CONTENTS

UNIT - II

ENVIRONMENTAL POLLUTION

SYLLABUS

GE6351 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
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OBJECTIVES:

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

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Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO_2, NOX, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization 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 Conversion

processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. 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.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act –The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS :

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004.

2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.

REFERENCES :

1. Trivedi.R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media, 3rd edition, BPB publications, 2010.

2. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.

3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.

4. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.

UNIT - I
ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY

1.1 ENVIRONMENT

Environmental science is the study of nature and the facts about environment. Environment can be defined as "all the social, economical, physical and chemical factors that surrounds man" or "all abiotic and biotic components around man-all living and non living things surrounds man".

1.1.1 PREREQUISITE DISCUSSIONS

The word environment is derived from the French word 'environ' which means to 'encircle or surround'.

Objective of this course is to develop concern for our own environment which will lead us to act at our own level to protect the environment we all live in.

Ever since people first recognized that their health and well-being were related to the quality of their environment, they have applied thoughtful principles to attempt to improve the quality of their environment.

There are three reasons for studying the state of the environment.

The first is the need for information that clarifies modern environmental concepts like equitable use of natural resources, more sustainable life styles etc.

Second, there is a need to change the way in which we view our own environment, using practical approach based on observation and self learning.

Third, there is a need to create a concern for our environment that will trigger pro-environmental action; including simple activities we can do in our daily life to protect it.

1.1.2 CONCEPTS

According to ancient man the environment was the Panchaboodhas (i.e.) air, water, land, sky and energy.

The human were disciples of nature. They were able to protect themselves from harmful one and protect the others. But according to modern man the environment is only air land and water.

Exploitation of various earth resources to satisfy the increasing needs of human population has resulted in 1) depletion of various resources of earth 2) pollution. Principles of environmental education:

- Examine the major environmental issues
- Discover the root cause
- Develop problem solving skills
- Promote co-operation in solving problems
- Emphasis active participation in prevention and solution to problems

1.1.3 SCOPE OF ENVIRONMENTAL SCIENCE

- Studying the interrelationship between the components of environment.
- Carrying out impact analysis and Environmental Audit
- Preventing pollution from existing and new industries
- Stopping the use of biological and nuclear weapons
- Managing unpredictable disasters etc.

1.1.4 PUBLIC AWARENESS

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection.

- Public awareness of environmental issue is at infant stage
- 30-40% of public of developing country are aware of environmental. Problems but they do not bother about it.
- Ignorance and incomplete knowledge has lead to misconceptions.
- Development and improvement in std. of living has lead to serious environmental disasters.
- Debates on environmental Issues are treated as anti-developmental.

1.1.5 APPLICATION

- Environmental science is essentially the application of scientific methods and principles to the study of environmental issues, so it has probably been around in some forms as long as science itself.
- Environmental science is often confused with other fields of related interest, especially ecology, environmental studies, environmental education and environmental engineering.
- Environmental science is not constrained with any one discipline and it is a comprehensive field.

1.1.6 RISK AND HAZARDS IN THE ENVIRONMENT

Environmental risk due to various environmental hazards is an important topic for environmental engineers to recognise and understand in order to protect human society and ecosystems from harms or damages at local, regional or global scales. For example, to deal with contaminated soil and ground water at a brown field, risk and exposure assessment help engineers choose an optimal solution to either treat the hazard (e.g., to remove the contaminants from the soil and water) or reduce the exposure (e.g., to cover up the land with a barrier).

A hazard is a threat to life, health, property, or ecosystems, i.e., it involves something that could potentially be harmful. Therefore, when a dormant hazard comes to fruition, it will cause physical damage or destruction, loss of life, or drastic change to the environment, and result in an incident, accident, emergency event, or disaster. Hazards may be classified into:

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

1.2 ECOSYSTEM

Living organisms cannot be isolated from their non-living environment because the later provides materials and energy for the survival of the farmer.

An ecosystem is therefore defined as a natural functional ecological unit comprising of living organisms and their non-living environment that interact to form a stable self supporting system.

1.2.1 PREREQUISITE DISCUSSIONS

EO Wilson is an entomologist who envisioned that biological diversity was a key to human survival on Earth. He wrote 'Diversity of life' in 1993, which was awarded a prize for the best book published on environmental issues.

He emphasised the risks to mankind due to manmade disturbances in natural ecosystems that are leading to the rapid extinction of species at the global level.

An Indian ornithologist and naturalist, Salim Ali known as the "birdman of India", was among the first Indians to conduct systematic bird surveys across India.

He was instrumental in creating the Bharatpur bird sanctuary (Keoladeo National Park) and prevented the destruction of what is now the Silent Valley National Park. He was awarded India's second highest civilian honour, the Padma Vibhushan in 1976.

