality monitoring etc. One of the most simple applications is inventorying surface water body.

DATABASE

It is the collection of inter related data on various objects. In the computer the information of database is arranged in a systematic manner.

Applications: I The ministry of environment and forest. They are compiling database on various biotic components. Database is also available for diseases likes HIV | AIDS. Malaria, Fluorosis.

National Management Information System (NMIS) : They compile database on R & D

Projects along with information about research scientists and personnel involved.

Environmental Information System : It functions in 25 centresall over the country.

They generate net work of database in areas like pollution control, remote sensing, biodiversity, and desertification.

GEOGRAPHICAL INFORMATION SYSTEM (GIS)

It is **a** technique of superimposing various thematic maps using digital data on large

Number of inter related aspects.

Applications: Different thematic maps having digital information on water resources,

Soil type, forest land, crop land, grass lands are superimposed on a layered form in computer using soft ware.

Interpretation of polluted zones, degraded lands can be made on GIS base.

3. GIS can be used to check unplanned growth and related environmental problems.

SATELLITE DATA:

It helps in providing correct and reliable information forest cover

Provides information of monsoon, ozone layer depletion Smog etc.

Helps in discovering reserves of oil, minerals.

WWW (world wide web):

More current data is available on www on line learning centre.

Www .mhhe.com \ environmental science.

Multimedia Digital content manager (DCM) in the form of CD ROMS.

ROLE OF INFORMATION TECHNOLOGY IN HUMAN HEALTH

The health service technology involves three systems

1. Finance and accounting
2. Pathology
3. Patient Administration – clinical system.

Applications

* Data regarding birth and death rates
* To monitor the health of the people effectively
* The information regarding the outbreak of epidemic diseases.
* Online Consultation
* Drugs and its replacement.
