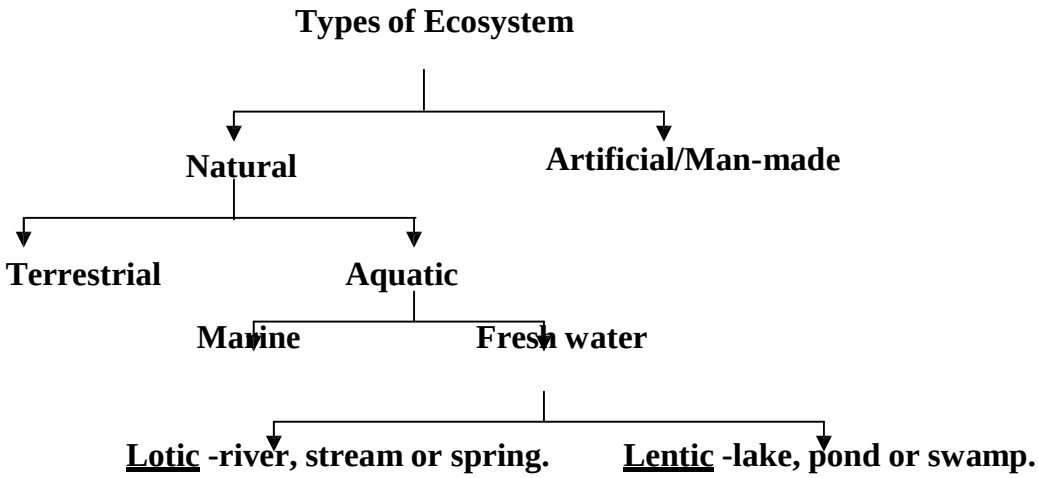
CHAPTER I INTRODUCTION TO ENVIRONMENTAL STUDIES ECOSYSTEMS AND BIODIVERSITY

2.1 Ecosystem -living things in a given area, non-living chemical and physical factors of their environment, linked together through nutrient cycle and energy flow



2.2.1 Ecology - Study of the distribution and abundance of organisms, the flows of energy and materials between abiotic and biotic components of ecosystems.

2.2 Ecosystem Structure: The living components of an ecosystem

- The roles of organisms in an ecosystem:
- Producer (autotrophy): make food; plants, algae
- Consumer (heterotrophy): eat other organisms
- Decomposer: eat dead organic matter; bacteria and fungi

2.2.1 Classes of Consumers

Herbivore – primary consumer – eats plants

Carnivores – secondary – meat eaters; eat herbivores

Tertiary – feed on carnivores

Omnivores – eat plants/animals.

2.2.2 Role of Organisms

Scavengers – feed on dead organisms (vultures, flies, crows, lobsters)

Detritus feeders – organisms that extract nutrients from fragments of dead organisms into more simple organic waste (termites, earthworms, crabs)

Decomposers – organisms that digest parts of the dead organisms into simplest chemicals (bacteria, fungi)

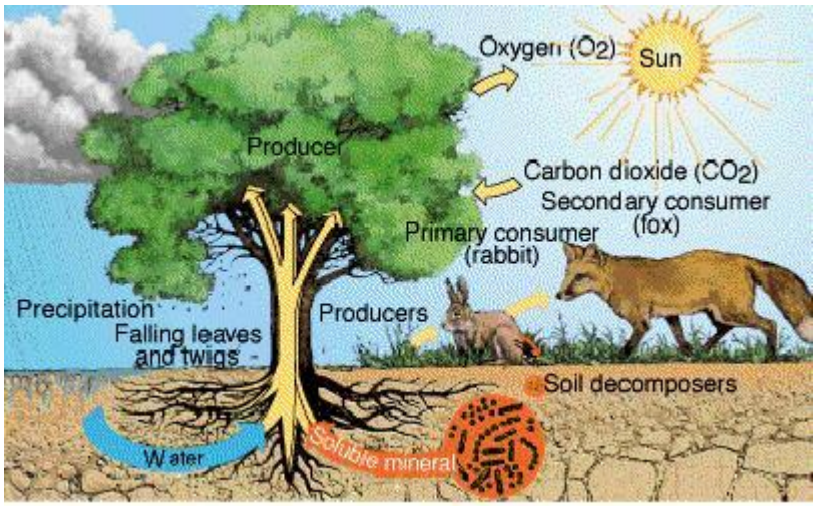


Fig. 2.2.2 Role of organisms

2.3 FOREST ECOSYSTEM (TERRESTRIAL ECOSYSTEM)

2.3.1 Introduction

- A forest is an area with a high density of trees.
- World's total land area is 13,076 million hectares - (Source: FAO; 1989)
- Of which total forests account for about 31% of the world's land area.
- In India, the forest cover is roughly 19% of the total land area.
- The forest ecosystems are of great concern from the environmental point of view.
- It provides numerous environmental services like;
    - Nutrient cycling,
    - Maintaining biodiversity
    - Providing wildlife habitat
    - Affecting rainfall patterns
    - Regulating stream flow
    - Storing water
    - Reducing flooding
    - Preventing soil erosion
    - Reclaiming degraded land & many more….
- Apart from environmental values, forest ecosystems have some traditional values as well.
- Examples are:

- Fire Wood & Timber.
- Fruits.
- Gums.
- Herbs & drugs.

2.3.2 Structure and Function of Forest Ecosystem

I. Biotic components

- The various biotic components, representatives from the three functional groups, of a forest ecosystem are:

1) Producer Organisms

- In a forest, the producers are mainly trees.
- Trees are of different kinds depending upon the type of forest developed in that climate.
- Apart from trees, climbers, epiphytes, shrubs and ground vegetation.
- Dominant species of trees in major types of forest ecosystems are:
  - Tectona grandis, Acer, Betula, Picea, Pine, Cedrus.

2) Consumers

- In a forest, consumers are of three main types;

a) Primary Consumers

- These are Herbivores which feed directly on producers.

  Eg:

  - Ants, Beetles, Bugs, spiders etc. feeding on tree leaves.
  - Larger animals such as Elephants, Deer, giraffe etc. grazing on shoots and/or fruits of trees.

b) Secondary Consumers

- These are carnivores and feed on primary consumers.

  Eg: Birds, Lizards, Frogs, Snakes and Foxes.

c) Tertiary Consumers

- These are secondary carnivores and feed on secondary consumers
  - These include top carnivores like Lion, Tiger.

3) Decomposers

- These include wide variety of saprotrophic micro- organism like;
  - Bacteria (Bacillus Sp., Clostridium sp., pseudomonas.
  - Fungi (Aspergillus sp., Ganoderma sp., Fusarium.
  - Actinomycetes (Streptomyces).
- They attract the dead or decayed bodies of organisms & thus decomposition takes place.

❖ Therefore, nutrients are released for reuse.

II. Abiotic components

❖ These include basic inorganic & organic compounds present in the soil & atmosphere.

❖ In addition dead organic debris is also found littered in forests.

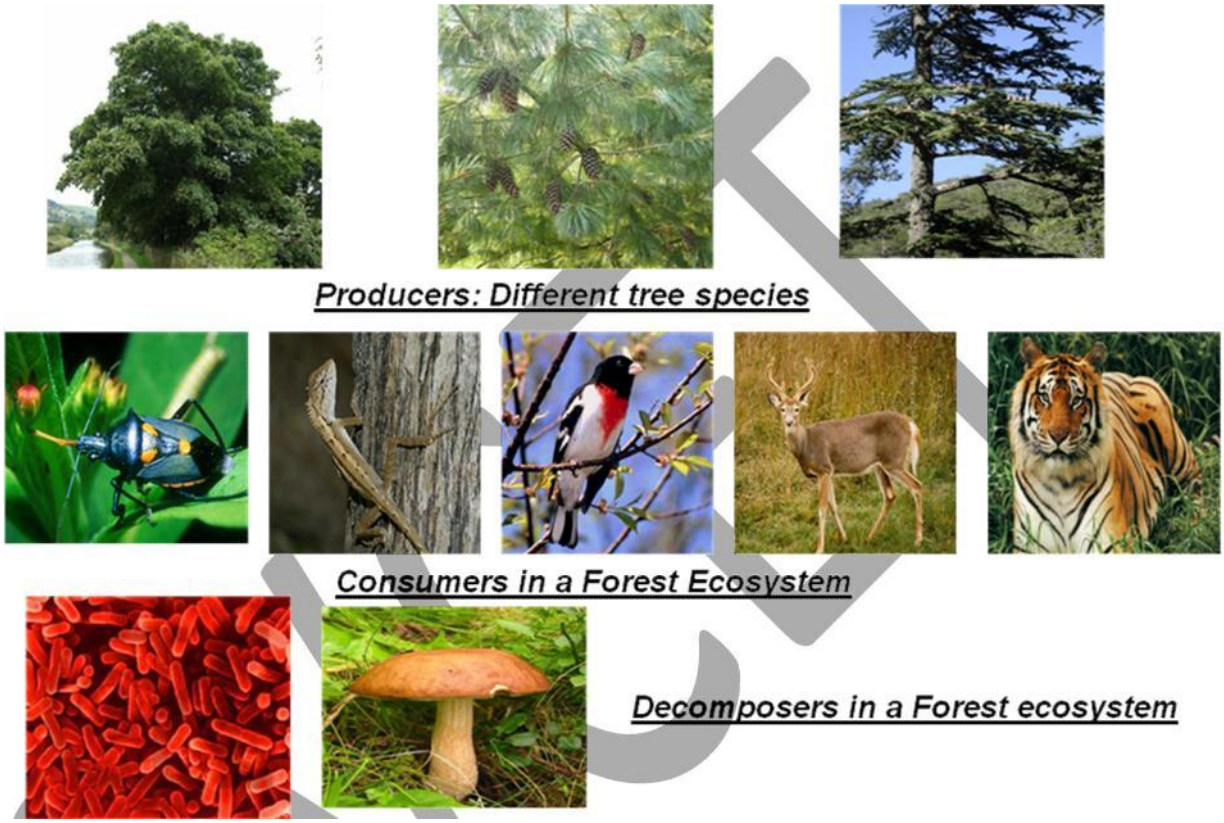


Fig.2.3 Forest Ecosystem

2.4 GRASSLAND ECOSYSTEM (TERRESTRIAL ECOSYSTEM)

2.4.1 Introduction

❖ Grasslands (also called Greenswards) are areas where the vegetation is dominated by grasses and other herbaceous (non-woody) plants.

❖ Grasslands occupy about 24% of the earth's surface.

❖ Grasslands occur in regions too dry for forests and too moist for deserts

❖ The annual rainfall ranges between 25- 75 cm, Usually seasonal

❖ The principal grasslands include:

- Prairies (Canada, USA),Pampas (South America),Steppes (Europe & Asia) Veldts (Africa)

❖ The highest abundance & greatest diversity of large mammals are found in these ecosystems.❖ The dominant animal species include

- ❖ Wild horses, asses & antelope of Eurasia,

- Herds of Bison of America; and
- The antelope & other large herbivores of Africa.

2.4.2 Structure and functions of Grassland Ecosystems

I. Biotic components

1) Producer Organisms

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

2) Consumers

- In a grassland, consumers are of three main types;

a) Primary Consumers

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

b) Secondary Consumers

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

c) Tertiary Consumers

- These include hawks etc. which feed on secondary consumers.

3) Decomposers

- These include wide variety of saprotrophic micro- organism like: Bacteria; Fungi; Actinomycetes
- They attract the dead or decayed bodies of organisms & thus decomposition takes place.
- Therefore, nutrients are released for reuse by producers.

II. Abiotic components

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

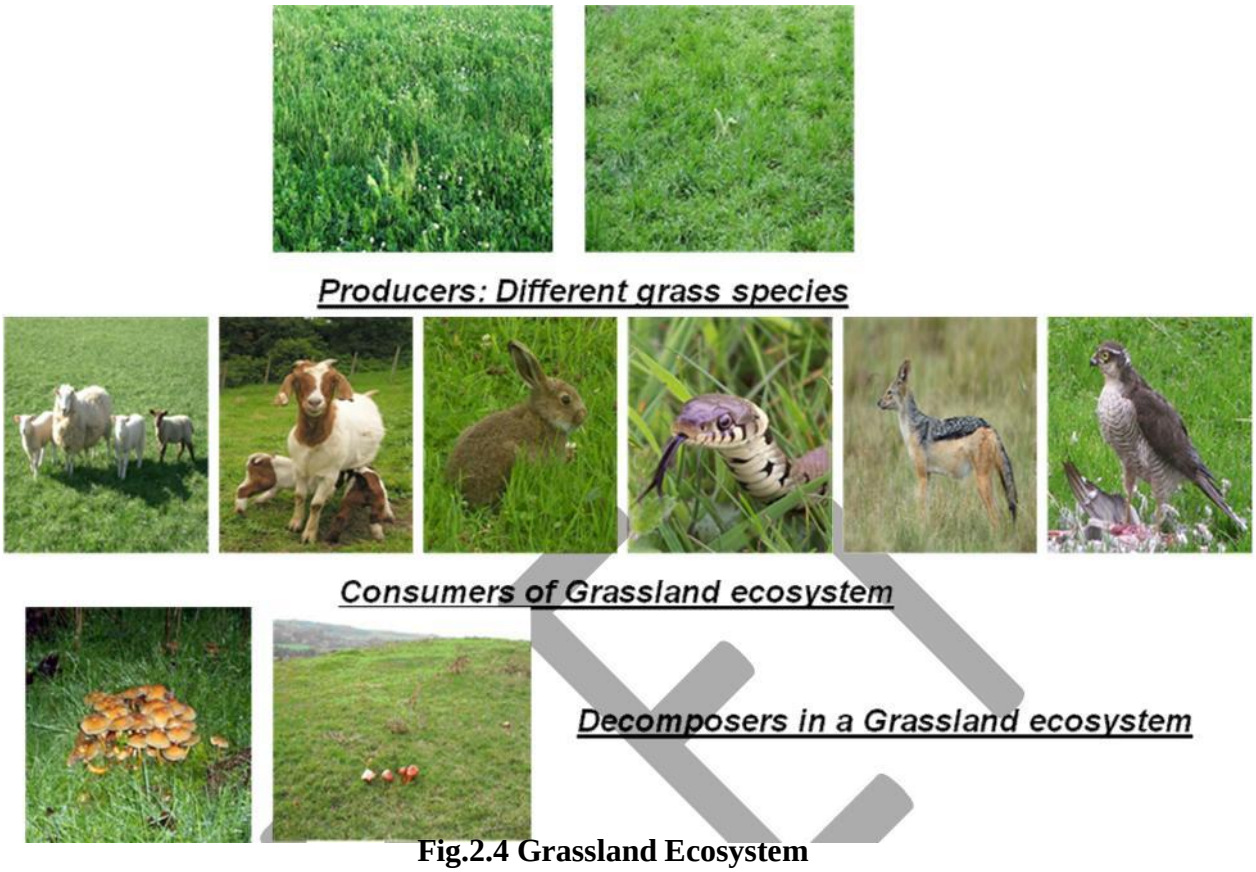


Fig.2.4 Grassland Ecosystem

2.5 DESERT ECOSYSTEM

2.5.1 Introduction

- A desert is a landscape or region that receives almost no precipitation.
- Deserts are defined as areas with an average annual precipitation of less than 250 millimeters per year.
- It occupies about 17% of the earth's surface.
- Deserts are characterized by hot days & cold nights.
- The deserts of the world are mainly located in the

  South- western United States, Mexico, North

  America, Asia (Thar, Gobi, Tibet) & west Asia.
- Deserts are characterized by scanty flora & fauna.
- Soils of deserts often have abundant nutrients but little or no organic matter.

2.5.2 Sturucture and Functions of Desert Ecosystms

I. Biotic components

1) Producer Organisms

- In a desert, producers are mainly shrubs/bushes; some grasses & a few trees.
- Dominant plant species include: Succulents (water - retaining plants adapted to arid climate or soil conditions) & hardy grasses.
- Besides some lower plants such as lichens & xerophytic mosses are also present.

2) Consumer Organisms

These include animals such as insects, reptiles which are capable of living in xeric conditions

- Besides some nocturnal rodents, birds & some mammalians like camel etc are also found.

3) Decomposers

Due to poor vegetation with very low amount of dead organic matter, decomposers are poor in desert ecosystem.

- The common decomposers are some bacteria & fungi, most of which are thermophillic.

II. Abiotic components

Due to high temperature & very low rainfall, the organic substances are poorly present in the soil.

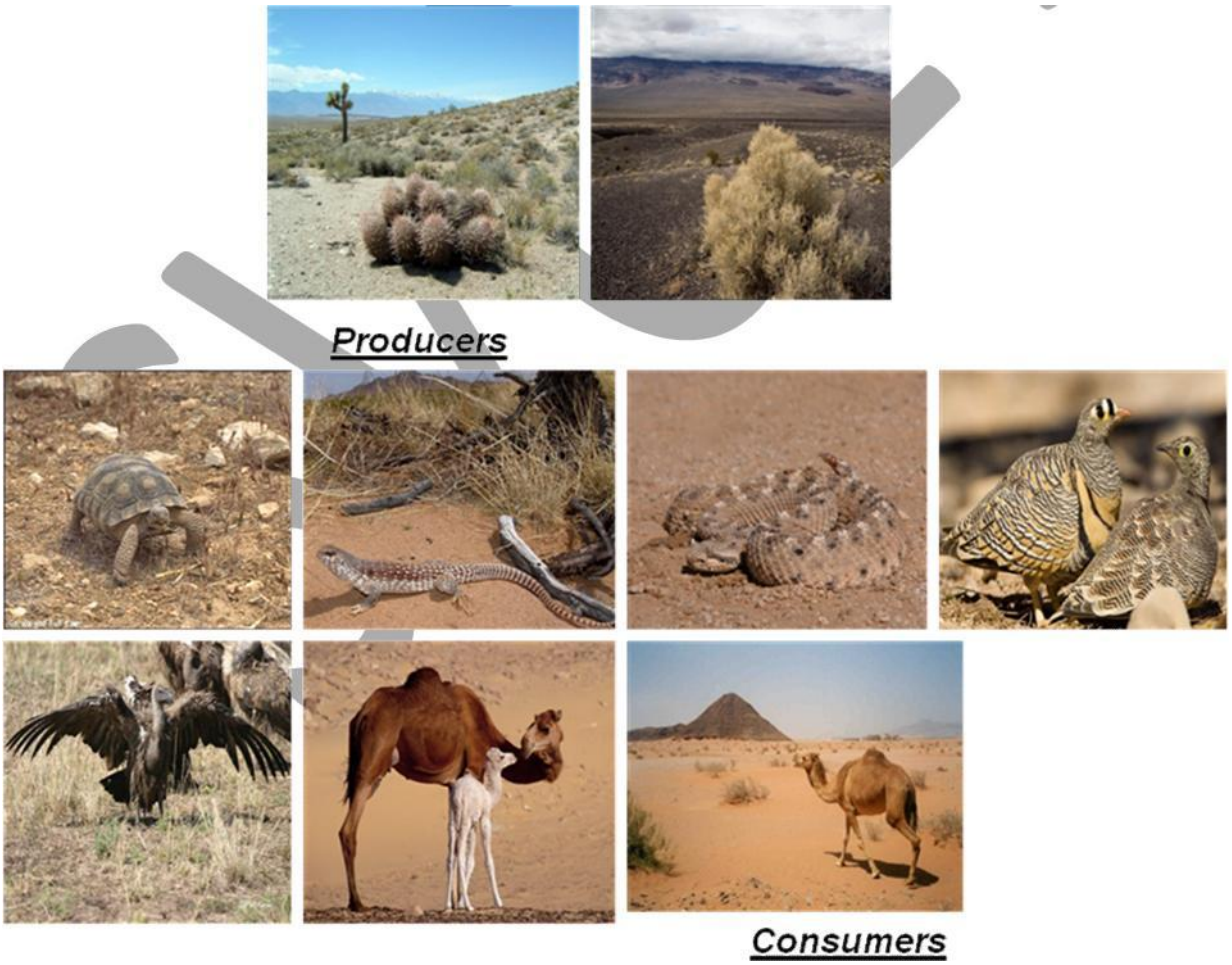


Fig. 2.5 Forest Ecosystem

2.6 AQUATIC ECOSYSTEMS

2.6.1 Introduction

- Aquatic ecosystems deal with biotic community present in water bodies.
- In terrestrial ecosystem, carbon dioxide & oxygen are present in gaseous form whereas in aquatic ecosystem, these are available in dissolved state.
- Depending upon the quality and nature of water, the aquatic ecosystem are categorized into:
    - Freshwater Ecosystem and
    - Marine Ecosystem.