His autobiography, **Fall of a sparrow**, should be read by every nature enthusiast. He was our country's leading conservation scientist and influenced environmental policies in our country for over 50 years.

1.2.2 CONCEPTS

Ecology is the study of the distribution and abundance of organisms, the flows of energy and materials between abiotic and biotic components of ecosystems.

Structure of Ecosystem

1. Abiotic or non-living components or physical components
2. Biotic or Living components
3. Energy components

Function of organisms in an ecosystem

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

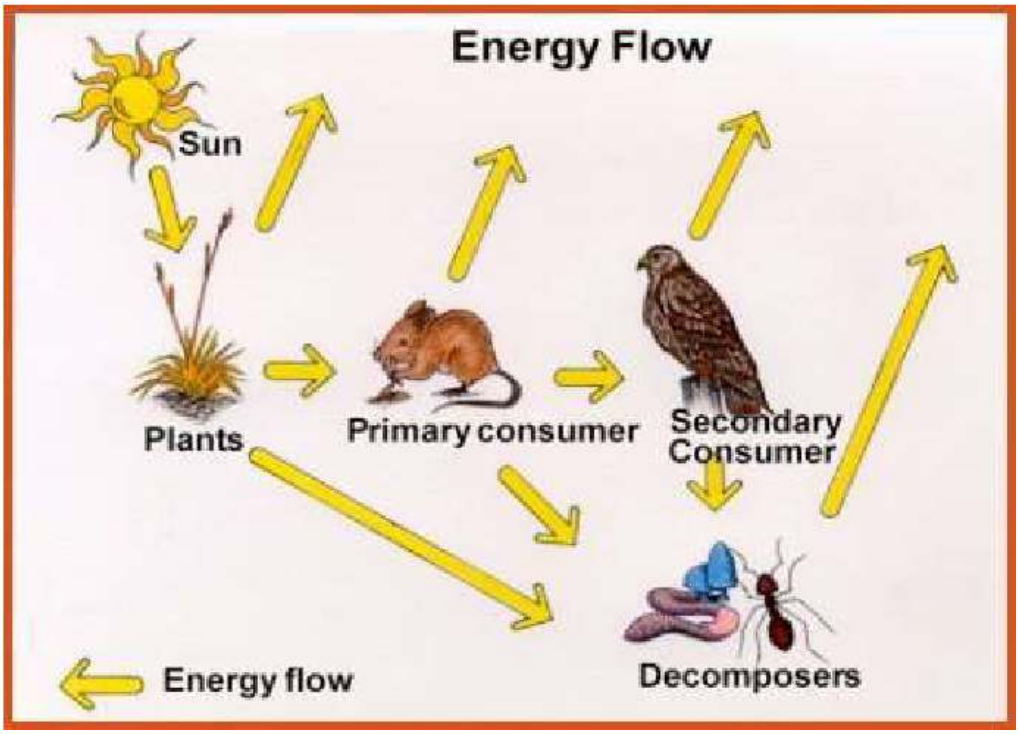
Classes of Consumers

- Herbivore – primary consumer – eats plants
- Carnivores – secondary – meat eaters; eat herbivores
- Tertiary – feed on carnivores
- Omnivores – eat plants/animals

1.2.3 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.



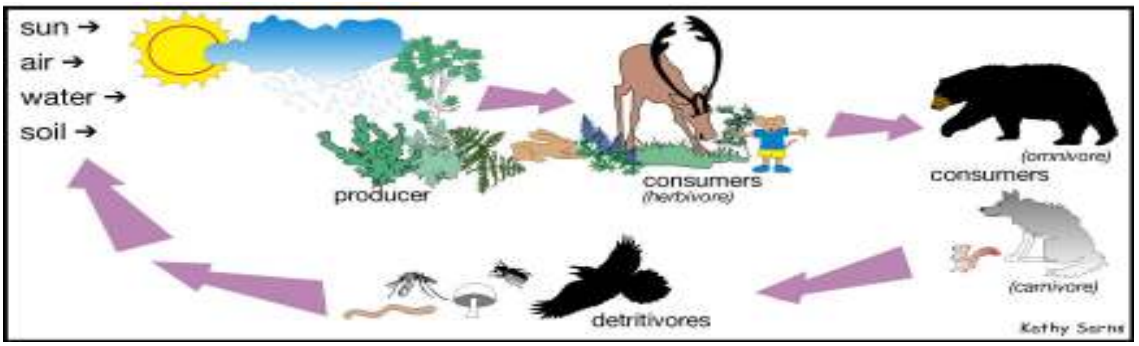
Energy Flow

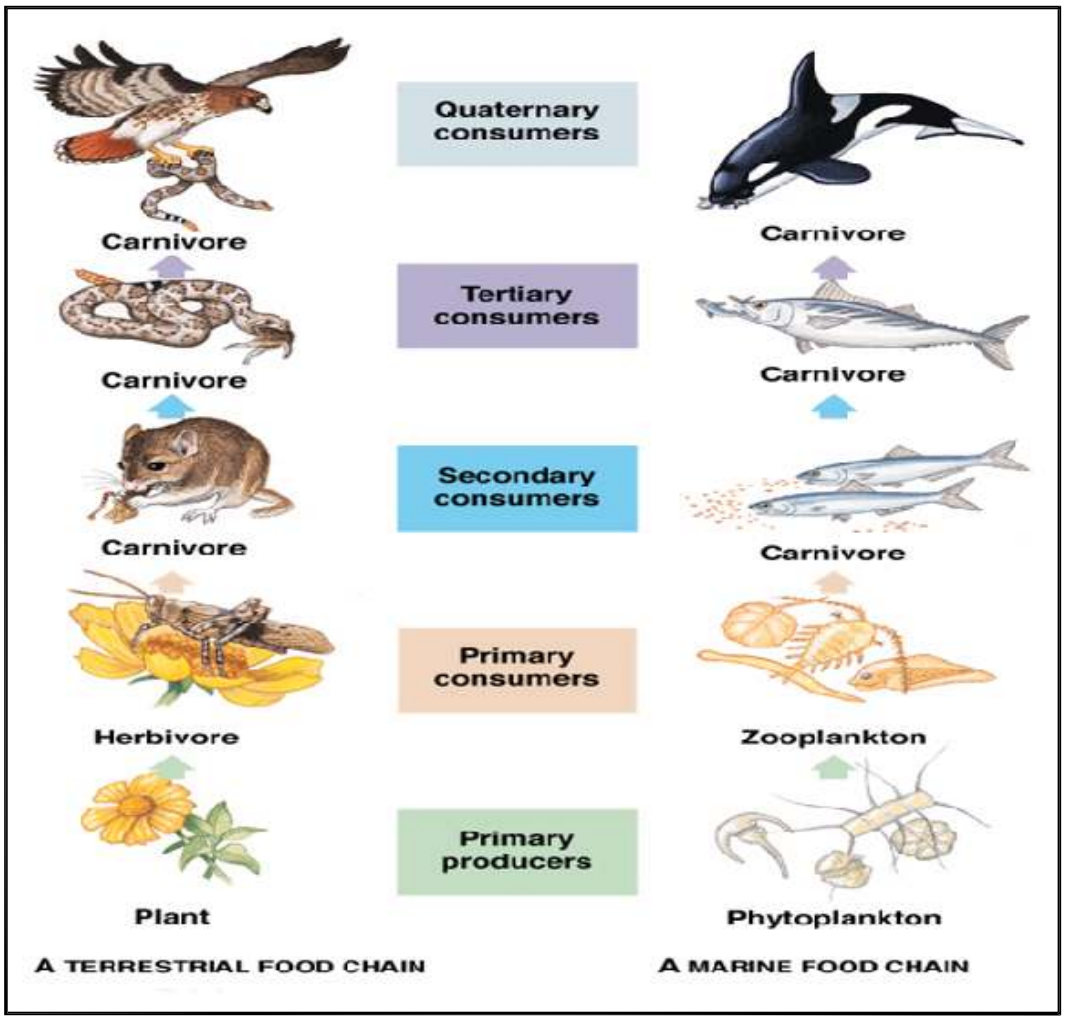
- Starts from autotrophs (the producer level, i.e., first trophic level) to Heterotrophs including plant eaters or Herbivores (second trophic level) and so on.
- The amount of energy decreases with successive trophic levels.
- Only About 1% of energy from the sun is used by green plants & rest remains 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.

1.2.4 FOOD CHAIN

Plants by photosynthesis convert solar energy into protoplasm. Small herbivores consume the vegetable matter and convert into animal matter which in turn eaten by large carnivores.

- 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.