2.6.2 Freshwater Ecosystems

- Freshwater ecosystems cover 0.8% of the Earth's surface and contain 0.009% of its total water.
- Freshwater ecosystems contain 41% of the world's known fish species.
- Aquatic ecosystems perform many important environmental functions. For example:
    - They recycle nutrients, purify water, attenuate floods, recharge ground water and provide habitats for wildlife.
    - Aquatic ecosystems are also used for human recreation, and are very important to the tourism industry, especially in coastal region.
- There are three basic types of freshwater ecosystems:
    - Lentic: slow-moving water, including Pools, Ponds, and Lakes.
    - Lotic: rapidly-moving water, for example Streams and Rivers.
    - Wetlands: areas where the soil is saturated with water or inundated for at least part of the time

2.6.3 Lakes & pond Ecosystem

- A pond is a place where living organisms not only live but interact with biotic & abiotic components.
- Ponds are often exposed to tremendous anthropogenic pressure which significantly affects the system.
- Lakes are usually big standing freshwater bodies.
- They have a shallow water zone called Littoral zone; an open water zone where effective penetration of solar light takes place, called limnetic zone and a deep water zone where light penetration is negligible, called Profoundal zone.

I. Biotic components

1) Producer Organisms

- It includes submerged, free floating and amphibious macrophytes (like; Hydrilla, Utricularia, Wolfia, Azolla, Typha etc.) and minute floating and suspended lower phytoplanktons (like; Ulothrix, Spirogyra, Oedogonium etc.)

2) Consumer Organisms

a) Primary consumers:These are zooplanktons (ciliates, flagellates, other protozoan, small crustaceans) and benthos.

b) Secondary consumers: These are carnivores like insects and fishes feeding on herbivores

c) Tertiary consumers: These are the large fishes feeding on small fishes.

3) Decomposers Micro – organisms like bacteria, fungi and actinomyctes.

II. Abiotic component

- These are the inorganic as well as organic substances present in the bottom soil or dissolved in water. In addition, to the minerals, some dead organic matter is also present.

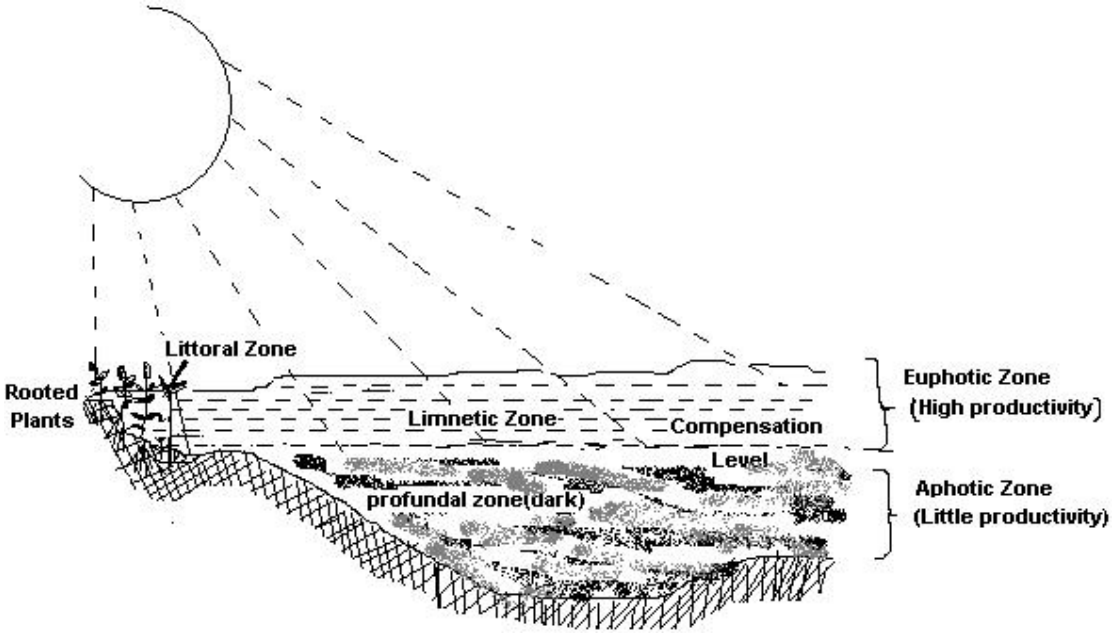


Fig.2.6.4 Zonation in a lake ecosystem

2.6.4 Marine or Ocean Ecosystem

- Marine ecosystems are among the Earth's aquatic ecosystems. They include: Oceans, Estuaries and Lagoons, Mangroves and Coral reefs, the Deep sea and the Sea floor.
- These are the gigantic reservoirs of water covering approximately 71% of the Earth's surface (an area of some 361 million square kilometers).
- These ecosystems are different from freshwater ecosystem mainly because of its salty water.
- The salt concentration in an open sea is usually 3.5% (35 parts per thousand (ppt)). Dominant ions are sodium & chloride.
- Average temperature of Marine ecosystem is 2-3 degree centigrade, devoid of light.

I. Biotic components

1) Producers It includes phytoplanktons (diatoms, dinoflagillates), large seaweeds (mainly algae like chlorophyceae, phaeophyceae & rhodophyceae; angiosperms like Ruppia, Zostera, posidonia), and mangrove vegetation (like Rhizophora, Carapa etc.)

2) Consumers

a) Primary consumers: These are herbivores and feed directly on producers (Crustaceans, Mollusks, fish etc.)

b) Secondary consumers: These are carnivorous fishes (Herring, Sahd and Mackerel)

c) Tertiary consumers: These are top carnivorous fishes (Cod, Haddock, etc.)

3) Decomposers These are micro – organisms like bacteria, fungi

II. Abiotic components

- High Na, Ca, Mg and K salt concentration, variable dissolved oxygen content, light & temperature make a unique physiochemical conditions in marine water.

Fig.2.6.5 Ocean Ecosystem

2.7 ENERGY FLOW IN ECOSYSTEM

- All organisms must obtain a supply of energy and nutrients from their environment in order to survive.
- The transformations of energy in an ecosystem begin first with the input of energy from the sun.
- Because, it is the first step in the production of energy for living things, it is called "Primary production".
- Photosynthesis -- Chemical reaction where green plants use water & carbon dioxide to store the sun's energy in glucose.
- ENERGY is stored in glucose.
- Glucose is stored as starch in plants
- The majority of autotrophs are photoautotrophs that harness the energy of the sun and pass some of this energy onto consumers through feeding pathways.

- The energy contained within producers and consumers is ultimately passed to the decomposers that are responsible for the constant recycling of nutrients.
- Thus, there is a one-way flow of energy through the biotic community and a cycling of nutrients between the biotic and abiotic components of the ecosystem
- Energy flow cannot occur in reverse direction.
- Starts from autotrophs (the producer level, i.e., first trophic level) to Heterotrophs including plant eaters or Herbivores (second trophic level) and so on.
- The amount of energy decreases with successive trophic levels.
- Only About 1% of energy from the sun is used by green plants & rest remains unutilized.
- Similarly, there is loss of energy in each trophic level.
- The transfer of food energy between the organisms in an ecosystem can be tracked by constructing food chains, food webs, pyramids of numbers, biomass and energy and energy flow diagrams.

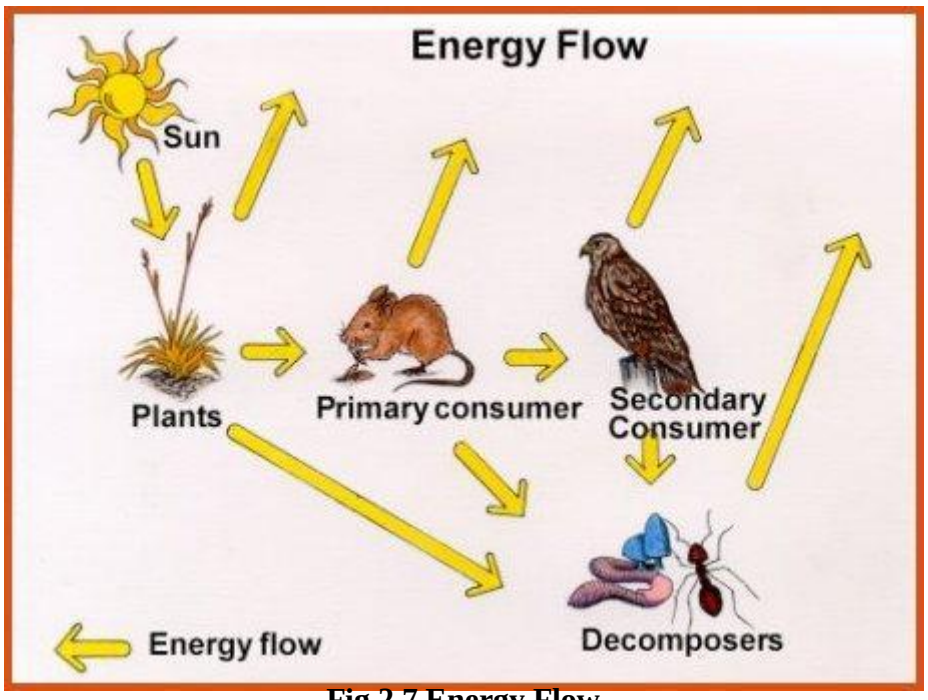


Fig.2.7 Energy Flow

2.8 FOOD CHAIN

- A food chain may be defined as, "the transfer of energy and nutrients through a series of organisms with repeated process of eating and being eaten".
- In an ecosystem, all the organisms are linked together with one another by food relationship.
- Each organism living or dead is potential food for some other organism.

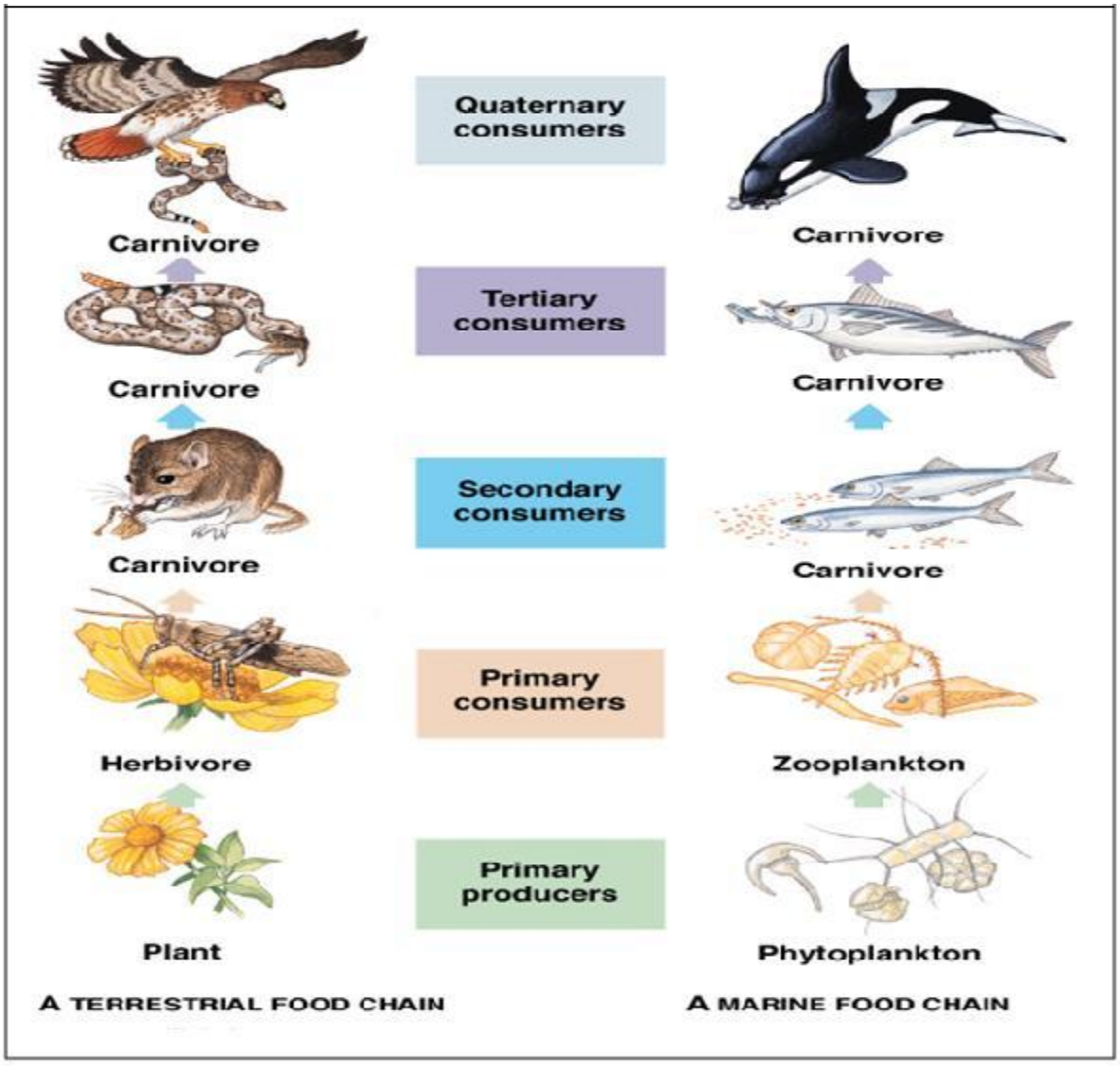


Fig.2.8 Food Chain

2.9 FOOD WEB

- Under natural conditions, the linear arrangement of food chains hardly occurs & these remains connected interconnected with each other through different types of organisms.
- Interlocking pattern of several interlinked food chains is termed as FOOD WEB.

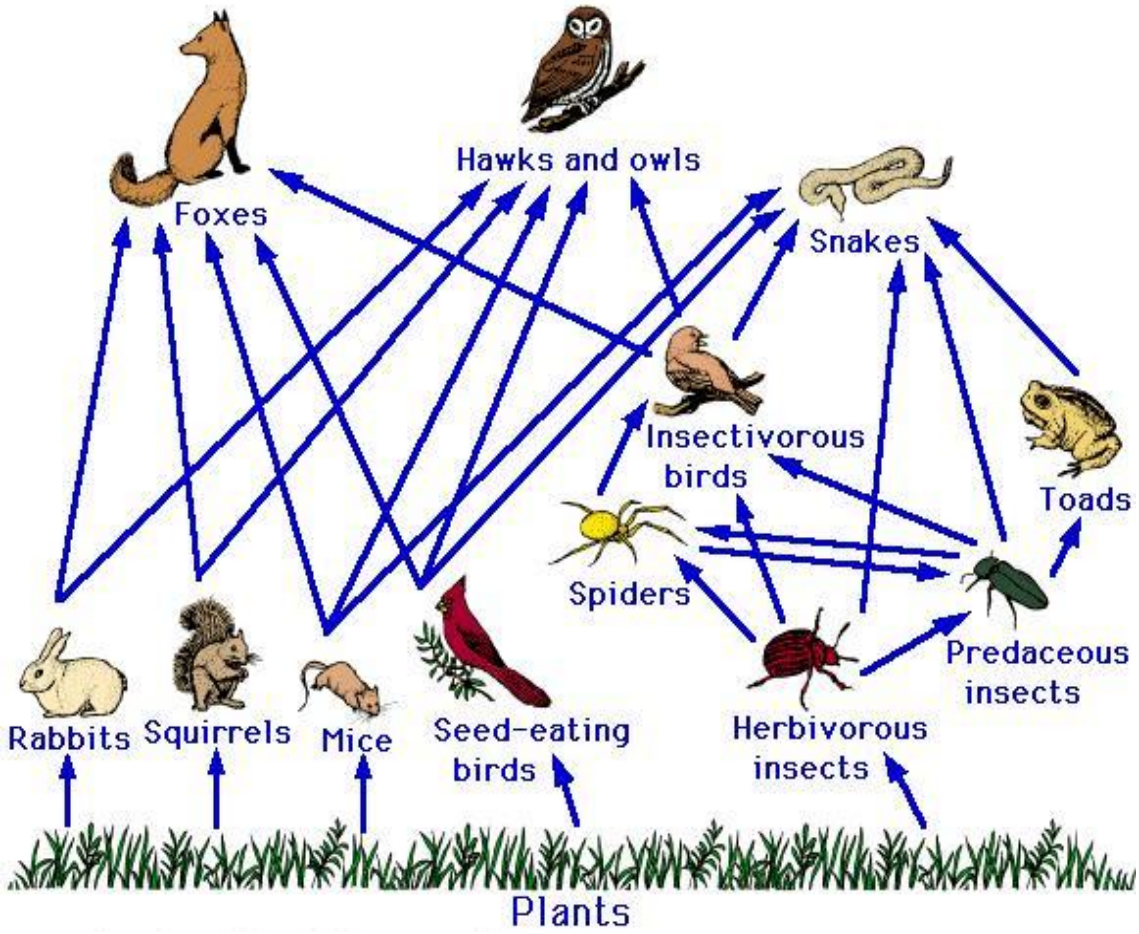


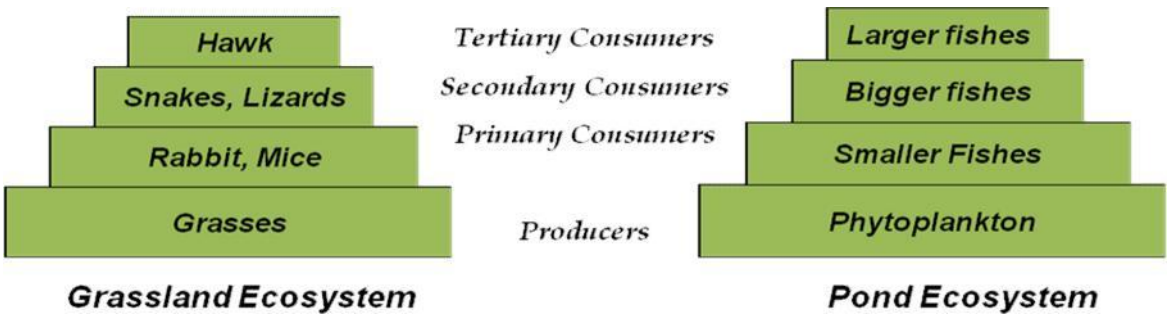
Fig.2.9 Food web in grassland ecosystem

2.10 ECOLOGICAL PYRAMIDS

- An"Ecological pyramid" is a graphical representation that shows the relative amounts of energy or matter contained within each tropic level in a food chain or food web.
- An ecological pyramid shows the relationship between consumers and producers at different tropic levels in an ecosystem
- There are three ecological pyramids recognized by ecologists:

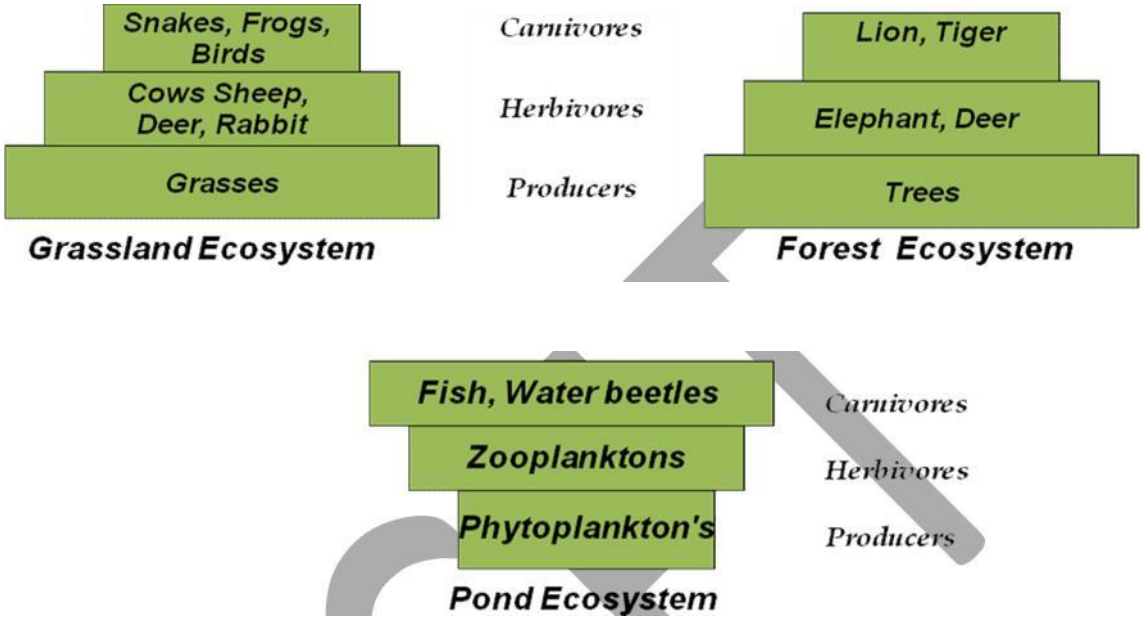
2.10.1 Pyramid of Numbers

- ✓ Shows the relative number of individual organisms at each tropic level.



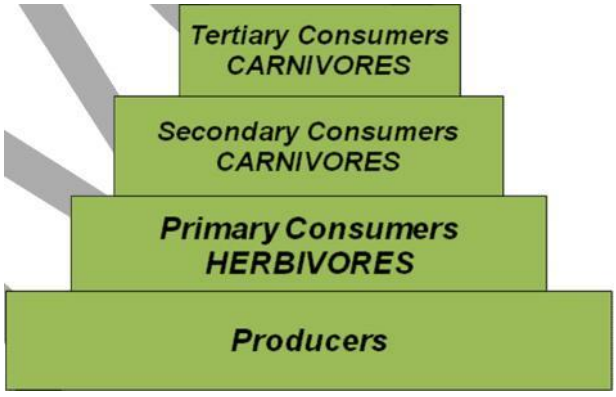
2.10.2 Pyramid of Biomass

- A pyramid of biomass represents the total dry mass (in grams per square meter of area) of all the organisms in each tropic level at a particular time.