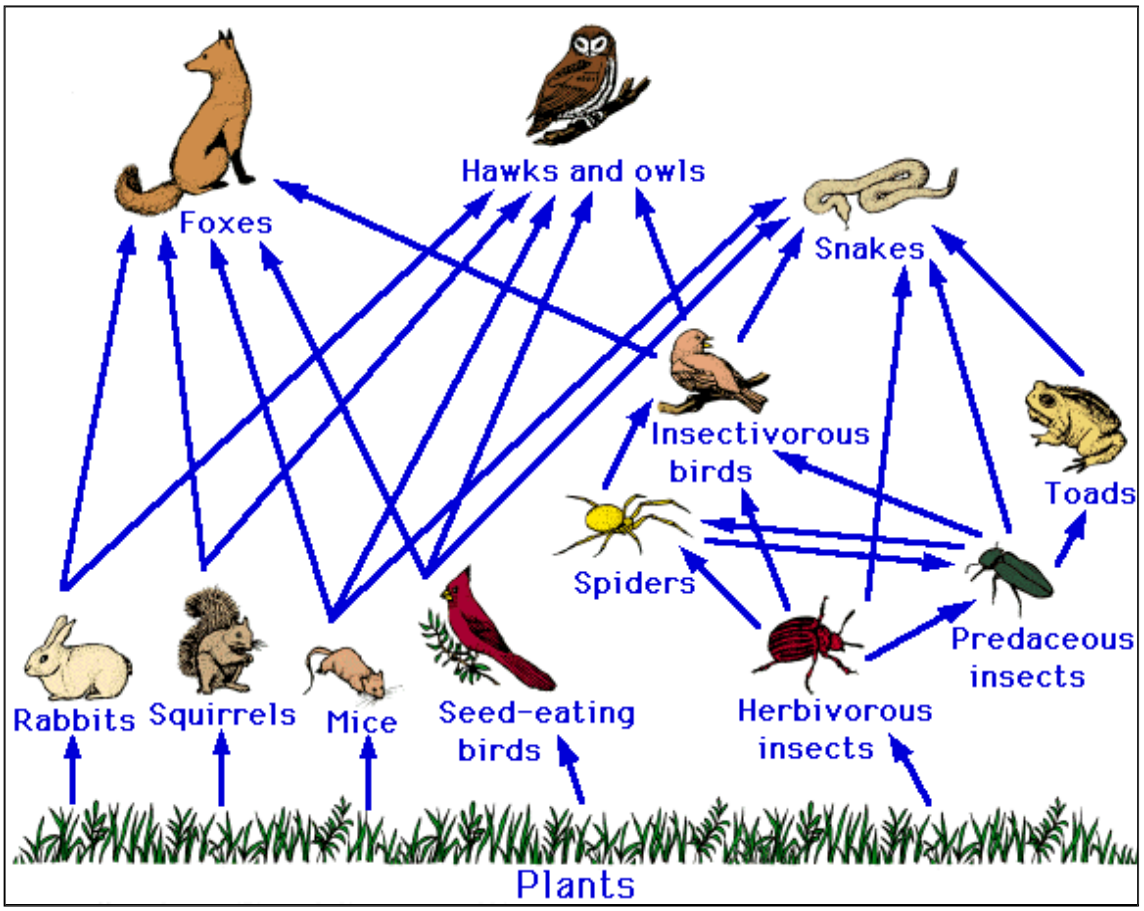




Food Chain

1.2.5 FOOD WEB

The food relationship between various organisms is being depicted by linking all the possible prey and predators of different food level. In an ecosystem linking of feeding habit relations will provide a food web or Interlocking pattern of several interlinked food chains is termed as FOOD WEB.

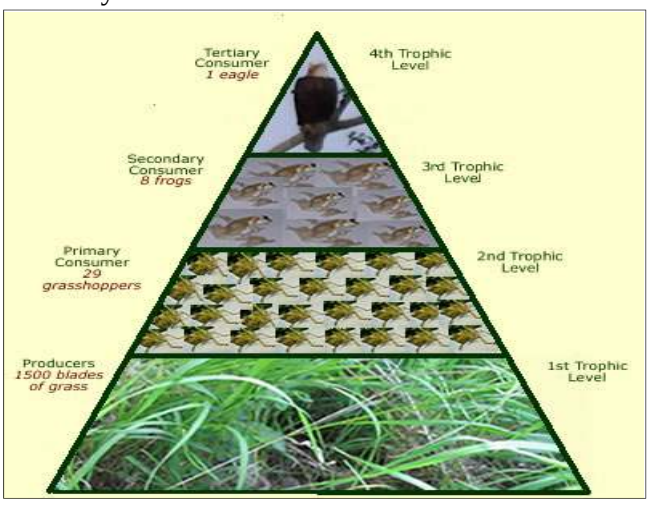


Food web in grassland ecosystem

1.2.6 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.