2.10.3 Pyramid of Energy

- A pyramid of biomass represents the rate of energy flow and/or productivity at successive tropic levels. The pyramids of energy are always upright.



2.11 NUTRIENT CYCLES

- Nutrient cycles involve storage and transfer of nutrients through different components of the ecosystem, so that the nutrients are repeadly used.
- The cyclic movements of chemical elements of the biosphere between the organisms and environment are referred as **"BIOGEOCHEMICAL CYCLES"**

Gaseous cycle: Those elements in which the reservoir is the air or the oceans (via evaporation). Gaseous cycles include those of Carbon, Nitrogen, Oxygen, Carbon, and Water.

Sedimentary cycle: Those elements which are received from the Earth's crust. Sedimentary cycles include those of iron, calcium, phosphorus, and other more earth bound elements.

2.11.1 NITROGEN CYCLE

- Nitrogen is crucial for all organisms
  - Nucleic acids
  - Proteins
  - Chlorophyll
- Nitrogen- 78% in Atmosphere
- N2 is very stable and must be broken apart by organisms, combined with other atoms into a usable form.
- Nitogen cycle completes in 5 steps:

1) Nitrogen Fixation

Conversion of $N_2 \rightarrow NH_3$

- Combustion, volcanic action, Lightning, Industrial processes (making fertilizer). Bacteria (Azotobactor, Clostridium, Nostoc etc.)

2) Nitrification

Conversion of $NH_3 \rightarrow NO_3$

Soil bacteria convert in a two step process.

3) Assimilation

Roots absorb NH_3, NH_4, or NO_3 and incorporate them into nucleic acids and protein.

4) Ammonification

Amino acids and nucleotides are broken down into waste products NH_3 or NH_4

5) Denitrification

The reduction of NO_3 to N_2 .Denitrifying bacteria return some of the nitrogen to the atmosphere

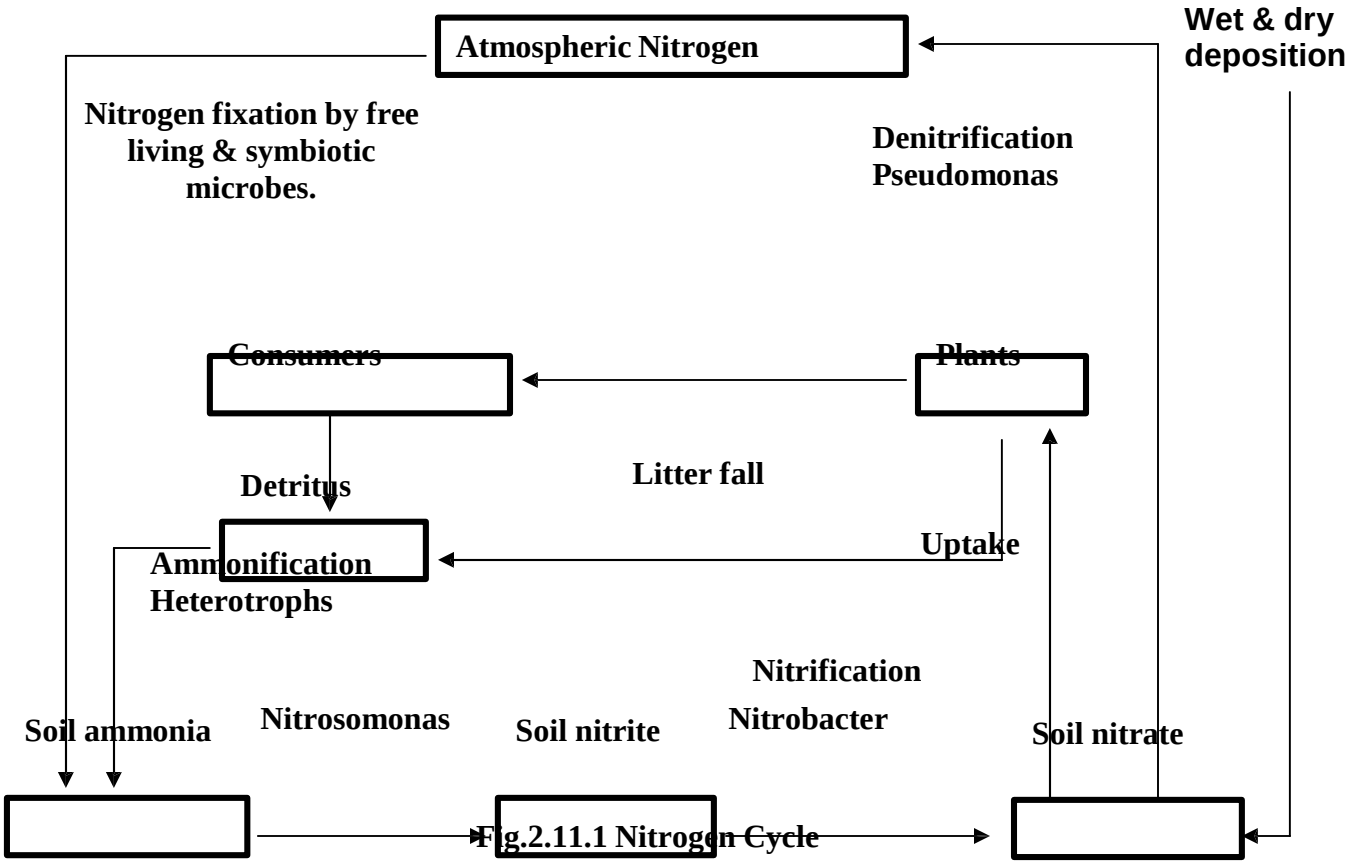


Fig.2.11.1 Nitrogen Cycle

2.11.2 CARBON CYCLE

- Carbon enters plants, etc., as CO_2
  - Bacteria process carbon in a fashion that allows it to be recycled.
  - Obtain energy from the molecules, and convert carbohydrates to carbon dioxide as a result of respiration.
- Photosynthesis removes carbon from the abiotic environment (fixes carbon into organic molecules)
- Carbon moves through food chain through consumption of one organisms by another
- Cellular respiration, combustion, and erosion of limestone return carbon to the atmosphere, water and abiotic environment.

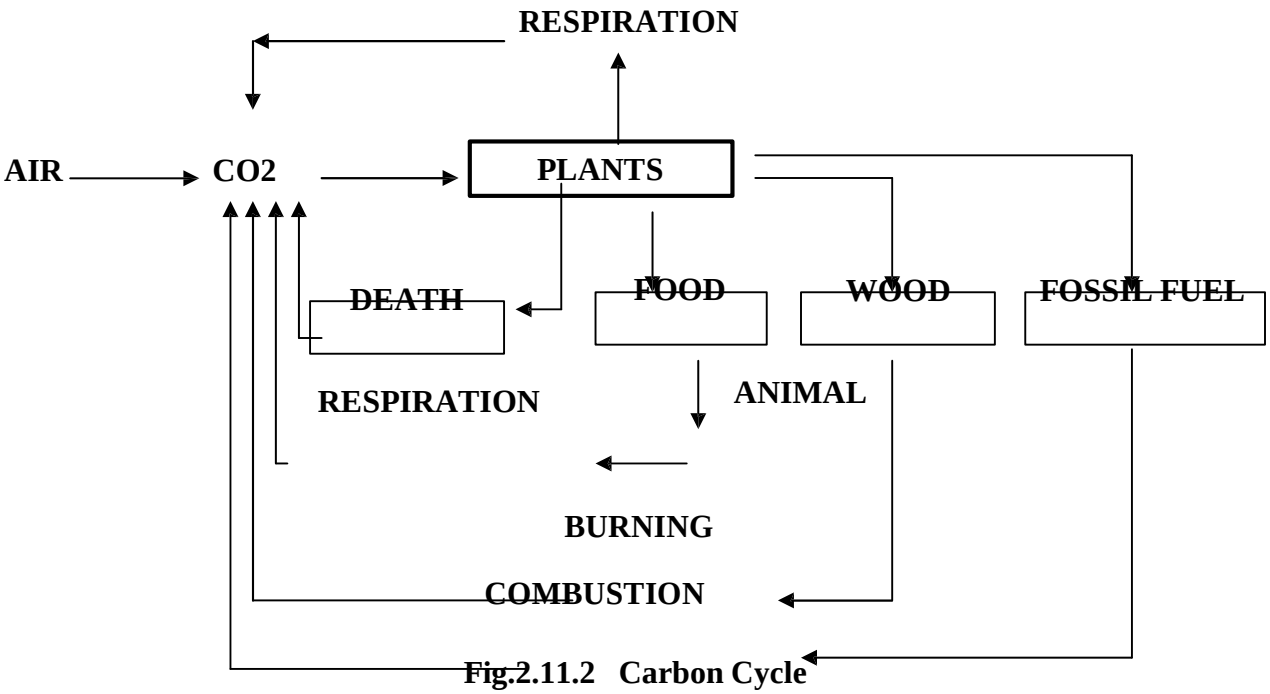


Fig.2.11.2 Carbon Cycle

The source of atmospheric carbon dioxide is variable but only plants can utilize atmospheric carbon directly

2.11.3 PHOSPHOROUS CYCLE

- The only cycle that does not have a gaseous state
- Inorganic phosphate PO_4^{3-} is released from rocks and sediments through the action of erosion.
- Soil PO_4^{3-} is absorbed by plants and incorporated into nucleic acids, phospholipids and ATP.
- Animals obtain most of their PO_4^{3-} by consumption of other animals and from water.
- PO_4^{3-} is released to the soil again by decomposers.
- Dissolved PO_4^{3-} gets absorbed by algae and aquatic plants
- Decomposers break down waste and returns PO_4^{3-} to sediments on the seabed.
- Some returns to terrestrial environment through geologic processes and via seabirds. Guano

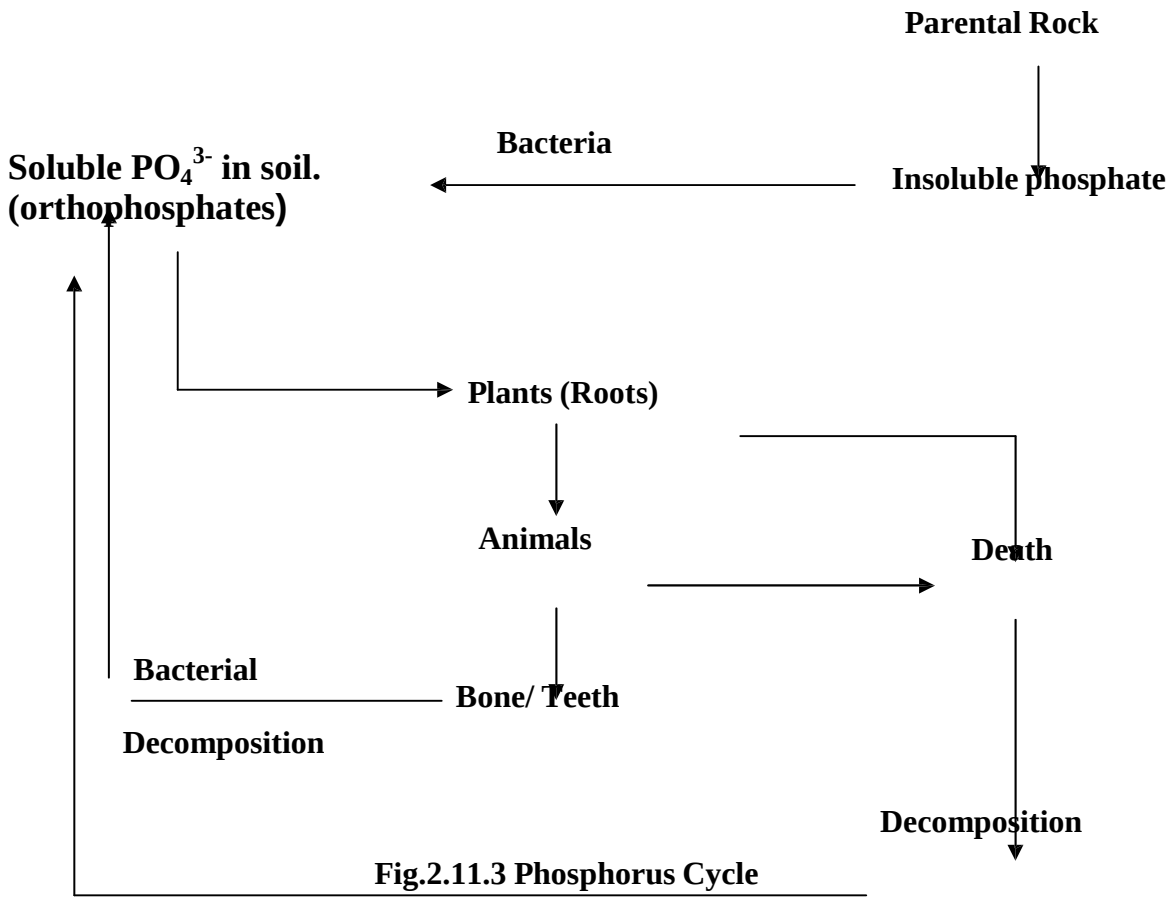


Fig.2.11.3 Phosphorus Cycle

2.12 ECOLOGICAL SUCCESSION

- Ecological succession is defined as, "A change in the community in which new populations of organisms gradually replace existing ones".
- There are two types of ecological succession:

1) Primary Succession

- Occurs where there is no soil, e.g. after a volcanic eruption or a glacial retreat.
- "Pioneer organisms"
- Simple plants first – no or shallow roots.
- Gradual influx of more complicated and larger plants as the habitat changes
- Unfavorable for life at first.
- Ends with a "climax community" – ecosystem stays constant, provided there are no changes in abiotic influences.

2) Secondary Succession

- Community development in the areas that were previously occupied by a other community.

- Occurs after a disturbance. E.g., loss of trees after disease, Fire or wind, deforestation etc.
- Conditions are favorable for as soil and nutrients are already present.
- More rapid than primary succession.

Primary Succession Vs Secondary Succession

Primary	Secondary
➢ No soil.	➢ Soil already exists.
➢ Pioneer species.	➢ Seeds have suitable soil conditions.
➢ Weathering & decomposition	➢ Occurs much faster.
➢ Humus and sand increase over time.	➢ Climax community.
➢ End = Climax community.	

2.13 BIODIVERSITY

- Biodiversity is the variety and differences among living organisms from all sources, including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are a part.
- It is virtually synonymous with "**Life on earth**".
- Biologists most often define "**biological diversity" or "biodiversity**" as the "totality of genes, species, and ecosystems of a region".
- The biodiversity found on Earth today consists of many millions of distinct biological species, which is the **product of nearly 3.5 billion years of evolution**.

2.13.1 Levels of Biodiversity

1) Genetic diversity

- It is a level of biodiversity that refers to the **total number of genetic characteristics in the genetic makeup of a species.**
- It is **distinguished from genetic variability**, which describes the **tendency of genetic characteristics to vary.**

2) Species diversity

- It refers to the **variety of species within a region**.
- Species diversity is **an index that incorporates the number of species in an area** and also their relative abundance.
- It is generally a much more useful value than species richness.

3) Community and Ecosystem diversity

- Ecosystem diversity refers to the diversity of a place at the level of ecosystems. This has 3 perspective:

- **Alpha Diversity**: Within community diversity. Alpha diversity refers to the diversity of organisms **sharing the same Community/Habitat**.
- **Beta Diversity**: Between community diversity. It refers to the diversity of organisms sharing **two habitats.**
- **Gamma Diversity: Diversity of the habitat over the total landscape** or geographical area is called gamma diversity.

2.13.2 Values of Biodiversity

Food: About 80,000 edible plants and about 90% of present day food crops have been domesticated from wild.

Drugs & Medicines: About 75% of world's population depends on plants or plant extracts.

Fuel: Forests have been used since ages for fuel wood. Fossil fuels are also products of Biodiversity.

Social Value: Many of the plants like Tulsi, Lotus, Peepal etc are considered holy and sacred.

- About **2.1 million species have been identified till date**, while many more species are believed to exist.
- According to UNEP estimate, approximately 9.0 – 52 million of species exist on Earth
- India's position is **10th in the world & 4th in Asia in terms of Plant diversity.**

2.14 HOT- SPOTS OF BIODIVERSITY

- A biodiversity hotspot is a biogeographic region with a significant reservoir of biodiversity that is threatened with destruction.
- **An area is designated as a hot spot when it contains at least 0.5% of plant species as endemic.**
- There are **25 such hot spots of biodiversity on a global level,** out of which two are present in India.
- These are: **Indo- Burma (earlier The Eastern Himalayas) ,The western Ghats & Sri Lanka..**
- These hot spots covering **less than 2% of the world's land area** are found to have about 50% of the terrestrial biodiversity.

2.14.1 Criteria for determining hot-spots

- No. of Endemic Species i.e. the species which are found no where else.
- Degree of threat, which is measured in terms of Habitat loss.

E.g. Indo- Burma (Eastern Himalayas) Hotspot

- The hotspot includes all of Cambodia, Vietnam & Laos, and nearly the entire areas of Thailand, Myanmar & Bhutan as well as part of Nepal, far eastern India and extreme southern China.
- In addition, it covers several offshore Islands including Mainan Islands in the south China Sea and Andaman & Nicobar Islands in Indian Ocean.

- Indo-Burma is one of the most threatened biodiversity hotspots, due to the rate of resource exploitation and habitat loss.

E.g. Western Ghats and Sri Lanka

- Western Ghats and Sri Lanka, also known as the "Sahyadri Hills" encompasses the montane forests in the southwestern parts of India and on the neighboring Islands of Sri Lanka.
- The entire extent of hotspot was originally about 1,82,500 square kms, but due to tremendous population pressure, now only 12,445 square Km or 6.8% is in pristine condition.
- The important populations include Asian elephant, Indian tigers and the endangered lion tailed macaque.

2.15 THREATS TO BIODIVERSITY

- **Extinction** is a natural event and, from a geological perspective, routine.
- In last century, **human impact** has been so severe that thousands of species and varieties are becoming extinct annually.
- Some of the main causes are:
- **Habitat loss, degradation, fragmentation**.
- Habitat loss & degradation are major causes of species extinction, **affecting 89% of all threatened birds, 83% of mammals & 91% of all threatened plants** assessed globally (IUCN,
  2000)
- **The main causes of habitat are agriculture activities, Mining, development of human settlement, industry** etc.
- According to ICUN, UNEP report, **more than 50% of wildlife habitat has been destroyed in 49 out of 61 old world tropical countries.**

2.16 POACHING OF WILDLIFE

- **Poaching** is another threat that has emerged in recent decades as one of the primary reason for decline in number of species.
- **Wildlife is sold and traded in many countries for live specimens, folk medicines, furs, Skin, and other products such as Ivory, horns etc amounting** to millions of dollars.

2.17 MAN – WILDLIFE CONFLICTS

- The conflict between man and wildlife started with the evolution of man, but intensity increased due to the activities of modern man
- Due to the lack of stable food and disruption of movement, **wild animals came out of forest area and attack the agricultural field and humans and in turn got killed by the humans**.

2.17.1 Introduction of Exotic species / Elephants

- **Organisms introduced into habitats where they are not native are termed as exotics**.

- They can be thought of as Biological Pollutants and are considered to be among the most damaging agents of habitat alteration and degradation the world.

2.17.2 Climate change

A changing global climate threatens species and ecosystems.

- The distribution of species (biogeography) is largely determined by climate.
- Climate change may simply shift these distributions but, for a number of reasons, plants and animals may not be able to adjust.

2.18 ENDANGERED SPECIES

- According to The International Union of Conservation of Nature and Natural Resources (IUCN), the species that considered in imminent danger of extinction and whose survival is unlikely, if factors causing their decline continue to operate.
- Out of about **47,000 species of plants in our country, 7000 are endemic**
- India contains **172 species of animals considered globally threatened by IUCN**, or **2.9% of the world's total number of threatened species.**
- These include **53 species of mammals, 69 birds, 23 reptiles and 3 amphibians**
- As many as **3,000- 4,000 higher plants may be under high degree of threat in India**
- Thus Indian subcontinent has about **62% endemic flora, restricted mainly to Himalayas, khasi Hills & Western Ghats.**
- **Sapria himalayana, Uvaria lurida, Napenthes khasians** etc. are some endemic flora of our country.
- A large number out of a **total of 81,000 species of animals in our country is endemic**. About **62% amphibians and 50% lizards** are endemic to **western Ghats**.
- **Golden monkey, Niligiri Langur, Indian Wolf, Red Fox, Himalayan Brown Bear, Great Indian One Horned Rhinoceros, White Winged Wood Duck, Black Necked Crane, Indian Pea Fowl, Gharial, Indian egg eating Snake, Indian Salamandar etc**. are some examples of endemic animal species of India.

2.19 CONSERVATION OF BIODIVERSITY

- The convention on **Biological Diversity held in June, 1992** stressed the **need of the conservation of Biodiversity for sustainable development and perpetuation of human beings on earth.**
- Conservation is defined as " **the management of human use of the biosphere so that it may yield the greatest sustainable benefit to the present generation while maintaining its potential to meet the needs and aspirations of the future generations**".
- The two basic approaches to wildlife conservation in protected habitats are:

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

2.19.1 In- situ conservation

- It simply means **conservation of species in its natural ecosystem** or **even in man made ecosystems.**

❖ This strategy emphasizes **protection of total ecosystem through a network** of "**protected area**".

- **Protected Areas**: an area of land and/or sea specially dedicated to the protection and maintenance of biological diversity and managed through legal effective means.
- There are different categories of protected areas which are managed with different objectives. These include; **Biosphere reserves, National parks, Wild Life Sanctuaries** etc.
- At present we have **11 major biosphere reserves, 80 National parks, 420 wildlife sanctuaries in our country covering 4% of the geographic area.**
- The JIM CORBETT National Park was 1st national park established in India.

What is **Difference among Biosphere reserves, National parks, Wild Life Sanctuaries ?**

Examples of **Biosphere reserves** of India:

1. **Nilgiri- 5,520 sq.km**
2. **Nanda Devi- 5,860.69 sq. km**
3. **Manas – 2837 sq. km**
4. **Gulf of Mannar – 10,500 sq. km**
5. **Great Nicobar – 885 sq. km**
6. **Panchmarhi – 4,926.28 Sq Km**

Examples of some National park in India

1. **Kaziranga- Assam, Gir National Park- Gujarat, Periyar – Kerala, Sariska – Rajasthan**

Examples of some Wild Life Sanctuaries of India:

1. **Ghana Bird sanctuaries**
2. **Hazaribagh sanctuaries**
3. **Abohar wild life sanctuaries**
4. **Jaldapara wild life sanctuaries**
5. **Mudamalai wild life sanctuaries**

2.19.2 Ex- situ conservation

- It is defined as **"the conservation of component of biological diversity (Sample of genetic diversity, particularly of endangered species) outside their natural habitats**".
- It involves **maintenance and breeding of endangered plant and animal species under partially or wholly controlled conditions.** E.g. **Zoos, Botanical Gardens, Aquaria, Nurseries, DNA bank, Seed bank, Gene bank etc.**
- There are more than **1500 Botanical gardens in the world containing more than 80,000 species**.
- There are more than **800 zoos around the world with about 3,000 species of mammals, birds, reptiles and amphibians.**

CHAPTER 2 ENVIRONMENTAL POLLUTION

3.1 Introduction

Environmental pollution can be defined as "the unfavorable alteration of our surroundings"

3.1.1 Types of pollutants

1. Bio degradable pollutants - decompose rapidly by natural processes.
2. Non- degradable pollutants - do not decompose or slowly decompose in the environment.

3.1.2 Classification of Pollution

- ✓ Air pollution
- ✓ Water pollution
- ✓ Soil pollution
- ✓ Marine pollution
- ✓ Noise pollution
- ✓ Thermal pollution and
- ✓ Nuclear hazards

3.2 AIR POLLUTION

The presence of one or more contaminants like dust, smoke, mist and odor in the atmosphere which are injurious to human beings, plants and animals.

3.2.1 Sources of air pollution

Natural pollution - volcanic eruptions, forest fires, biological decay.
Man – made activities – Thermal power plants, agricultural activities.

3.2.2 Classification

- Primary pollutant – these are those emitted directly in the atmosphere in harmful form like CO, NO.
- Secondary pollutant – these may react with one another or with the basic components of air to form new pollutants.

3.2.3 Control Measures

1. Source control

- ❖ Use only unleaded petrol
- ❖ Use petroleum products and other fuels that have low sulphur and ash content
- ❖ Plant trees along busy streets because they remove particulates and carbon monoxide and absorb noise.

- ❖ Industries and waste disposal sites should be situated outside the city centre.
- ❖ Use catalytic converters to help control the emissions of carbon monoxide and hydrocarbons.

2. Control measures in Industrial centers

- ❖ Emission rates should be restricted to permissible levels
- ❖ Incorporation of air pollution control equipments in the design of the plant lay out.

3.3 WATER POLLUTION

- o It may be defined as "the alteration in physical, chemical and biological characteristics of water which may cause harmful effects on human and aquatic life.

3.3.1 Types, effects and sources of water pollution

1. Infectious agents: Bacteria, viruses, protozoa and parasitic worms.
Sources: Human and animal wastes.
Effects: Variety of diseases.

2. Oxygen demanding wastes: Animal manure and plant debris that can be decomposed by aerobic bacteria.
Sources: Sewage, paper mills, and food processing facilities.

Effects: Wastes can degrade quality by depleting water of dissolved oxygen.
3. In organic Chemicals: Water soluble inorganic chemicals. Compounds of toxic metals such as lead, arsenic and selenium. Salts such as Nacl in ocean water.
Effects: Genetic mutations, birth defects and certain cancers.

4. Thermal pollution (Heat)
Example: Excessive heat.

5. Human source

- Water cooling of electric power plants and some types of industrial plants. Almost all of all water withdrawn in United States for cooling electric power plants.

3.3.2 Effects

- ✓ Lowers dissolved oxygen levels and makes aquatic organisms more vulnerable to disease and toxic chemicals
- ✓ When a power plant first opens or shuts down for repair, fish and other organisms adapted to a particular temperature range can be killed b the abrupt change in water temperature known as thermal shock.

3.3.3 Control measures of water pollution

- The administration of water pollution should be in the hands of state or central government.

- Industrial plants should be based on recycling operations, because it will not only stop the discharge of industrial wastes into natural water sources but by products can be extracted from the wastes.
- Plants, trees and forests control pollution and they acts as natural air conditioners.
- Highly qualified and experienced persons should be consulted from time to time for effective control of water pollution.
- Basic and applied research in pubic health engineering should be encouraged.

3.4 SOIL POLLUTION

It may be defined as "the contamination of soul by human and natural activities which may cause harmful effects on living beings".

3.4.1 Types

1. Industrial wastes
Sources and effects: Pulp and paper mills, chemical industries, oil refineries, sugar factories. These pollutants affect and alter the chemical and biological properties of soil. As a result, hazardous chemicals can enter into human food chain from the soil; disturb the bio chemical process and finally lead to serious effects.

2. Urban wastes
Sources and effects: Plastics, Glasses, metallic cans, fibers, papers, rubbers, street sweepings, and other discarded manufactured products. These are also dangerous.

3. Agricultural practices
Sources and effects: Huge quantities of fertilizers, pesticides, herbicides, and weedicides are added to increase the crop yield. Apart from these farm wastes, manure, slurry, are reported to cause soil pollution.

4. Radioactive pollutants
Sources and effects: These are resulting from explosions of nuclear dust and radio active wastes penetrate the soil and accumulate there by creating land pollution.

5. Biological agents
Sources and effects: Soil gets large quantities of human, animal and birds excreta which constitute the major source of land pollution by biological agents.

3.4.2 Control measures of soil pollution

The pressure on intensification of farm activities increases for two reasons

- ✓ Population growth
- ✓ Decrease of the available farm land due to urbanization
- ✓ Forestry and farm practices
- ✓ Proper dumping of unwanted materials
- ✓ Production of natural fertilizers
- ✓ Proper Hygienic condition

- ✓ Public awareness
- ✓ Recycling and Reuse of wastes
- ✓ Ban on Toxic chemicals.

3.5 MARINE POLLUTION

It may be defined as "the discharge of waste substances into the sea resulting in harm to living resources hazards to human health, hindrance to fishery and impairment of quality for use of sea water".

Source of marine pollution

The coastal zones contain rich heritage, coral reefs, wetlands, and sea grass beds.

3.5.1 Effects of marine pollutants

- ➢ The presence of heavy metals and organic pollutants cause more damage in birds as thinning of eggshell and tissue damage of egg.
- ➢ Oil spilling causes abnormally low body temperature in birds resulting in hypothermia.
- ➢ Oil films are able to retard significantly the rate of oxygen uptake by water.

3.5.2 Control measures of marine pollution

- ❖ Plants for conserving marine biodiversity must be taken into account of human needs.
- ❖ People should be educated about marine ecosystems and the benefits offered by them.
- ❖ Local communities must be involved in protecting and managing their coastal resources. Social and economic incentives must be offered for conserving and sustainable use of marine resources.
- ❖ Governments must manage their own water while extending cooperation to the neighboring states.

3.6 NOISE POLLUTION

It may be defined as "the unwanted, unpleasant or disagreeable sound that causes discomfort for all living beings"

3.6.1 Types of noise

- Industrial noise
- Transport noise
- Neighborhood noise

3.6.2 Effects of Noise pollution

- ✓ This affects human health, comfort and efficiency.
- ✓ It causes muscles to contract leading to nervous breakdown, tension.
- ✓ It affects health efficiency and behavior.
- ✓ In addition to serious loss of hearing due to excessive noise, impulsive noise also causes psychological and pathological disorders.

- ✓ Brain is also adversely affected by loud and sudden noise as that of jet and aero plane noise.

3.6.3 Control and preventing measures

- ❖ Source control – acoustic treatment to machine surface, design changes, limiting the operational timings.
- ❖ Transmission path intervention- the source inside a sound insulating enclosure, construction of a noise barrier or provision of sound absorbing materials.
- ❖ Oiling – Proper oiling will reduce the noise from the machines.

3.7 THERMAL POLLUTION

It may be defined as the "addition of excess of undesirable heat to water that makes it harmful to man, animal or aquatic life or otherwise causes significant departures from the normal activities of aquatic communities in water"

3.7.1 Sources of thermal pollution

- ✓ Nuclear power plants
- ✓ Coal fired power plants
- ✓ Industrial effluents
- ✓ Domestic sewage
- ✓ Hydro – electric power.

3.7.2 Effects of thermal pollution

- Reduction in dissolved oxygen
- Increase in Toxicity
- Interference with biological activities
- Interference with reproduction
- Direct mortality
- Food storage for fish.

3.7.3 Control measures of thermal pollution

- ➢ Cooling towers - This is used as a coolant wet cooling tower, dry cooling tower.
- ➢ Cooling ponds and spray ponds.
- ➢ Artificial lakes – The heated effluents can be discharged into the lake at one end and the water for cooling purposes from the other end.

3.8 NUCLEAR HAZARDS

The radiation hazard in the environment comes from ultraviolet, visible, cosmic rays and micro wave radiation which produces genetic mutation in man.

3.8.1 Sources of Nuclear Hazards

Natural Sources – This is in space which emits cosmic rays.
Man made Sources – (Anthropogenic sources) these are nuclear power plants, X-rays, nuclear accidents, nuclear bombs, diagnostic kits.

3.8.2 Effects of Nuclear Hazards

- Exposure of the brain and central nervous system ot high doses of radiation causes delirium, convulsions and death within hours or days.
- The use of eye is vulnerable to radiation. As its cell die, they become opaque forming cataracts that impair sight.
- Acute radiation sickness is marked by vomiting; bleeding of gums and in severe cases mouth ulcers.
- Nausea and vomiting often begin a few hours after the gastrointestinal tract is exposed. Infection of the intestinal wall can kill weeks afterwards.
- Unborn children are vulnerable to brain damage or mental retardation, especially if irradiation occurs during formation of the central nervous system in early pregnancy.

3.8.3 Control measures

- Nuclear devices should never be exploded in air.
- In nuclear reactors, closed cycle coolant system with gaseous coolant may be used to prevent extraneous activation products.
- Containments may also be employed to decrease the radio active emissions.
- Extreme care should be exercised in the disposal of industrial wastes contaminated with radio nuclides.
  Use of high chimneys and ventilations at the working place where radioactive contamination is high. It seems to be an effective way for dispersing pollutants.

3.9 SOLID WASTE MANAGEMENT

Management of solid waste is very important in order to minimize the adverse effects of solid wastes.

3.9.1 Types of solid wastes

1. Urban wastes

Sources

- ✓ Domestic wastes – Food waste, Cloth, Waste paper.
- ✓ Commercial wastes – Packing material, cans, bottles, polythene.
- ✓ Construction Wastes – Wood, concrete debris.
- ✓ Bio medical wastes – Anatomical wastes, infectious wastes.

2. Industrial wastes

Sources

- ✓ Nuclear power plants – generates radioactive wastes

- ✓ Thermal power plants – produces fly ash in large quantities

3. Chemical industries

Produces large quantities of hazardous and toxic materials

3.9.2 Steps involved in solid waste management

- ✓ Reduce, Reuse and Recycle of materials – raw materials re usage should be reduced, reuse of waste materials should be reduced and recycling of the discarded materials into new useful products should also be reduced.
- ✓ Discarding wastes
- ✓ Land fill: Solid wastes are placed in sanitary landfill system in alternate layers of 80 cm thick refuse, covered with selected earth fill of 20cm thickness
- ✓ Incineration: It is a hygienic way of disposing the solid waste. It is a thermal process and is very effective for detoxification of all combustible pathogens
- ✓ Composting: It is another popular method practiced in many cities in our country. In this method, bulk organic waste is converted into fertilizing manure by biological action.

3.9.3 Role of an individual in prevention of pollution

- Plant more trees
- Help more in pollution prevention than pollution control
- Use water, energy and other resources efficiently
- Purchase recyclable, recycled and environmentally safe products
- Reduce deforestation
- Remove NO from motor vehicular exhaust
- Use of eco friendly products.

3.9.4 Case studies

- ➢ Effluents treatment at MRL, Chennai
- ➢ The Bhopal gas tragedy
- ➢ Arsenic pollution in ground water
- ➢ Soft drink bottling unit
- ➢ Mercury wastes
- ➢ Palar river pollution
- ➢ The miniamatta epidemic (marine pollution)

3.10 DISASTER MANAGEMENT

Hazard

It is a perceived natural event which threatens both life and property.

Disaster

- ✓ A disaster is the realization of this hazard
- ✓ It is defined as the geological process and it is an event concentrated in time and space in which a society or subdivision of a society undergoes severe danger and causes loss of its members and physical property.

Types

Natural disasters – refers to those disasters that are generated by natural phenomena.

Man made disasters – refers to the disasters resulting from man made hazards.

3.11 FLOODS

Whenever the magnitude of water flow exceeds the carrying capacity of the channel within its banks the excess of water overflows on the surroundings causes floods.

3.11.1 Causes of floods

- Heavy rain, rainfall during cyclone causes floods
- Sudden snow melt also raises the quantity of water in streams and causes flood
- Sudden and excess release of impounded water behind dams
- Clearing of forests for agriculture has also increased severity of floods.

3.11.2 Flood Management

- Encroachment of flood ways should be banned.
- Building walls prevent spilling out the flood water over flood plains.
- Diverting excess water through channels or canals to areas like lake, rivers where water is not sufficient.
- Optical and microwave data from IRS is also used for flood management.
- Flood forecasts and flood warning are also given by the central water commission.

3.12 CYCLONES

It is a meteorological process, intense depressions forming over the open oceans and moving towards the land.

Cyclone is measured by Saffir-Simpson scale.

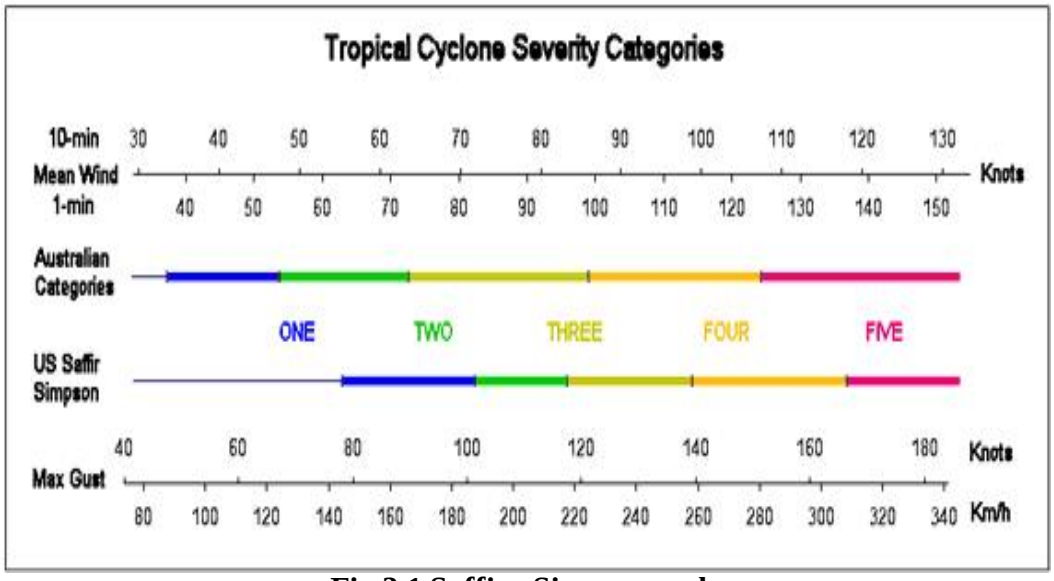


Fig.3.1 Saffir –Simpson scale

3.12.1 Effect

- ✓ The damage depends on the intensity of cyclone the damage to human life, crops, roads, transport, could be heavy.
- ✓ Cyclone occurrence slows down the developmental activities of the area.

Table 3.1 Classification of cyclones based on their speed

Category	Strongest Gust (km/h)	Typical Effects (indicative only)
1 (Tropical Cyclone)	Less than 125 (Gales)	Negligible house damage. Damage to some crops, trees and caravans. Craft may drag moorings.
2 (Tropical Cyclone)	125-169 (Destructive winds)	Minor house damage. Significant damage to signs, trees and caravans. Heavy damage to some crops. Risk of power failure. Small craft may break moorings.
3 (Severe Tropical Cyclone eg. *Roma*)	170-224 (Very destructive winds)	Some roof and structural damage. Some caravans destroyed. Power failure likely.
4 (Severe Tropical Cyclone eg. *Tracy*)	225-279 (Very destructive winds)	Significant roofing loss and structural damage. Many caravans destroyed and blown away. Dangerous airborne debris. Widespread power failures.
5 (Severe Tropical Cyclone eg. *Vance*)	More than 280 (Very destructive winds)	Extremely dangerous with widespread destruction.

3.12.2 Cyclone management

- Satellite images are used by meteorological departments for forecasting the weather conditions which reveal the strength and intensity of the storm.
- Radar system is used to detect the cyclone and is being used for cyclone warning.

3.12.3 Case studies

Cyclone in Orissa – 1999

- ✓ Two cyclones in Orissa occurred on 18th and 29th October 1999.In the coastal area of Orissa, a powerful cyclone storm hit with a wind velocity of about 260 km/hr. Nearly 14-30 districts of Orissa were in severe damage.
- ✓ It has been reported that nearly 15 millions of people were affected and 90-95% of the crop yield was affected. About 11,500 local schools have been damaged.

3.13 LAND SLIDES

The movement of earthy materials like coherent rock, mud, soil and debris from higher to lower region to gravitational pull is called land slides.

3.13.1 Causes

- ❖ Movement of heavy vehicles on the unstable sloppy regions.
- ❖ Earthquake, shocks, vibrations and cyclone.

3.13.2 Effects of landslides

1. Block roads and diverts the passage.
2. Soil erosion increases.
3. Causes damages to houses, crops and live stock.

3.14 EARTH QUAKES

An earthquake is a sudden vibration caused on earth surface with the sudden release of tremendous energy stored in rocks under the earth's crust.

3.14.1 Causes

1. Disequilibrium in any part of the earth crust
2. Underground nuclear testing
3. Decrease of underground water level.

3.14.2 Severity of an earthquake: Generally it is measured by its magnitude on Richter scale.

Richter Scale	Severity of earthquake
Less than 4	Insignificant
4- 4.9	Minor
5- 5.9	Damaging
6- 6.9	Destructive
7- 7.9	Major
More than 8	Great

3.14.3 Effect

- Damage the settlements and transport systems

- Collapses houses and their structures
- Deformation of ground surface
- Tsunami

3.14.4 Earthquake Management

- ✓ Constructing earthquake resistant building
- ✓ Wooden houses are preferred
- ✓ Seismic hazard map should give the information about the magnitude of intensity of anticipated earthquakes.

3.15 TSUNAMI

A tsunami is a large wave that is generated in a water body when the seafloor is deformed by seismic activity. This activity displaces the overlying water in the ocean.

3.15.1 Causes of tsunami

- ❖ Seismic activities like earthquakes, landslides, volcanic eruptions, explosions, can generate tsunami.
- ❖ Deformation of the sea floor due to the movement of plates.