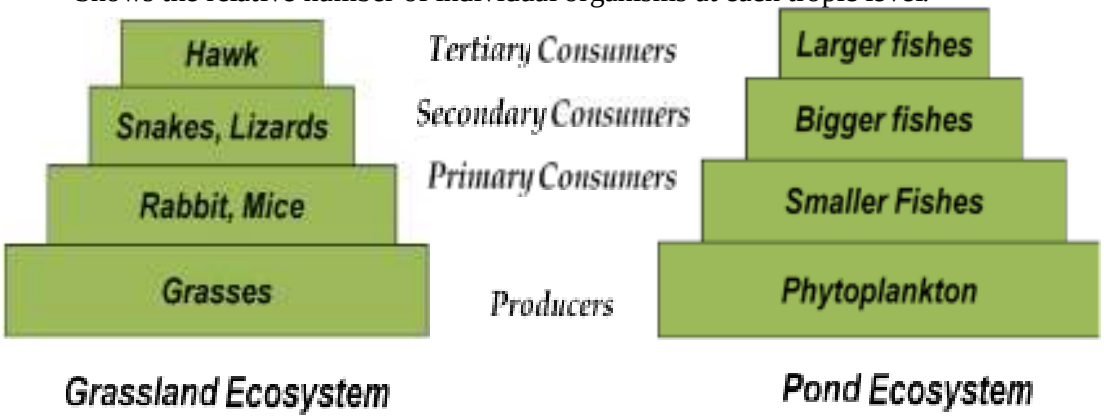


Ecological Pyramid

Types of Ecological Pyramids

Pyramid of Numbers

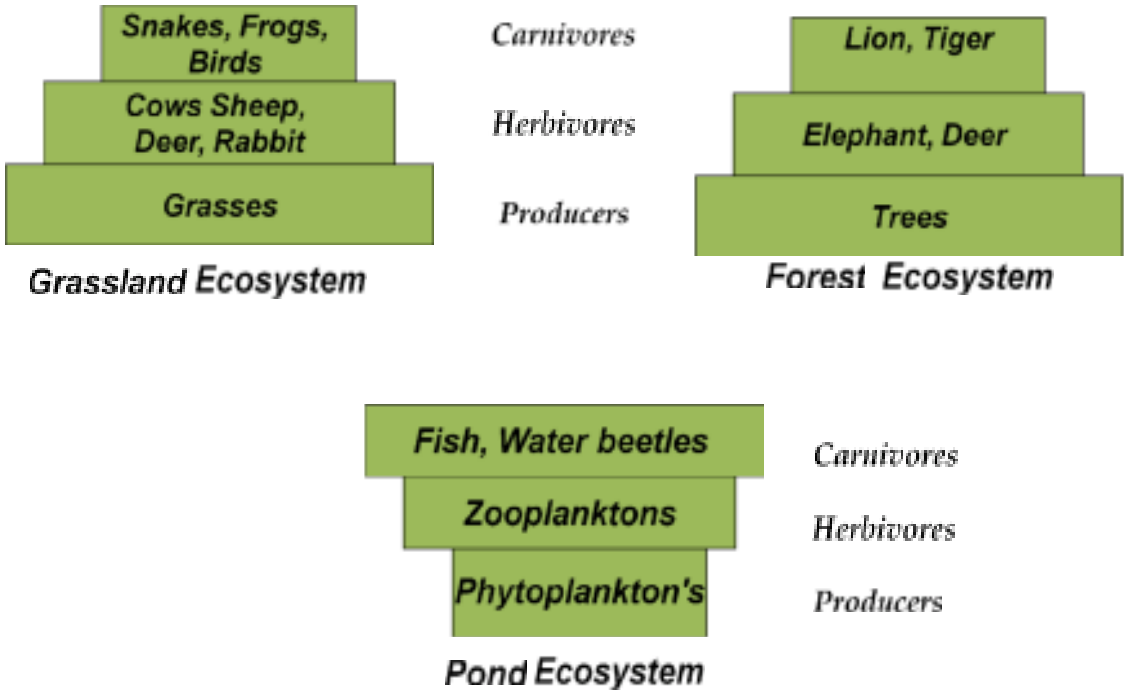
Shows the relative number of individual organisms at each tropic level.



Pyramid of Numbers

Pyramid of Biomass

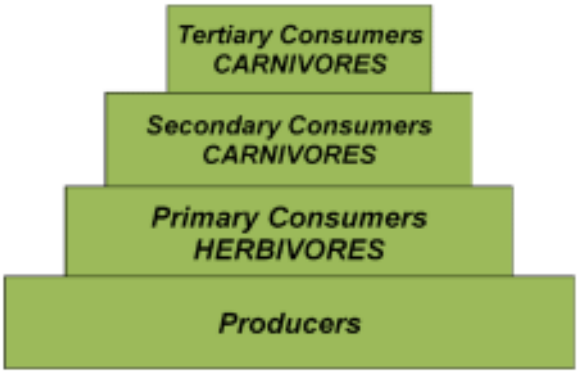
A pyramid of biomass represents the total dry mass (in grams per square meter of area) of all the organisms in each tropic level at a particular time.