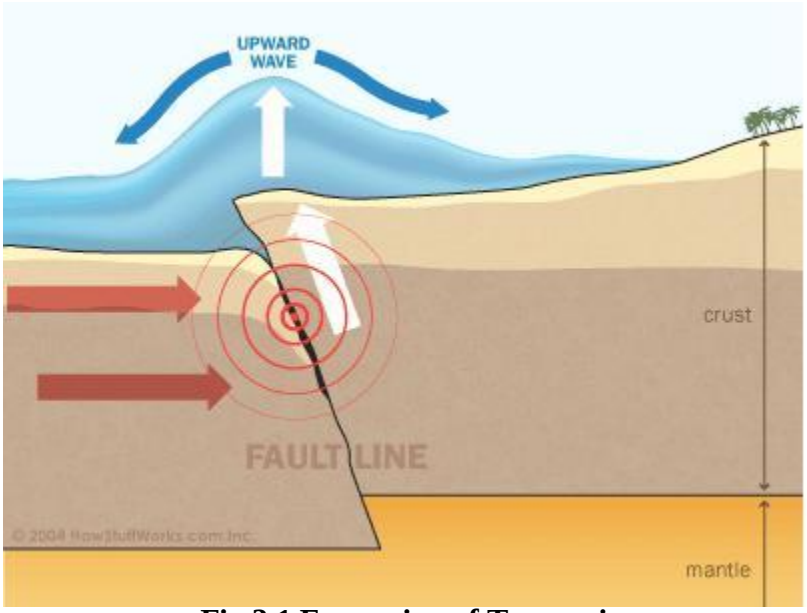


Fig.3.1 Formation of Tsunami

3.15.2 Concept of Tsunami

A tsunami is not a single wave but a series of waves like the ordinary waves which we see on seas.

3.15.3 Effects on Tsunami

- Tsunami attacks mostly the coastlines, causing devastating property, damage and loss of life.
- Tsunami can kill lot of human beings, livestock's.
- Tsunami may also spread lot of water borne diseases.

3.15.4 Tsunami Management

- ✓ Earthquakes under the water are monitored by sensors on the floor of the sea.
- ✓ The sensors send the information of floating buoys on the surface, whenever they detect any changes in pressure of the sea.
- ✓ The information is then relayed to satellites, which passes it on to the earth stations.
- ✓ Finally the country make the people alert through the media to take all necessary precautions.

3.15.5 Case studies

Tsunami- Japan 2011, India 2004.

UNIT - III Natural Resources

Forest resources : use and over-exploitation, deforestation, case studies - timber extinction, mining, dams and their effects on forests and tribal people - Water resources : use and over utilization of surface and ground water, dams - benefits and problems - Mineral Resources - use and exploitation environmental effects of extracting and using mineral resources, case studies - Food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies - Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. , Energy conservation procer, - Biogas-production and uses, anerobic digestion, case study - Land resources : Land as a resources, land degradation, man induced landslides, soil erosion and desertification - role of an individual in conservation of natural resources - Equitable use of resources for sustainable life styles. Introduction to Environmental Biochemistry, proteins - Biochemical degradation of pollutants, Bioconversion of pollutants.

Field study of local area to document environmental assets - river/ forest / grassland / hill / mountain.

1) Defn: Natural Resources

Life on this plant earth depends upon a large number of things and services provided by nature, which are known as Natural resources.

Example: water, air, soil, minerals, coal, forests, crops and wild life.

2) Kinds of natural Resources:-

1. Renewable Resources: which are inexhaustive and can be regenerated with in a given span of time. e.g. forests, wild life, wind energy, biomass energy, tidal energy, hydro power etc.

Solar energy is also a renewable form of energy as it is an inexhaustible source of energy.

2. Non-renewable Resources: which cannot be regenerated. e.g: fossil fuels like coal, petroleum, minerals etc.

Once we exhaust these reserves, the same cannot be replenished.

3) Major Natural Resources.

1. Forest Resources.
2. Water resources
3. Mineral resources
4. Food resources.
5. Energy resources
6. Land resources.

Forest Resources:

Forest are one of the most important natural resources on this earth.

Uses of forests:

1. Commercial uses: * Forest provide us a large number of commercial goods which include timber, fire wood, pulpwood, food items, gum, resins.

* Half of the timber cut each year is used as fuel for heating and cooking.

* one sixth of wood harvest is converted into pulp and used for paper industry.

2. Ecological uses:

(i) **Production of oxygen:** The trees produce Oxygen by photosynthesis. which is so vital for life on this earth.

They are rightly called as 'earth's lungs'

(ii) **Reducing global warming:** The main greenhouse gas carbon dioxide (CO_2) is absorbed by forests as raw material for photosynthesis.

Thus forest canopy acts as sink for CO_2 thus by reducing the problem of global

warming caused by green house gas CO_2.

(iii) Soil conservation. - forest bind the soil particles tightly in their roots and prevent soil erosion.

They also act as wind-breaks.

Over exploitation of forests:

* Since time immemorial, human have depended heavily on forests for food, medicine, shelter, wood and fuel.

* with growing civilization the demands for raw material like timber, pulp, minerals, fuel wood. etc...

Deforestation:

* Total forest area of world in 1990 was estimated to be 7,000 million hectares. which reduced to 2850 million ha in 1975 and felldown to just 2,300 million ha by 2000.

Major causes of Deforestation:

(i) shifting cultivation:

(ii) fuel requirement

(iii) Raw materials for industrial use.

(iv) Development projects.

(v) Growing food needs.

(vi) over grazing.

Major consequences of Deforestation:

(i) It threatens the existence of many wild life species due to destruction of their natural habitat.

(ii) Biodiversity is lost and along with that genetic diversity is eroded.

(iii) In hilly areas, it often leads to land slides.

(iv) Problm of soil erosion and loss of soil fertility increase.

Major activities in Forests:

1) Timber Extraction
2) Mining
3) – surface mining
   – subsurface mining

Dams and their effects on forests and people.

India has more than 1550 large dams, the maximum being in the state of Maharashtra followed by Gujarat & Madhya Pradesh.

– case study.

Water Resources:

Water is an indispensable natural resources on this earth on which all life depends.

About 97% of the earth's surface is covered by water and most of animals and plants have 60-65% water in their body.

Characteristics of water:

(i) It exists as a liquid over a wide range of temperature ie, from 0° to 100°C.

(ii) It has highest specific heat, due to which it warms up and cools down very slowly with out causing shocks of temperature jerks to the aquatic life.

(iii) It has high latent heat of vaporization Hence, it takes a huge amount of energy for getting vaporized. That's why it produces a cooling effect as it evaporates.

(iv) Due to high surface tension and cohesion it can easily rise through great heights through the trunk even in the tallest of the trees like sequoia.

Water use and over-exploitation:

* Water use by humans is of two types:

Water withdrawal: taking water from ground water or surface water resources.

Water consumption: the water which is taken up but not returned for reuse.

* Globally, only about 60 percent of the water withdrawn is consumed due to loss through evaporation.

* Water: A precious Natural Resource.
  - 97% salty water (marine)
  - 3% Fresh water.

* over use of ground water for drinking, irrigation domestic purposes has resulted in rapid depletion of ground water in various regions leading lower table. and drying of the wells.

* pollution of ground water aquifers — unsuitable for drinking.

Ground water:

About 9.86% of total fresh water resources is in the form of ground water and it is about 35-50 times that of surface water supplies.

A layer of sediment or rock that is highly permeable and contains water is called aquifer.

Unconfined Aquifer — overlaid by permeable earth materials

Confined Aquifer — which are sand witched between two impermeable layers of rock or sediments and recharged only in those areas where the aquifer intersects and land surface.

Effects of Ground water uraye.

1) Subsidence — When gond water withdrawal is more than its recharge rate, the sediments in the aquifer get compacted, a phenomenon known as Ground Subsidence.

2) Lowering of water table: — Mining of ground water is done extensively in arid and semi-arid regions for irrigating crop fields.

3) Water logging — When excessive irrigation is done with brackish water is raises the water table gradually leading to water-logging and salinity problems.

Surface Water:

The water coming through precipitation when does not percolate down into ground or does not return to the atmosphere as evaporation or transpiration loss,

assumes the form of streams, lakes, ponds, wetlands or artificial reservoirs known as Surface water.

Floods:

In some countries like India, and Bangladesh rainfall does not occur throughout year, rather 90% of it is concentrated into a few months.

Heavy rainfall causes floods in the low lying coastal areas.

Big dams - Benefits and problems:

Benefits:

1) River valley projects with big dams have usually been considered to play a key role in the development process due to their multiple uses.

2) India has the distinction of having the largest number of river valley projects.

3) These dams are often regarded as symbol of national development.

4) The dams have tremendous potential for economic upliftment and growth.

5) They can help in checking floods and famines, generate electricity and reduce water and power shortage, provide irrigation water to lower areas, provide drinking water in remote areas and promote navigation, fishery etc...

Environmental problems:

a) The upstream problems include the following

1) Displacement of tribal people.
2) Loss of forest, flora and fauna.
3) Changes in fisheries and spawning grounds.
4) Siltation and sedimentation of reservoirs.
5) Loss of non-forest land.
6) Stagnation and water logging near reservoir.
7) Breeding of vectors and spread of vector borne diseases.
8) Growth of aquatic weeds.

b) The downstream impacts include the following:

1) water logging and salinity due to over irrigation.
2) Micro-climatic changes.
3) flash floods.
4) Reduce water flow and silt deposition in river.
5) salt water intrusion at river mouth.
6) Loss of land fertility along the river since the sediments carrying nutrients get deposited in the reservoir.

Mineral Resources:

Minerals are naturally occurring inorganic, crystalline solids having a definite chemical composition and characteristics physical properties.

Uses and exploitation:

uses:

1) Development of industrial plants and machinery
2) Generation of energy e.g coal, lignite, uranium
3) Construction, housing, settlements.
4) Defence equipments – weapons, armaments.
5) Transportation means.
6) Agriculture – as fertilizer, seed dressing & fungicides (e.g: zinc, maneb – containing manganese etc) .
7) Jewellery – e.g Gold, silver, platinum, Diamond.

Non-metal Mineral	Major uses.
Silicate minerals	sand and gravel for construction, Bricks, paving etc.
Limestone	used for concrete, building stone, used in cement industry.
Gypsum	used in plaster wall-board in agriculture
Potash, Phosphorite	Used as fertilizers.
Sulphur pyrites	used in medicine, car battery, industry.

Metal – Aluminium, Chromium, copper, Iron, Lead Manganese, platinum group, gold, silver, Nickel.

Environmental impacts of mineral Extraction and use:

Indian Scenario: India is producer of 84 minerals the annual value of which is about Rs. 50000 crore.

At least six major mines need a mention here which are known for causing severe problems.

1) Jaduguda uranium Mine, Jharkand – exposing local people to radioactive hazards.

Impact of Mining:

Mining is done to extract minerals from deep deposits in soil by using **Sub-surface mining**. Or from shallow deposits by **surface mining**.

Surface mining: 1) Open-pit mining
2) Dredging
3) Strip mining.

1) Devegetation and defacing of landscape:
2) Subsidence of land.
3) Ground water contamination:
4) Surface water pollution
5) Air pollution.
6) occupational health hazards.

Remedial measures:

Safety of mine workers is usually not a priority subject of industry.

In order to minimize the adverse impacts of mining it is desirable to adopt eco friendly mining technology.

The low grade ores can be better utilized by using microbial - leaching technique.

The ores are inoculated with the desired strains of bacteria, which remove the impurities (like Sulphur) and leave the pure mineral.

The biological method is helpful from economic as well as environmental point of view.

Food Resources:

The main food resources include wheat, rice, maize, potato, barley, oats, cassava, sweet potato, sugarcane, pulses, sorghum, millet..

The Food and agriculture organization (FAO) of united nations estimated that on an average the minimum caloric intake on a global scale is 2500 calories/day.

People receiving less than 90% of these minimum dietary calories are called undernourished and if it is less than 80% they are said to be seriously undernourished.

Besides the minimum calorie intake we also need proteins, minerals etc. Deficiency or lack of nutrition often leads to malnutrition resulting in several diseases.

World Food Problems:

Every year our food pblm is killing as many people as were killed by the atomic bomb dropped on Hiroshima during world war II.

During the last 50 years world grain production has increased almost three times, thereby increasing percapita production by about 50%.

The World Food Summit, 1996 has set the target to reduce the number of undernourished to just half by 2015, which still means 410 million undernourished people on the earth.

Impacts of overgrazing and Agriculture:

(a) overgrazing:

Livestock wealth plays a crucial role in the rural life of our country.

India leads in livestock population in the world.

The huge population of livestock needs to be fed and the grazing lands or pasture near are not adequate.

Remedial measure:-

Safety of mine workers is usually not a priority subject of industry.

In order to minimize the adverse impact of mining it is desirable to adopt eco friendly mining technology. The low-grade ores can be better utilized by using microbial- leaching technique.

Impacts of overgrazing:-

1) Land degradation :-

Overgrazing removes the vegetal covers over the soil and the exposed soil gets compacted due to which the operative soil depth declines.

So the roots cannot go much deep into soil. and adequate soil moisture is not available

Organic recycling also declines in the ecosystem because not enough detritus or litter remains on the soil to be decomposed.

Overgrazing leads to multiple actions resulting in loss of soil structure, hydraulic conductivity and soil fertility.

2) Soil Erosion:

* Due to overgrazing by cattle, the cover of vegetation almost gets removed from the land.
* The soil becomes exposed and gets eroded by the action of strong wind, rainfall etc.
* The grass roots are very good binders of soil.
* When the grasses are removed, the soil become loose and susceptible to the action of wind and water.

(iii) Loss of useful species.

B) Agriculture:-

1. Traditional agriculture and its impacts:

It usually involves a small plot, simple tools, naturally available water, organic fertilizer and a mix of crops.

(i) Deforestation

(ii) Soil erosion.

(iii) Depletion of nutrients.

2. Modern Agriculture and its impacts:-

(i) Impacts related to high yielding varieties (HYV).

(ii) fertilizer related problems.

a) micronutrient imbalance

b) Nitrate pollution → Blue Baby Syndrome – concentration exceeds 25mg/l.

c) Eutrophication.

(iii) pesticide related problems.

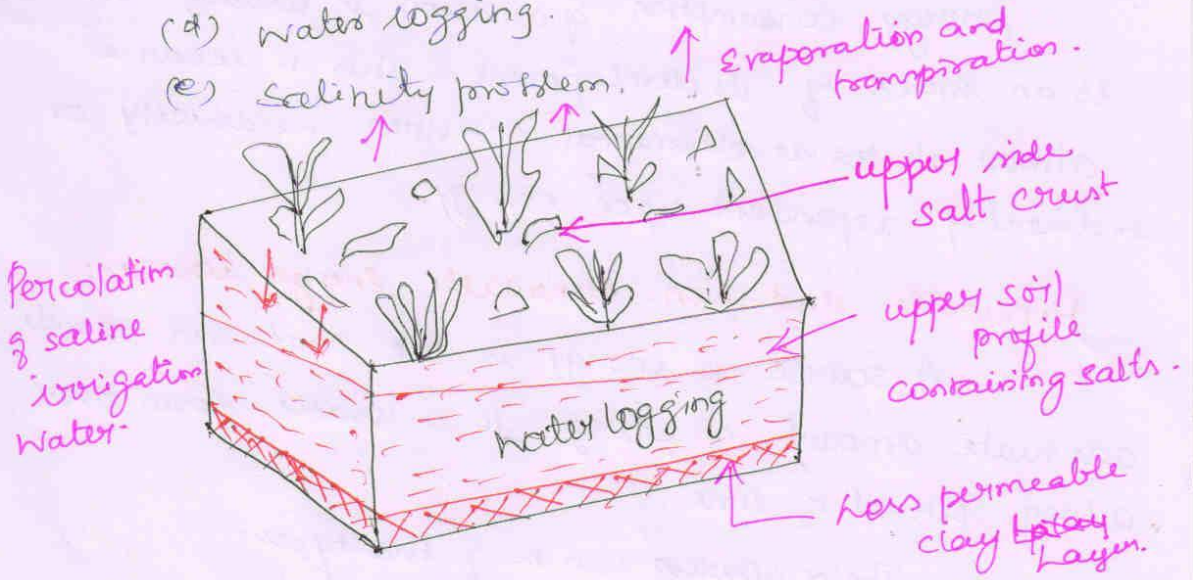
a) Creating resistance in pests and producing new pests.

(b) Death of non-target organism.

(c) Biological magnification

(d) water logging.

(e) Salinity problem.



Salinization

* Addition of salts with saline irrigation water
* Evapo-transpiration leaves behind salts.
* Salt build up occurs in upper soil profile.

Waterlogging

* Rain water and irrigation water percolate down
* water table rises.

Remedy:

The most common method for getting rid of salts is to flush them out by applying more good quality water to such soils.

Another method is laying underground network of perforated drainage pipes for flushing out the salts slowly.

Energy Resources:

Energy consumption of a nation is usually considered as an index of its development. This is because almost all the developmental activities are directly or indirectly dependent upon energy.

Renewable and Non-renewable Energy Sources:

A source of energy is one that can provide adequate amount of energy in a usable form over a long period of time.

These sources can be of two types:

(1) Renewable Resources which can be generated continuously in nature and are inexhaustible
Eg. wood, solar energy, wind energy.

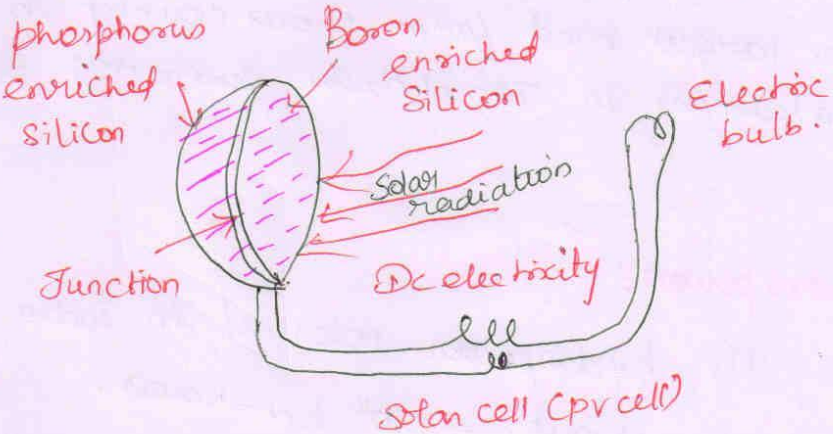
(2) Non renewable resources which have accumulated in nature over a long span of time and cannot be quickly replenished when exhausted.
Ex: coal, petroleum, natural gas and nuclear fuels like uranium and thorium.

a) Renewable Energy source:-

Solar energy: Sun is the ultimate source of energy, directly or indirectly for all other forms of energy.

(i) Solar heat collectors – (Explain)

(ii) solar cells. – They are also known as photo voltaic cells or pv cells.



a) Solar cell.

(iii) Solar Cooker. – Solar cookers make use of solar heat by reflecting the solar radiation using a mirror directly on to a glass sheet which covers the black insulated box within which the raw food is kept.

(iv) Solar water heater.

(v) Solar furnace

(vi) Solar power plant.

Wind Energy:

A large number of wind mills are installed in clusters called wind farms, which feed power to the utility

grid and produce a large amount of electricity.

* The wind power potential of our country is estimated to be about 20000 MW, while at present we are generating about 1020 MW.

The largest wind farm of our country is near Kanyakumari in Tamil nadu generating 380 MW electricity.

Hydro power:

The hydropower potential in India is estimated to be about 4×10^{11} kW-hours.

The water flowing in the river is collected by constructing a big dam where the water is stored and allowed to fall from a height.

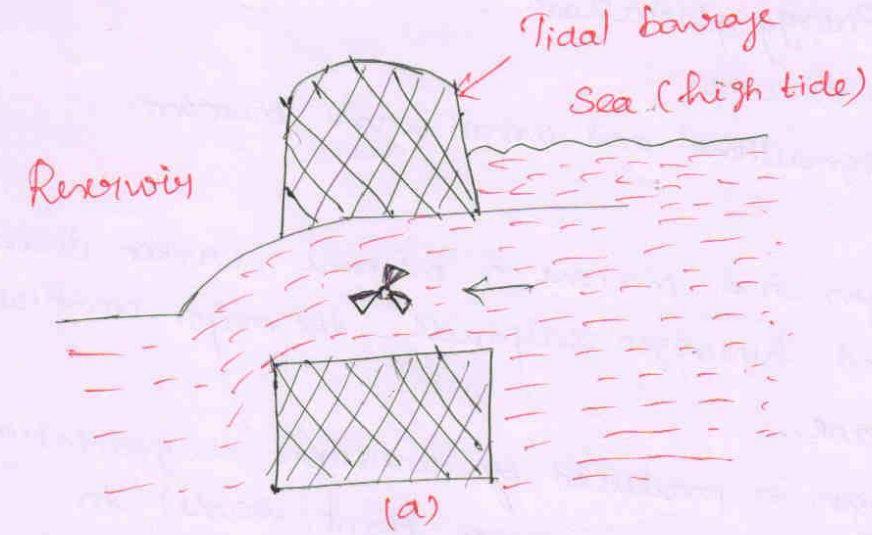
The blades of the turbine located at the bottom of the dam move with the fast moving water which in turn rotate the generator and produce electricity.

Tidal Energy:

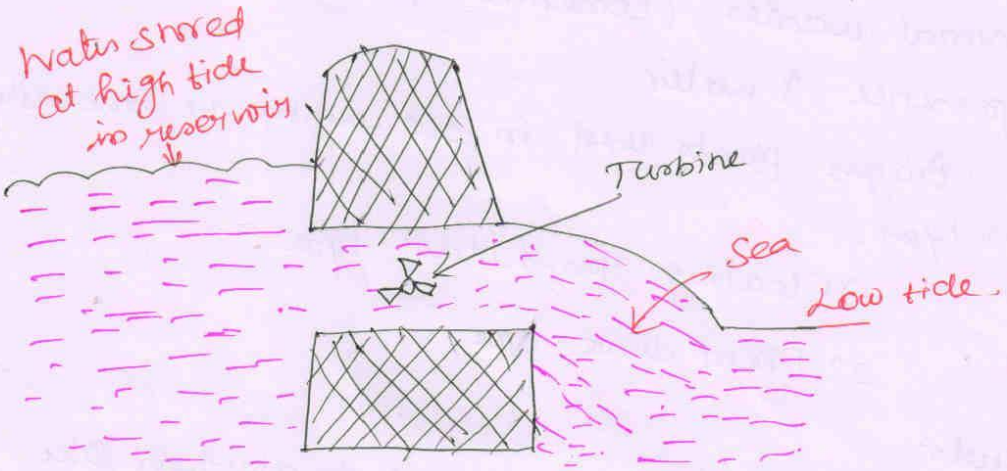
Ocean tide produced by gravitational forces of sun and moon contain enormous amount of energy.

The 'high tide' and 'low tide' refer to the

the rise and falling waters in the oceans.



(a)



(b)

Water flows into the reservoir to turn the turbine at high tide (a), and flow out from reservoir to the sea again turning the turbine at low tide.

Biogas energy:

a) Energy plantations.
b) petro-crops
c) Agricultural and urban waste biomass.

Biogas:

Biogas is a mixture of methane, carbon dioxide hydrogen and hydrogen sulphide, the major constituent being methane.

Biogas is produced by anaerobic degradation of animal wastes (sometimes plant waste) in the presence of water.

Biogas plants used in our country are basically of two type.

1) Floating gas-holder type
2) Fixed dome type.

Biofuels:

Bio mass can be fermented to alcohols like ethanol and methanol which can be used as fuels.

Gasohol is a common fuel used in Brazil and Zimbabwe for running cars and buses.

Methanol is very useful since it burns at a lower temperature than gasoline or diesel.

Methanol can be easily obtained from woody plants and ethanol from grain based or sugar-containing plants.

* Hydrogen as a fuel
* coal
* petroleum
* Natural gas

} Explain notes after book.

Nuclear Energy.

Nuclear energy is known for its high destructive power as evidenced from nuclear weapons.

The nuclear energy can also be harnessed for provided commercial energy.

Nuclear energy can be generated by two types of reactions.

(i) Nuclear Fission: It is the nuclear change in which nucleus of certain isotopes with large mass numbers are split in to ~~big~~ lighter nuclei on bombardment by neutrons and a large amounts of energy is released through a chain reaction.

$$_{92}U^{235} + {}_{0}n^{1} \longrightarrow {}_{36}Kr^{92} + {}_{56}Ba^{141} + 3\,{}_{0}n^{1} + \text{Energy}.$$

(2) Nuclear fusion:-

Here two isotopes of light element are forced together at extremely high temperature until they fuse to form a heavier nucleus releasing enormous energy in the process.

$$_1H^2 + _1H^2 \longrightarrow {}_3He^2 + {}_0n^1 + \text{Energy.}$$

Nuclear power in India is still not very well developed. There are four nuclear power stations with an installed capacity of 2005 MW.

Land Resources.

Land is a finite and valuable resources upon which we depend for our food, fibre and feed wood. the basic amenities of life.

Land Degradation:

With increasing population growth the demands for arable land for producing food, fibre and feed wood is also increasing.

Hence there is more and more pressure on the limited land resources which are getting degraded due to over-exploitation.

Soil erosion:

Soil erosion is wearing away of soil, soil erosion is defined as the movement of soil components, especially surface litter and topsoil from one place to another.

(i) Normal erosion or geologic erosion

(ii) Accelerated erosion.

1) (i) Climatic agents

(ii) wind erosion.

* Saltation
* suspension
* surface creep

(ii) water induced soil erosion.

(2) Biotic agents.

Soil conservation Practices.

(i) conservational till farming.

(ii) contour farming

(iii) Terracing

(iv) Strip cropping.

(v) Alley cropping.

Desertification:

Desertification is a process whereby the productive potential of arid or semi arid land falls by ten percent or more.

Causes of Desertification: formation of deserts may takes place due to natural phenomena like climate change or may be due to abusive use of land.

a) Deforestation: The process of denuding and degrading forest land initiates a desert producing cycle that feeds on itself.

(b) Overgrazing:- The region most seriously affected by desertification are the cattle producing areas of the world.

(C) Mining and quarrying:- These activities are also responsible for loss of vegetal cover and denudation of extensive land areas leading to desertification.

Unit - IV

CHAPTER6 SOCIAL ISSUES AND THE ENVIRONMENT

4.1 Objectives

Developing and modernizing the technologies without losing our sound traditional values and practices is essential.

4.1.1 Sustainable development

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

4.1.2 True sustainable development

Optimum use of natural resources with high degree of reusability, minimum wastage, least generation of toxic byproducts and maximum productivity.

4.1.3 Dimensions of sustainable development

Multi dimensional concept – derived from interactions between society, economy and environment.

4.1.4 Aspects of sustainable development

- Inter-generational equity
- Intra-generational equity.

4.1.5 Approaches for sustainable development

- Developing appropriate technology - locally adaptable, eco-friendly, resource efficient and culturally suitable.
- Reduce, reuse, recycle [3R] approach – reduces waste generation and pollution
- Providing environmental education and awareness – changing attitude of the people

- Consumption of renewable resources – attain sustainability
- Conservation of non renewable resources – conserved by recycling and reusing
- Population control.

4.1.6 Urban problems related to energy

- Energy demanding activities
- Solution for urban energy problem.

4.2 WATER CONSERVATION

The process of saving water for future utilization.

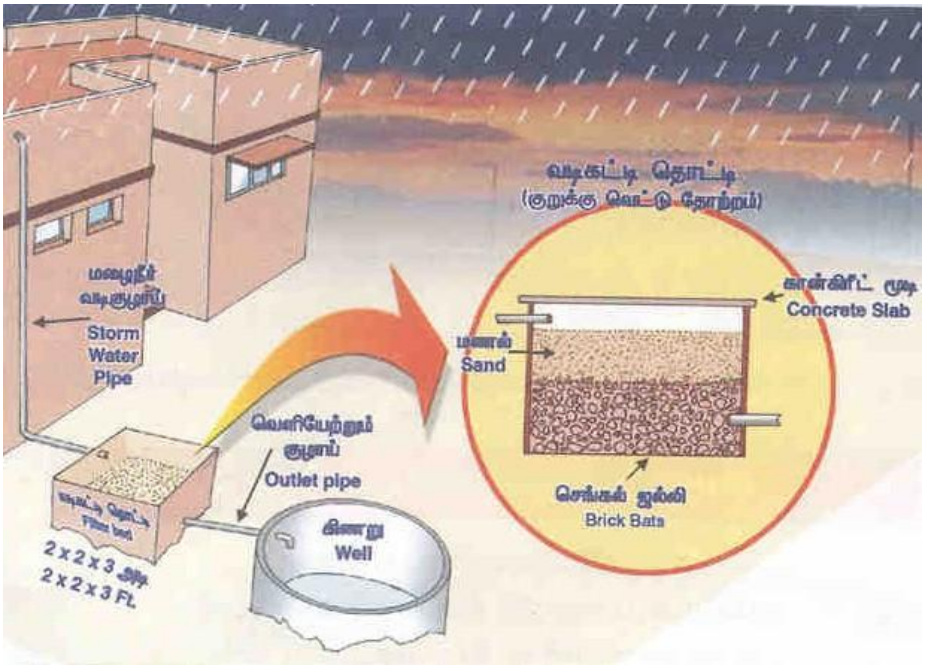


Fig.4.1 Rain Water Harvesting

4.2.1 Need for water conservation

- ✓ Changes in environmental factors
- ✓ Better lifestyles
- ✓ Increase in population
- ✓ Deforestation
- ✓ Over exploitation of ground water
- ✓ Agricultural and industrial activities.

4.2.2 Strategies of water conservation

- ➢ Reducing evaporation losses
- ➢ Reducing irrigation losses
- ➢ Re use of water
- ➢ Preventing of wastage of water
- ➢ Decreasing run-off losses
- ➢ Avoid discharge of sewage.

4.2.3 Methods of water conservation

Rain water harvesting- A technique of capturing and storing of rain water for further utilization.

4.2.4 Objectives of rain water harvesting

- ❖ Increasing demands
- ❖ Recharging the ground water
- ❖ Reducing the ground water
- ❖ Increase in hydro static pressure.

4.3 WATER SHED MANAGEMENT – The management of rainfall and resultant run-off.

4.3.1 Objectives

- To minimize of risk of floods
- For improving the economy
- For developmental activities
- To generate huge employment opportunities
- To promote forestry
- To protect soil from erosion.

4.3.2 Factors affecting watershed

- Unplanned land use
- Deforestation
- Droughty climates.

4.4 RESETTLEMENT AND REHABILITATION OF PEOPLE

4.4.1 Causes

- Due to Developmental activities
- Due to Disaster
- Due to conservation initiatives.

4.4.2 Rehabilitation issues

- ✓ Displacement of tribal's increases poverty
- ✓ Breakup of families
- ✓ Communal ownership of property
- ✓ Vanishing social and cultural activities
- ✓ Loss of identity between the people.

4.4.3 Case Studies

SardarSarovar Dam, the Theri dam Project, Pong Dam.

4.4.4 Environmental ethics

Refers to the issues, principles and guidelines relating to human interactions with their environment.

4.4.5 Environmental problems

- ❖ Deforestation
- ❖ Population growth
- ❖ Pollution due to effluent and smoke
- ❖ Water scarcity
- ❖ Land degradation.

4.4.6 Solutions

- Reducing the energy sources
- Recycle and reuse of waste products
- Soil degradation
- Sustainable development
- Protection of Bio – diversity
- Reducing the population.

4.5 CLIMATE

The average weather of an area.

4.5.1 Causes of climate change

- Presence of green house gases
- Depletion of ozone gases.

4.5.2 Effect of climate change

- Migration of animals
- Upsetting the hydrological cycles results in floods and droughts
- Changes in global pattern of winds.

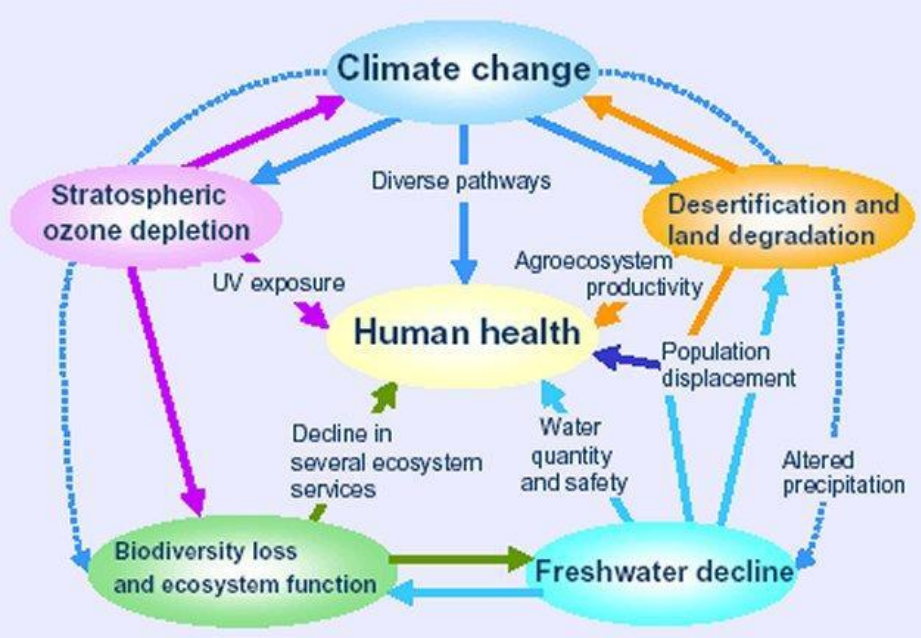


Fig.4.2 Climate Changes

4.5.3 Green house effect

The progressive warming of earth surface due to blanketing effect of man made CO_2 in the atmosphere.

Green house gases- causing global warming

CO_2, CH_4, N_2O, CFCs.

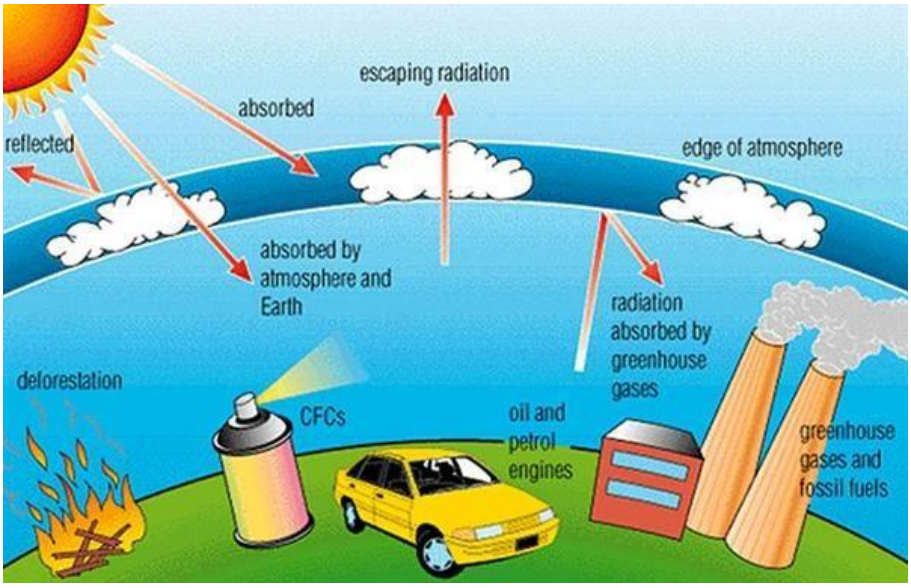


Fig.4.3 Green House effect

4.5.4 Effect on global warming

- Sea level
- Agriculture and forestry
- Water resources
- Terrestrial ecosystems
- Human health.

4.5.5. Measures

- ❖ Reducing CO_2 emission
- ❖ Utilizing renewable resources
- ❖ Plant more trees
- ❖ Adopt sustainable agriculture.

4.6 ACID RAIN

The precipitation of CO_2, SO_2, and NO_2 gases as pollutants in water.

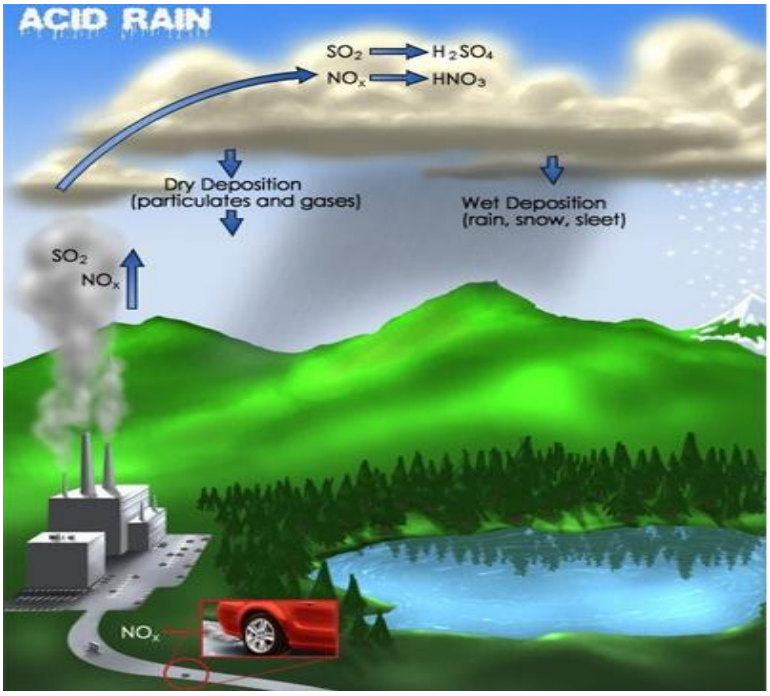


Fig.4.4 Acid Rain formation

4.6.1 Effects of acid rain

1. Human beings

- Destroy life – nervous, respiratory and digestive system
- Causes premature death from heart and lung disorders.

2. On Buildings

Corrosion - TajMahal, houses, statues, bridges, metals.

3. On terrestrial and Lake Ecosystem

- Reduces rate of photosynthesis, growth of crops, Fish population.
- And bio mass production.

4.6.2 Control measures

- ✓ Clean combustion technologies
- ✓ Using pollution control equipments
- ✓ Replacement of coal by natural gas
- ✓ Liming of lakes and soils.

4.7 OZONE LAYER DEPLETION

Ozone is formed in the stratosphere by photo - chemical reaction.

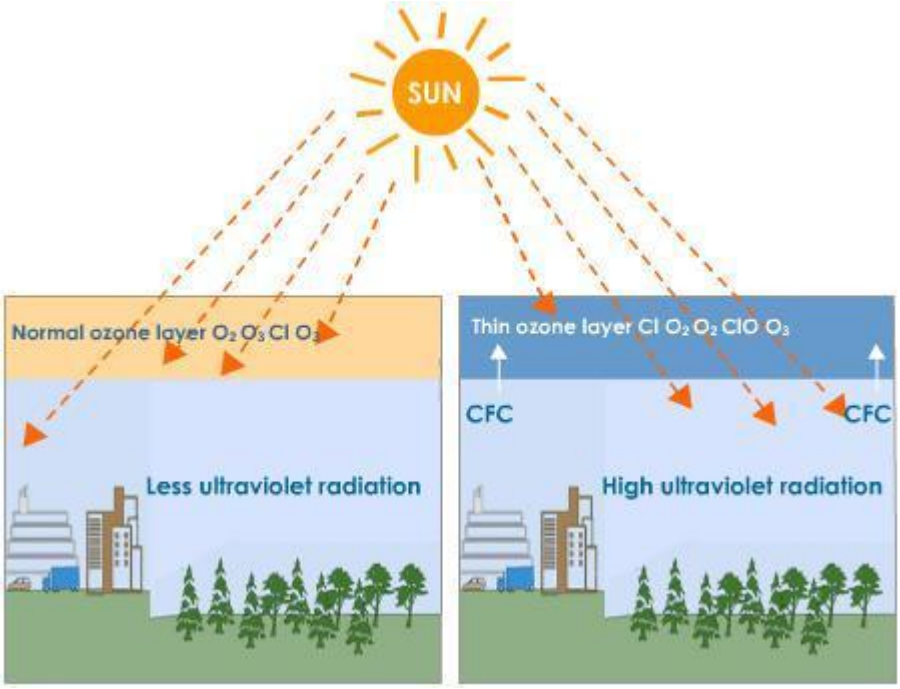


Fig.4.5 Depletion of Ozone layer

4.7.1 Ozone depleting chemicals

Chloro Fluro carbon, Hydro chloro fluoro carbon, Bromo fluoroCarbon.

4.7.2 Effects

- On human health – Skin cancer, cataracts, allergies etc.
- On aquatic systems- phyto plankton, fish
- On materials- paints, plastics
- On climate – increasing the average temperature of the earth surface.

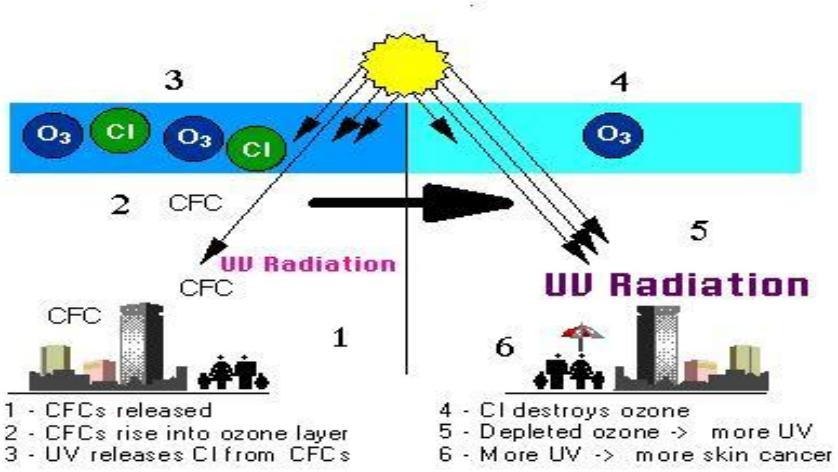


Fig.4.6Causes and Effects of O_3 depletion

4.7.3 Control Measures

- Replacing CFCs

- Use of methyl bromide – crop fumigant.

4.8 NUCLEAR ACCIDENTS AND HOLOCAUST

The release of large amounts of nuclear energy and radioactive products into the atmosphere.