Pyramid of Biomass

Pyramid of Energy

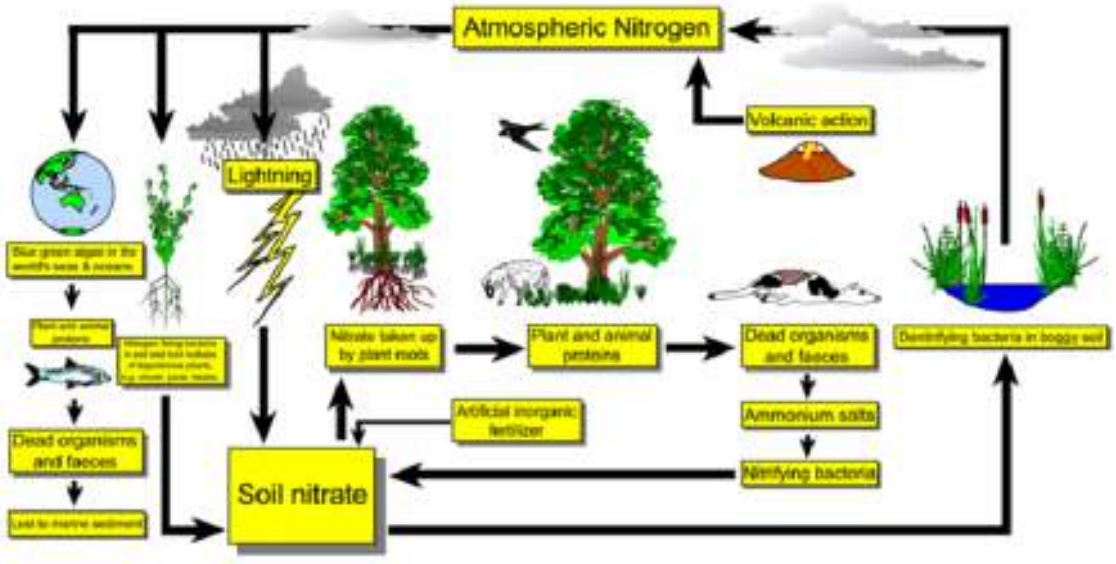
A pyramid of biomass represents the rate of energy flow and/or productivity at successive tropic levels. The pyramids of energy are always upright.



Pyramid of Energy

1.2.7 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.



Nitrogen Cycle

Nitogen cycle completes in 5 steps:

1) Nitrogen Fixation

Conversion of N_2 NH_3

Combustion, volcanic action, Lightning, Industrial processes (making fertilizer).

Bacteria (Azotobactor, Clostridium, Nostoc etc.)

2) Nitrification

Conversion of NH_3 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

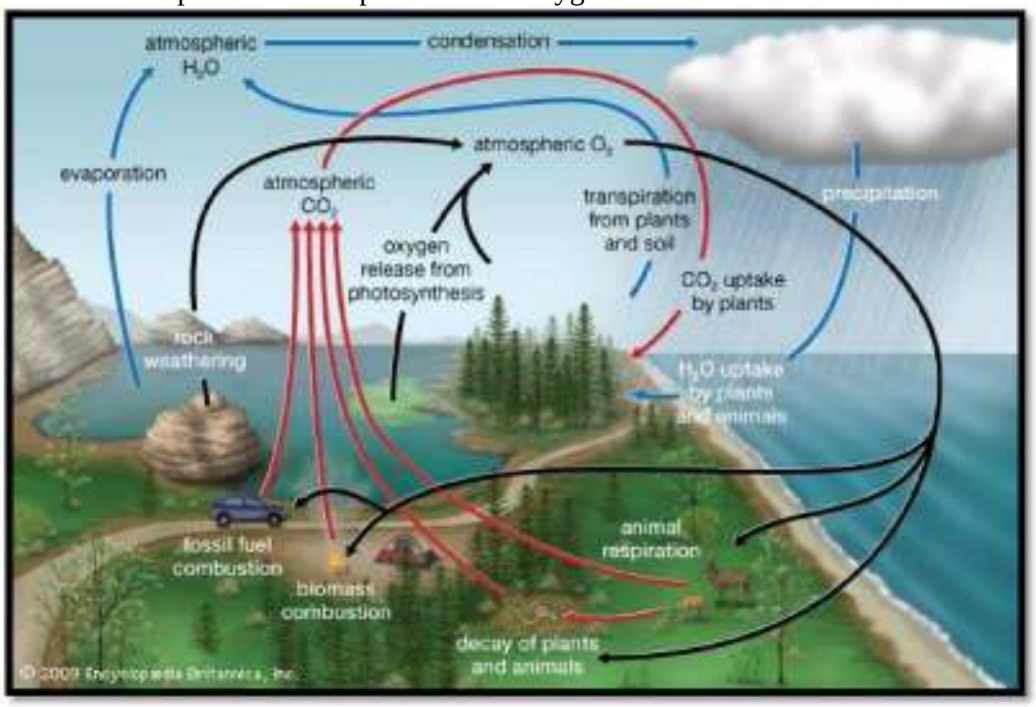
1.2.8 OXYGEN CYCLE

oxygen cycle is the circulation of oxygen in various forms through nature free in the air and dissolved in water.