Nuclear energy was researched by man as an alternate source of energy compared to fossil fuels. Although this did happen along with the benefits came its downfall. In the short history of nuclear energy there has been a number of accidents that have surpassed any natural calamity. A single nuclear accident causes loss of life, long term illness and destruction of property on a large scale.

Examples

1.THE CARELESS SITING OF INDUSTRIES-Bhopal gas tragedy

The careless siting of industries and relatively poor regulatory controls leads to ill health in the.The Bhopal gas tragedy on December 2nd 1984, where Union Carbide's Plant leaked 43 tons of Methyl Isocynate and other substances, used in the manufacture of pesticides is one of the worst industrial accidents in the recent past. Of the 5,20,000 people who were exposed to the gas - 8,000 died during the first week and another 8,000 later. The impact of the survivors is visible even today.

Fig.4.7 Bhopal gas tragedy plant

2. CHERNOBYL REACTOR INCIDENT

On April 25, 1986, Russian engineers and scientists begin preliminary tests on Chernobyl power plant's 4th reactor. In order to control the experiment, the automatic control system was shut down. After some work, stability was reached at very low power outputs. Unfortunately, manual control of the water pressure wasn't maintained. The reactor began to create excess heat. Without the automatic control, the control rods couldn't be reinserted in time; a deadly chain reaction had begun. Within a matter of 3-4 seconds, the reactor went from 5% output to 100 times its normal level. The water in the reactor flash-

boiled, creating an explosion that leveled thousands of tons of concrete and steel, including the housing for the reactor. The steam carried almost 70% of the nuclear material out of the reactor into the surrounding environment. Several thousand volunteers died on the scene, and it is estimated that 7,000 to 10,000 volunteers died in total, considering short and long-term effects. Thousands of miles from the scene, the birth defect rate became double the world average. It is also estimated that 150,000 were put at risk for thyroid cancer, and over 800,000 children were put at risk of contracting leukemia. 2 million acres of land (1/5 of the usable farmland in the Ukraine) was, and still is, completely unusable. It remains difficult to determine the scope of the disaster; radiation resulting from the event was detected all over the globe. It is estimated that it may cost up to $400 billion and will take up to 200 years to correct the damage done to the area, and to compensate those affected by the meltdown.

Fig.4.8 Chernobyl Reactor

4.8.1 Effects

- Nuclear winter
- Ignition of all combustible material

4.8.2

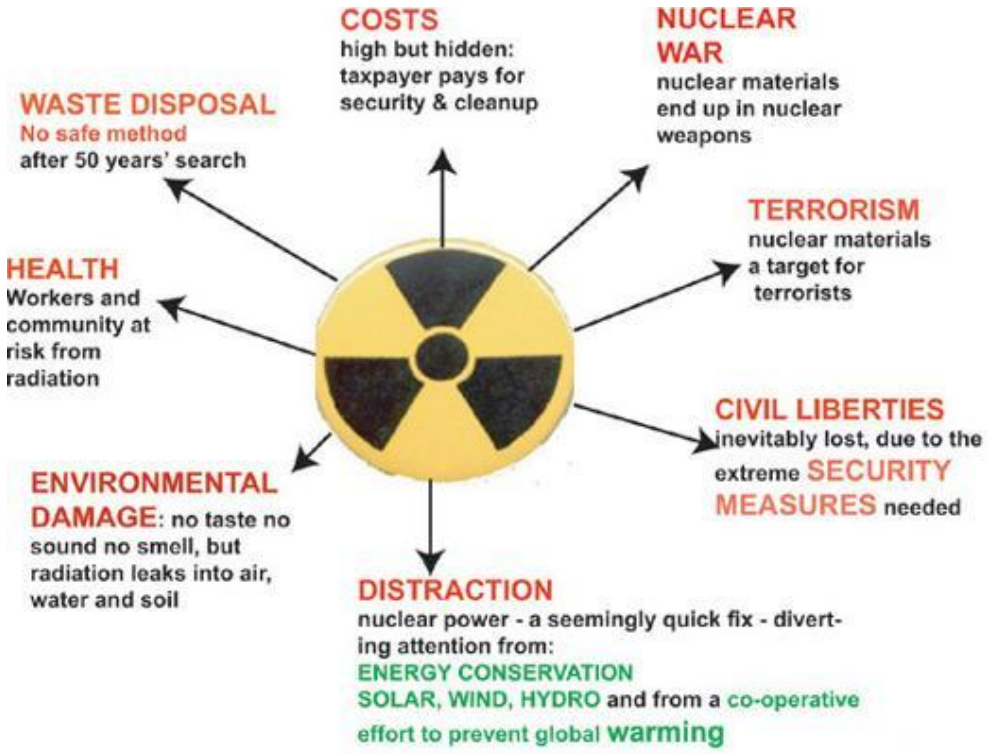


Fig.4.9 Effects of Nuclear Hazards

Control Measures

- Suitable precautions to avoid accident
- Constant monitoring of the radiation level
- Checks and control measures done by Atomic Energy Regulatory Board.

4.9 WASTE LAND RECLAMATION

Waste land: - The land which is not in use – unproductive, unfit for cultivation another economic uses.

4.9.1Types of waste land

1. Uncultivable waste land

– Barren rocky areas, hilly slopes, sandy deserts.

2. Cultivable waste land

- degraded forest lands, gullied lands. Marsh lands, saline land etc.

4.9.2 Causes for waste land formation

- Soil Erosion, Deforestation, Water logging, Salinity.
- Excessive use of pesticides.
- Construction of dams.
- Over-exploitation of natural resources.
- Sewage and industrial wastes.

- ❖ Mining
- ❖ Growing demands for fuel, fodder wood and food causes degradation and loss of soil productivity.

4.9.3 Objectives of waste land reclamation

- To improve the physical structure and quality of the soil
- To prevent soil erosion
- To avoid over – exploitation of natural resources
- To conserve the biological resources.

4.9.4 Methods of waste land reclamation

- ✓ Drainage
- ✓ Leaching
- ✓ Irrigation practices
- ✓ Green manures and bio fertilizers
- ✓ Application of Gypsum
- ✓ Afforestation programmes
- ✓ Social forestry programmes.

4.9.5 Consumerisation of Waste products

- Consumerisation – Consumption of resources.
- Traditionally favorable rights of sellers
- Right to introduce product, price, Incentives
- Traditionally buyer rights
- Right to buy, right to expect the product to perform as claimed

4.9.6 Important information to be known by buyers

- ➢ About ingredients,
- ➢ Manufacturing dates,
- ➢ Expiry date, etc.

4.9.7 Objectives of Consumerisation

- Improves rights and power of the buyers
- Making the manufacturer liable
- Reuse and recycle the product
- Reclaiming useful parts
- Reusable packing materials
- Health and happiness.

4.10 SOURCES OF WASTES

Glass, papers, garbage's, food waste, automobile waste, dead animals etc.

4.10.1 E – Waste

Computers, printers, mobile phones, Xerox machines, calculators etc.

4.10.2 Effects of wastes

- Dangerous to human life
- Degrade soil
- Cadmium in chips, Cathode ray tube, PVC causes cancer and other respiratory problems.
- Non biodegradable plastics reduce toxic gases.

4.10.3 Factors affecting consumerisation and generation of wastes

- ✓ People over – Population
- ✓ Consumption over – Population.

4.11 ENVIRONMENTAL LEGISLATION AND LAWS – IMPORTANT PROTECTION ACTS

- ❖ **Water Act 1974, 1978**-An Act to provide for the levy and collection of water consumed by persons carrying on certain industries and by local authorities, with a view to augment the resources of the Central Board and the State Boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974.
- ❖ **Water amendment Act 1987**-As a result, some of thebasic principles of water law applicable today in India derive from irrigation acts. The early Northern India Canaland Drainage Act, 1873 sought, for instance, to regulate irrigation, navigation and drainage in Northern India.
- o One of the long-term implications of this act was the introduction of the right of the Government to ‘use andcontrol for public purposes the water of all rivers and streams flowing in natural channels, and of all lakes. The1873 act refrained from asserting state ownership over surface waters. Nevertheless, this act is a milestone sinceit asserted the right of the Government to control water use for the benefit of the broader public.
- o This wasprogressively strengthened. Thus, the Madhya Pradesh Irrigation Act, 1931 went much further and asserted directstate control over water: ‘All rights in the water of any river, natural stream or natural drainage channel, naturallake or other natural collection of water shall vest in the Government.

- ❖ **Air Act 1981**-An Act to provide for the prevention, control and abatement of air pollution, for the establishment, with a view to carrying out the aforesaid purposes, of Boards, for conferring on and assigning to such Boards powers and functions relating thereto and for matters connected therewith.

    - Whereas decisions were taken at the United Nations Conference on the Hum an Environment held in Stockholm in June, 1972, in which India participated, to take appropriate steps for the preservation of the natural resources of the earth which, among other things, include the preservation

of the quality of air and control of air pollution; and whereas it is considered necessary to implement the decisions aforesaid in so far as they relate to the preservation of the quality of air and control of air pollution;

- Be it enacted by Parliament in the Thirty-second Year of the Republic of India

- **Wild life Act 1972-**It refers to a sweeping package of legislation enacted in 1972 by the Government of India. Before 1972, India only had five designated national parks. Among other reforms, the Act established schedules of protected plant and animal species; hunting or harvesting these species was largely outlawed. The Act provides for the protection of wild animals, birds and plants; and for matters connected therewith or ancillary or incidental thereto. Formalization of national parks, wildlife sanctuaries, conservation reserves and community reserves. Protection to habitat and wildlife within premises of such protected areas. Development of National Board for Wildlife and State Boards for Wildlife for identification of future protected areas. Up to April 2010 there have been 16 convictions under this act relating to the death of tigers.

- **Forest Act 1980 and Environment Act 1972**- Environment protection act 1986 (23 May 1986) I- it is a legislation which signifies the central government determination to take effective steps to protect the environment.

Stating that: No State Government or other authority shall make any order directing-

(i) that any reserved forest shall cease to be reserved;

(ii) that any forest land or any portion thereof may be used for any non-forest purpose;

(iii) that any forest land or any portion thereof may be assigned by way of lease or otherwise to any private person or to any authority, corporation, agency or any other organization not owned, managed or controlled by Government;

(iv) that any forest land or any portion thereof may be cleared of trees which have grown naturally in that land or portion, for the purpose of using it for reafforestat.

4.12 ISSUES INVOLVED IN ENFORCEMENT OF ENVIRONMENTAL LEGISLATION

- Drawbacks of wildlife protection Act
- Drawbacks of Forest Act 1980 and
- Drawbacks of Environment Act 1972.

4.13 PUBLIC AWARENESS

Our environment is presently degrading due to many activities like pollution, deforestation, overgrazing, rapid industrialization and urbanization.

4.13.1 Objectives of public awareness

- Create awareness among people of rural and city about ecological imbalances, local environment, technological development and various development plants.

- To organize meetings, group discussion on development, tree plantation programmes exhibitions.
- To learn to live simple and eco-friendlily manner.

4.13.2 Methods to create environmental awareness

- ✓ In schools and colleges
- ✓ Through mass – media
- ✓ Cinema
- ✓ Newspapers
- ✓ Audio - Visual media
- ✓ Voluntary organizations
- ✓ Traditional techniques
- ✓ Arranging competitions
- ✓ Leaders appeal
- ✓ Non – government organizations.

Unit - V

CHAPTER 7 HUMAN POPULATION AND ENVIRONMENT

5.1 Objectives

- To get a knowledge on human population and human rights.
- To educate the students on value education.
- To equip the students towards the modern technology with respect to environment and human health.

5.1.1 Population density

Number of individuals of the population per unit area or per unit volume.

5.1.2 Parameters affecting population size

- ✓ Birth rate
- ✓ Death rate or Mortality
- ✓ Immigration
- ✓ Emigration.

5.1.3 Population Growth

The rapid growth of the global population for the past 100 years from the difference between the rate of birth and death.

Table.5.1 Population statistics in India as on 2010

Rank	State or union territory	Population	%	Rural Pop.	Urban Pop.	Area km²	Density (per km²)	Area mi²	Density (per mi²)	Sex ratio
1	Uttar Pradesh	193,977,661	16.16%	131,658,339	34,539,582	240,928	690	93,022.8	1,787	898
2	Maharashtra	110,878,627	9.42%	55,777,647	41,100,980	307,713	315	118,808.7	815	922
3	Bihar	102,998,509	8.07%	74,316,709	8,681,800	94,163	881	36,356.5	2,283	921
4	West Bengal	90,176,197	7.79%	57,748,946	22,427,251	88,752	903	34,267.3	2,340	934
5	Andhra Pradesh	82,210,007	7.41%	55,401,067	20,808,940	275,045	277	106,195.5	718	978
6	**Tamil Nadu**	**62,405,679**	**6.07%**	**34,921,681**	**27,483,998**	**130,058**	**480**	**50,215.7**	**1,243**	**987**
7	Madhya Pradesh	60,348,023	5.87%	44,380,878	15,967,145	308,245	196	119,014.1	507	919
8	Rajasthan	56,507,188	5.49%	43,292,813	13,214,375	342,239	165	132,139.2	428	921
9	Karnataka	52,850,562	5.14%	34,889,033	17,961,529	191,791	276	74,050.9	714	965
10	Gujarat	50,671,017	4.93%	31,740,767	18,930,250	196,024	258	75,685.3	669	920
11	Orissa	36,804,660	3.58%	31,287,422	5,517,238	155,707	236	60,118.8	612	972
12	Kerala	31,841,374	3.10%	23,574,449	8,266,925	38,863	819	15,005.1	2,122	1,058
13	Jharkhand	26,945,829	2.62%	20,952,088	5,993,741	79,714	338	30,777.7	875	941
14	Assam	26,655,528	2.59%	23,216,288	3,439,240	78,438	340	30,285.1	880	935
15	Punjab	24,358,999	2.37%	16,096,488	8,262,511	50,362	484	19,444.9	1,253	876
16	Haryana	21,144,564	2.06%	15,029,260	6,115,304	44,212	478	17,070.3	1,239	861

17	Chhattisgarh	20,833,803	2.03%	16,648,056	4,185,747	135,191	154	52,197.5	399	989
18	Jammu and Kashmir	10,143,700	0.99%	7,627,062	2,516,638	222,236	46	85,805.8	118	892
19	Uttarakhand	8,489,349	0.83%	6,310,275	2,179,074	53,483	159	20,649.9	411	962
20	Himachal Pradesh	6,077,900	0.59%	5,482,319	595,581	55,673	109	21,495.5	283	968
21	Tripura	3,199,203	0.31%	2,653,453	545,750	10,486	305	4,048.7	790	948
22	Meghalaya	2,318,822	0.23%	1,864,711	454,111	22,429	103	8,659.9	268	972
23	Manipur[β]	2,166,788	0.21%	1,590,820	575,968	22,327	97	8,620.5	251	974
24	Nagaland	1,990,036	0.19%	1,647,249	342,787	16,579	120	6,401.2	311	900
25	Goa	1,347,668	0.13%	677,091	670,577	3,702	364	1,429.4	943	961
26	Arunachal Pradesh	1,097,968	0.11%	870,087	227,881	83,743	13	32,333.4	34	893
27	Mizoram	888,573	0.09%	447,567	441,006	21,081	42	8,139.4	109	935
28	Sikkim	540,851	0.05%	480,981	59,870	7,096	76	2,739.8	197	875
UT1	Delhi	13,850,507	1.35%	944,727	12,905,780	1,483	9,340	572.6	24,189	821
UT2	Puducherry	974,345	0.09%	325,726	648,619	479	2,034	184.9	5,268	1,001
UT3	Chandigarh	900,635	0.09%	92,120	808,515	114	7,900	44.0	20,462	777
UT4	Andaman and Nicobar Islands	356,152	0.03%	239,954	116,198	8,249	43	3,185.0	112	846
UT5	Dadra and Nagar Haveli	220,490	0.02%	170,027	50,463	491	449	189.6	1,163	812
UT6	Daman and Diu	158,204	0.02%	100,856	57,348	112	1,413	43.2	3,658	710
UT7	Lakshadweep	60,650	0.01%	33,683	26,967	32	1,895	12.4	4,909	948
Total	**India**	**1,206,610,32**	**100.00**	**742,490,639**	**286,119,68**	**3,287,24**	**313**	**1,269,21**	**810**	**933**

5.1.4 Causes of rapid population growth

- The rapid population growth is due to decrease in death rate and increase in birth rate.
- Availability of antibiotics, immunization, increased food production, clean water and air decreases the famine-related deaths.
- In agricultural based countries, children are required to help parents in the field that is why population increases in the developing countries.

5.15 Characteristics of population growth

- Exponential growth
- Doubling time
- Infant mortality rate
- Total fertility rate
- Replacement level
- Male/female ratio
- Demographic transition.

5.1.6 Variation of population based on age structure

1. Pyramid shaped – India, Bangladesh, and Ethiopia.

2. Bell shaped – France, USA, and UK.

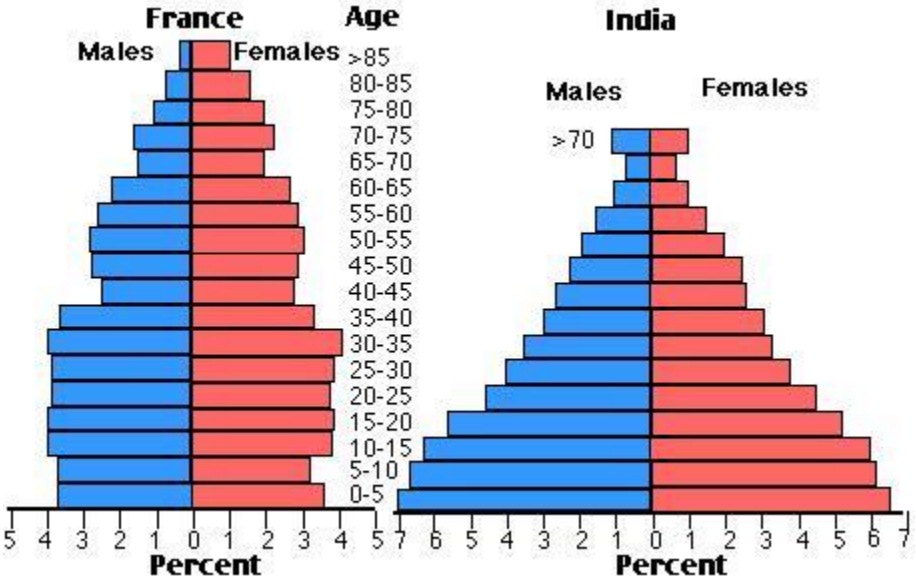


Fig. 5.1 Bell and Pyramid shaped Population structure

3. Urn shaped - Germany, Italy, and Japan.

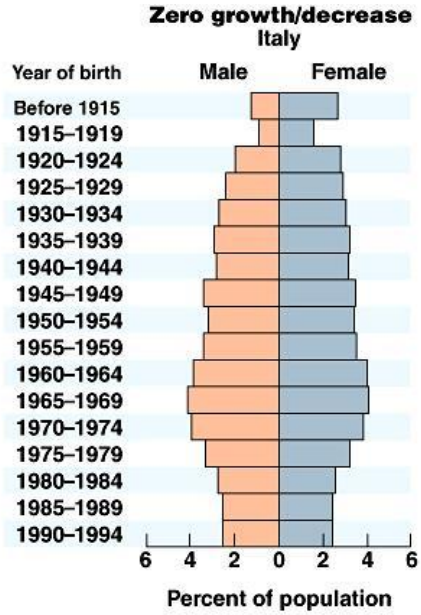


Fig. 5.2 Urn shaped Population structure

5.1.7 Population Explosion

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

5.1.8 Causes

Modern medical facilities, life expectancy, illiteracy.

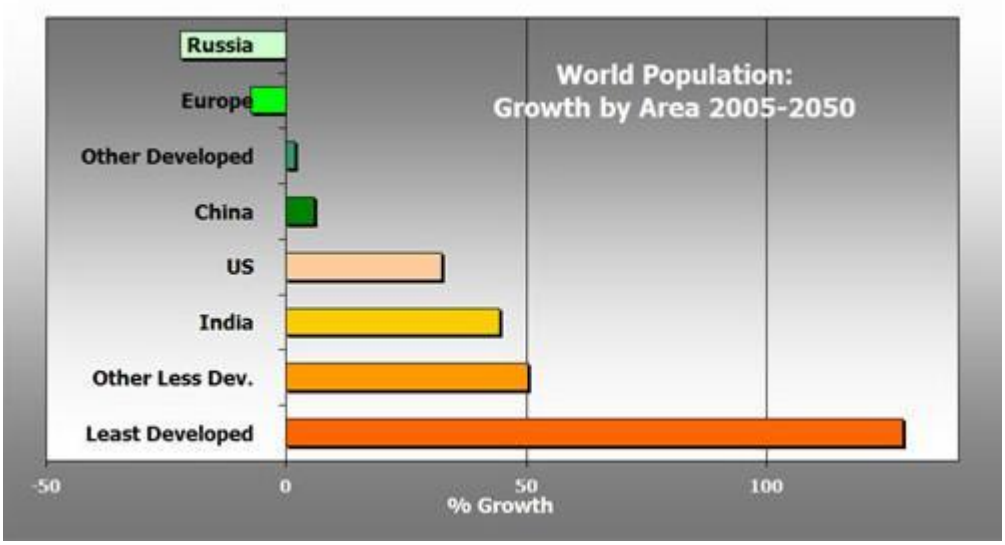


Fig. 5.3 World Population Growth

5.1.9 Effects

Poverty, Environmental degradation, over –exploitation of natural resources, threat, communal war.

5.1.10 Remedy

Through birth control programmes.

5.2 FAMILY WELFARE PROGRAMME

5.2.1 Objectives

- Slowing down the population explosion
- Over exploitation of natural resources

5.3 FAMILY PLANNING PROGRAMME

5.3.1Objectives

- Reduce infant mortality rate.
- Encourage late marriages.
- Improve women's health.
- Control of communal diseases.

5.4 ENVIRONMENT AND HUMAN HEALTH

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

5.5 HUMAN RIGHTS

- Human right to freedom
- Human right to property
- Human right to freedom of religion
- Human right to culture and education
- Human right to constitutional remedies
- Human right to equality
- Human right against exploitation
- Human right to food and environment
- Human right to good health.
- To promote interdependence among Asian countries in all areas of cooperation by identifying Asia's common strengths and opportunities which will help reduce poverty and improve the quality of life for Asian people whilst developing a knowledge-based society within Asia and enhancing community and people empowerment;
- To expand the trade and financial market within Asia and increase the bargaining power of Asian countries in lieu of competition and, in turn, enhance Asia's economic competitiveness in the global market;
- To serve as the missing link in Asian cooperation by building upon Asia's potentials and strengths through supplementing and complementing existing cooperative frameworks so as to become a viable partner for other regions;
- To ultimately transform the Asian continent into an Asian Community, capable of interacting with the rest of the world on a more equal footing and contributing more positively towards mutual peace and prosperity.

5.6 VALUE EDUCATION

Education

It is nothing but learning about the particular thing through knowledge. We can identify our values and ourselves with the help of knowledge and experience.

5.6.1 Types

1. Formal education-Self related learning process.
2. Value education – Analyze based on instruments.
3. Value-based environment education- Based on environment.

5.6.2 Objectives

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

5.6.3 Types of values

- ❖ Universal values-Importance of the human conditions.
- ❖ Cultural values-Right, wrong, good and bad.
- ❖ Individual values-Individual personality and experiences.
- ❖ Global values-Human civilization.
- ❖ Spiritual values-Self-restraint, discipline.

5.7 HIV /AIDS

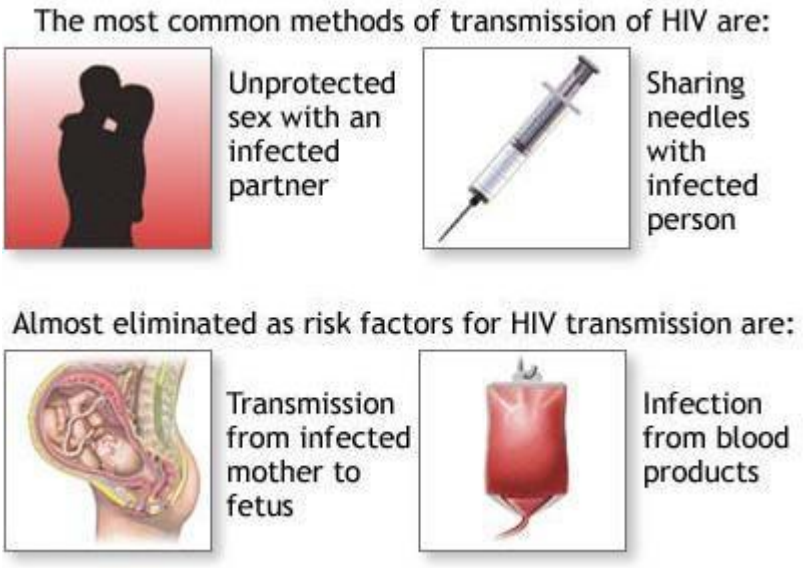
AIDS is the abbreviated form for **Acquired Immuno Deficiency Syndrome** caused by a virus called HIV (**Human Immune deficiency Virus**).

5.7.1 Origin of HIV/AIDS

1. Through African Monkey
   African monkey or Chimpanzees To human.
2. Through Vaccine Programme
   (a)Polio, small pox vaccine from monkey's kidney-Africa.
   (b) Hepatitis-B viral vaccine-Los Angles and New York.

5.7.2 Factors influencing modes of Transmission of HIV

1. Unprotected sex with infected person.
2. Using needles or syringes from HIV positive person.
3. During pregnancy, breast feeding HIV transmits from mother to infant babies.
4. Blood transfusion during accident and pregnancy.
5. Biologically the male to female transmission is 2 to 4 time more efficient than female to male transmission.
6. Women's cervical tissue is more vulnerable to HIV than men.



5.7.3 Factors not influencing transmission of HIV

1. Tears, food, air, cough, handshake and normal kissing.
2. Mosquito flies and insect bites.
3. Sharing of utensils, clothes, toilets and bathroom.

5.7.6 Effects

- Death
- Loss of labor
- Inability to work
- Lack of energy.

5.7.4 Functions of HIV in human body

White blood cells (WBC) are responsible for the formation of antibodies called T-helper cells'-helper cells are the key infection fighters in the immune system. Once HIV cells are enter into the boy they destroy the T-cells and cause many infection diseases.

5.7.5 Symptoms

I. Minor symptoms

- ✓ Persistent cough for more than one month.
- ✓ General skin disease.
- ✓ Viral infection.
- ✓ Fungus infection in mouth and throat.
- ✓ Frequent fever, headache and fatigue.

II. Major symptoms

- ✓ Diarrhea for more than one month.
- ✓ TB for more than one month.
- ✓ Fall of hairs.
- ✓ 10% of body weight loss within short period.

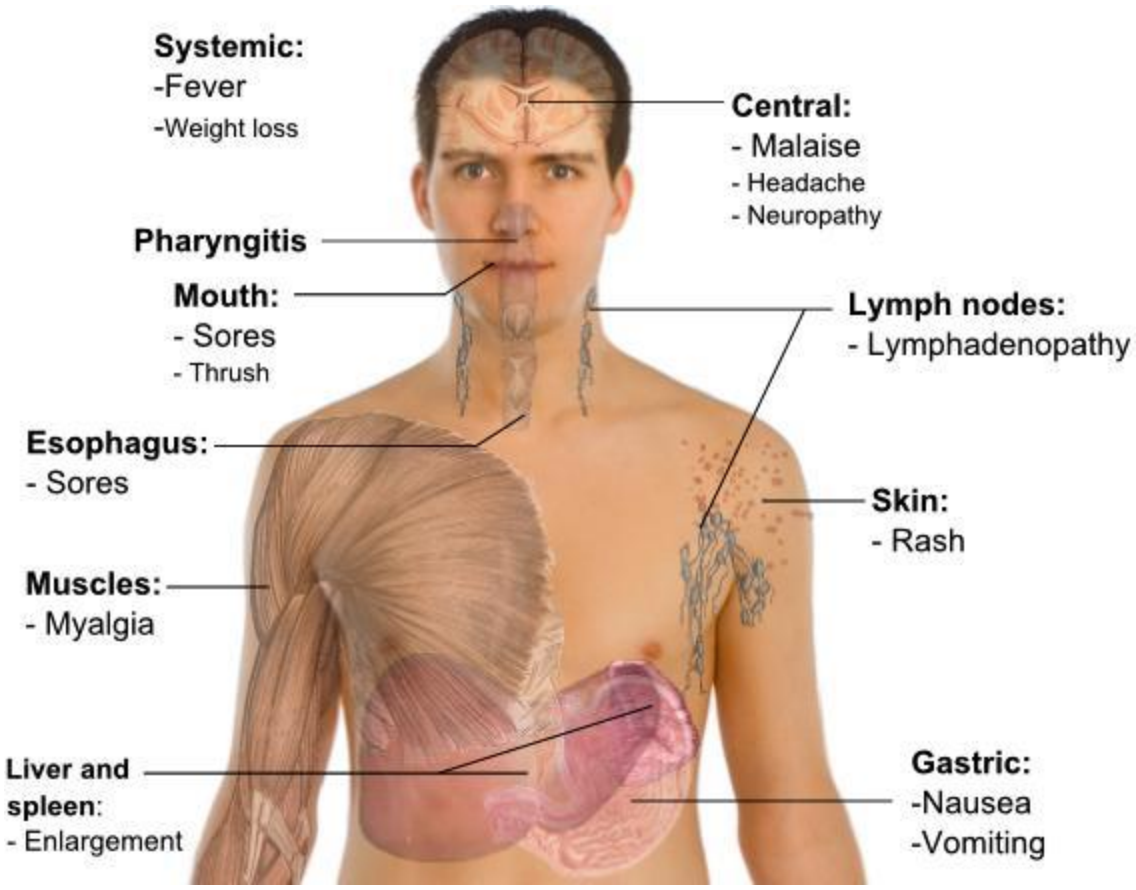


Fig.5.4 Main Symptoms of HIV

5.7.6 Mechanism of Infection

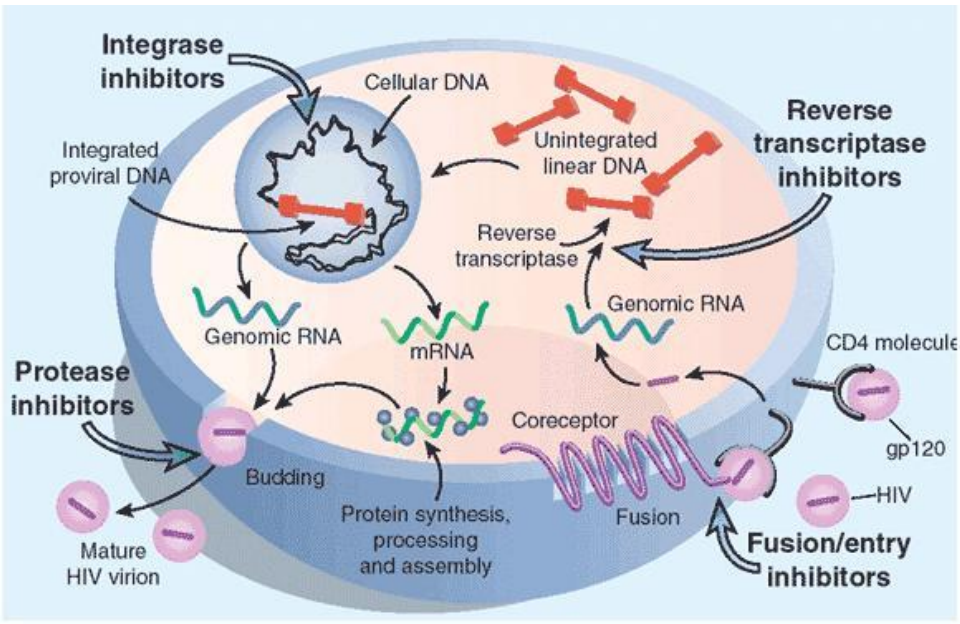


Fig.5.5 Mechanism of HIV infection

5.7.7 Control and Preventive measures

1. Education.
2. Prevention of Blood borne HIV transmission.
3. Primary health care.
4. Counseling services.
5. Drug treatment.

5.7.8 Scenario in India

Large number of cases has been reported in Maharashtra and Tamil Nadu.

5.7.9 World Scenario

Nearly 90% of the HIV affected peoples live in developing countries.13% of world's population live in Africa. About 3 million people so far died due to HIV in 2003.In the world AIDS ranking India is in 2nd place.

5.7.10 HIV symbol and World AIDS day

Fig.5.6 Symbol of HIV

5.8 WOMANS AND CHILD WELFARE

5.8.1 Objectives

- To provide education
- To impart vocational training
- To generate awareness
- To improve employment opportunities
- To restore dignity, equality and respect.

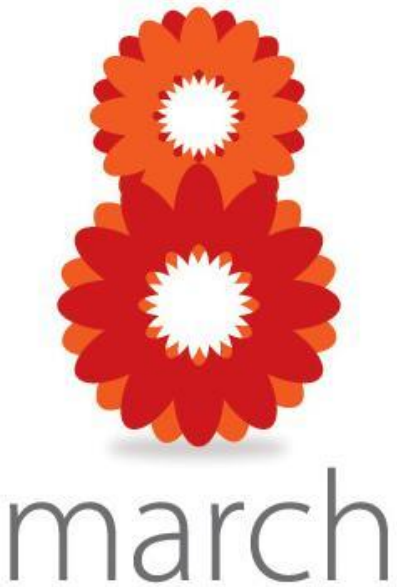


Fig.5.7 International women's day

5.9 ROLE OF INFORMATION TECHNOLOGY IN ENVIRONMENT

1. Remote sensing

Components - A platform, aircraft, a balloon, rocket and satellite.

Functions

- Origin of electro magnetic energy
- Transmission of energy
- Interaction of energy
- Detection of energy
- Preprocessing of data
- Data analysis and interpretation
- Integration and other applications.

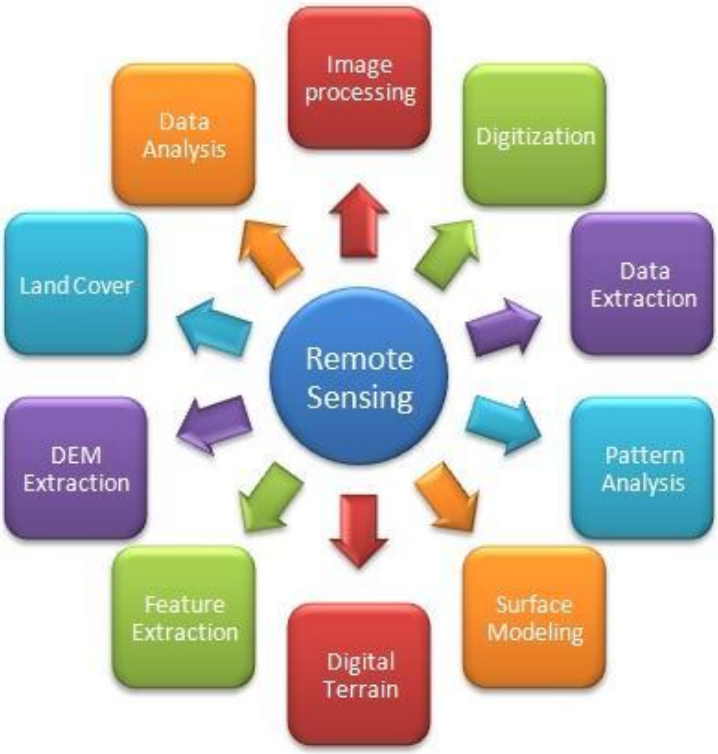


Fig.5.8 Functions of remote sensing

Applications

In agriculture, forestry, land cover, water resources.

2. Data Base- Collection of inter related data on various subjects.

Applications

- Ministry of environment and forest
- National management information system
- Environmental information system.

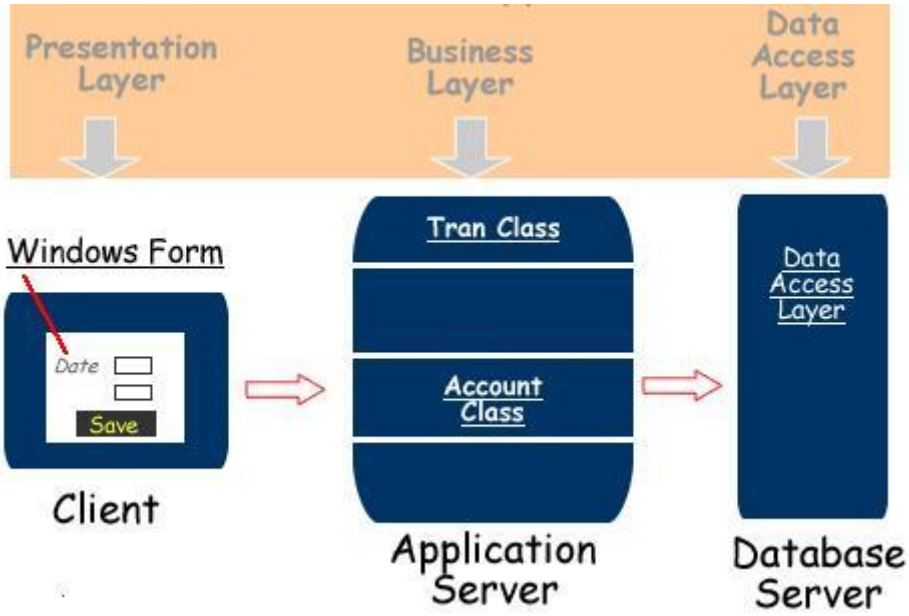


Fig.5.9 Applications of Database

3. Geographical information system (GIS)

It is a technique of superimposing various thematic maps using digital data on a large number of inter-related aspects.

Fig.5.10 GIS operations

Application

- Thematic maps are super imposed using soft wares.
- Interpretation of polluted zones
- To check unplanned growth and related environmental problems.

4. Satellite data

- Helps in providing reliable information and data about forest cover
- Provide information about forecasting weather
- Reserves of oil, minerals can be discovered.

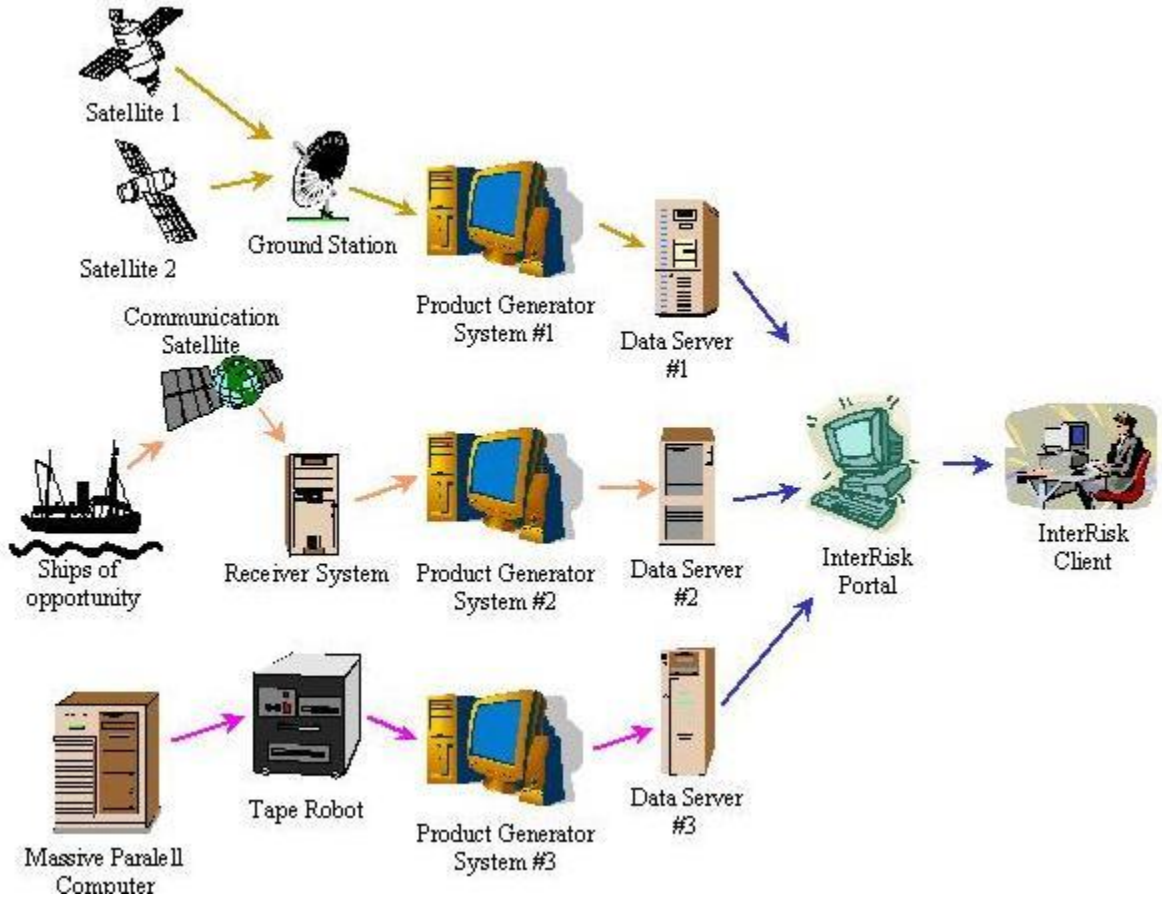


Fig.5.11 Satellite data processing

5. World Wide Web

It provides **Current data**.

Applications

- Online learning
- Digital files or photos, animations on environmental studies.

5.10 ROLE OF INFORMATION TECHNOLOGY IN HUMAN HEALTH

The health service technology involves three systems

- Finance and accounting
- Pathology
- 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.