Oxygen is second only to nitrogen in abundance among uncombined elements in the atmosphere.

Plants and animals use oxygen to respire and return it to the air and water as carbon dioxide (CO_2). CO_2 is then taken up by algae and terrestrial green plants and converted into carbohydrates during the process of photosynthesis, oxygen being a by-product.

The waters of the world are the main oxygen generators of the biosphere; their algae are estimated to replace about 90 percent of all oxygen used.



The generalized oxygen cycle

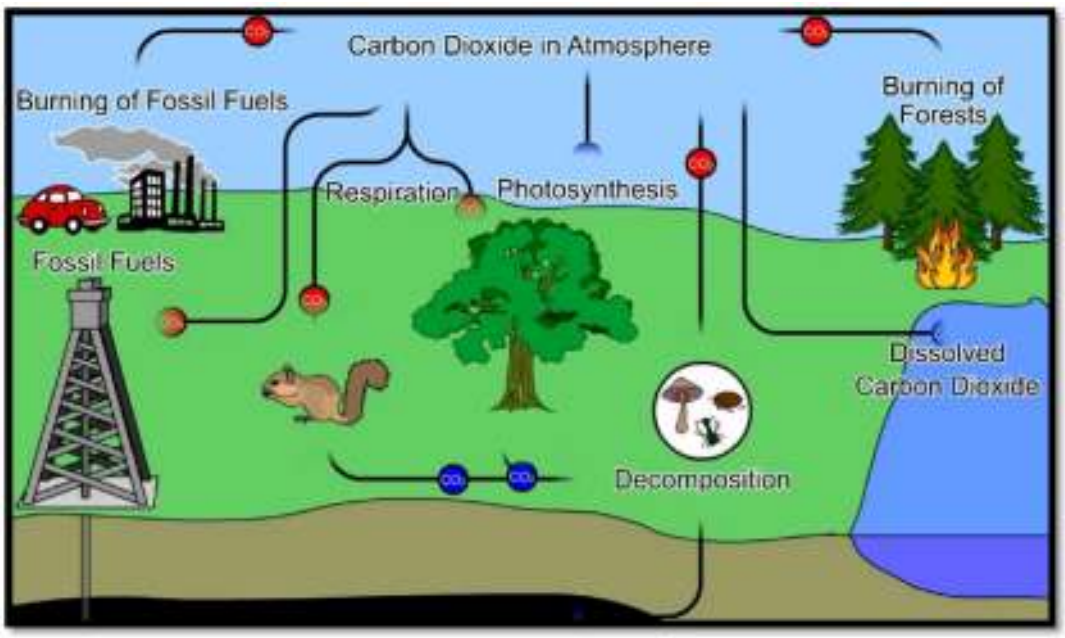
Oxygen is involved to some degree in all the other biogeochemical cycles. For example, over time, detritus from living organisms transfers oxygen-containing compounds such as calcium carbonates into the lithosphere.

Despite the burning of fossil fuel and the reduction of natural vegetation (on land and in the sea), the level of atmospheric oxygen appears to be relatively stable because of the increase in plant productivity resulting from agricultural advances worldwide.

1.2.9 CARBON CYCLE

- Carbon enters plants, etc., as CO2
  - 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.

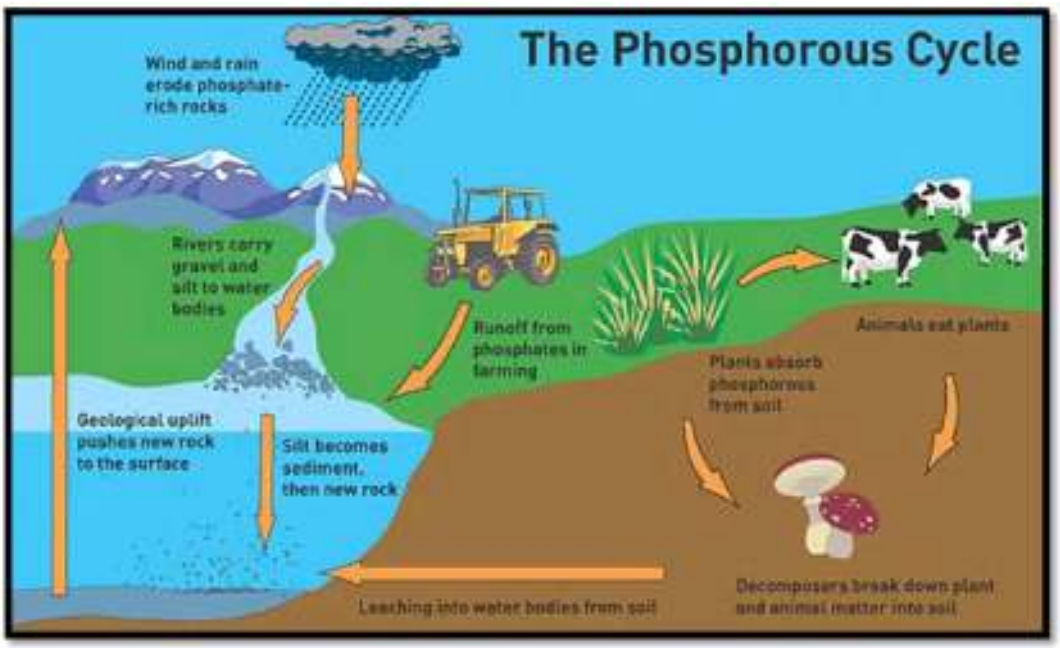


Carbon Cycle

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

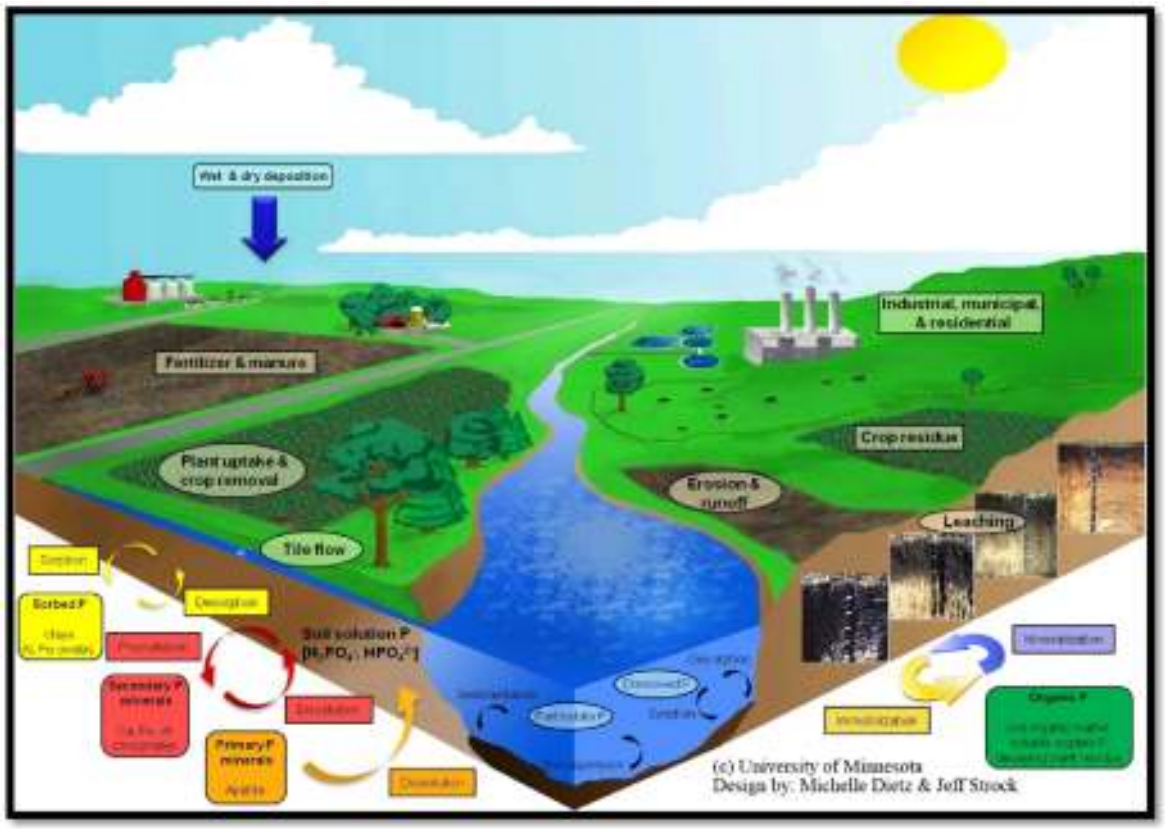
1.2.10 PHOSPHOROUS CYCLE

- 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.



Phosphorous Cycle

- 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.



Phosphorous Cycle

1.2.11 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:

- **Primary Succession:** Occurs where there is no soil, e.g. after a volcanic eruption or a glacial retreat.
- **Secondary Succession:** Community development in the areas that were previously occupied by another community. It occurs after a disturbance. E.g., loss of trees after disease, Fire or wind, deforestation etc.

Primary Succession Vs Secondary Succession

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

1.2.12 FOREST ECOSYSTEM (TERRESTRIAL ECOSYSTEM)

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

Structure and Function of Forest Ecosystem

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.

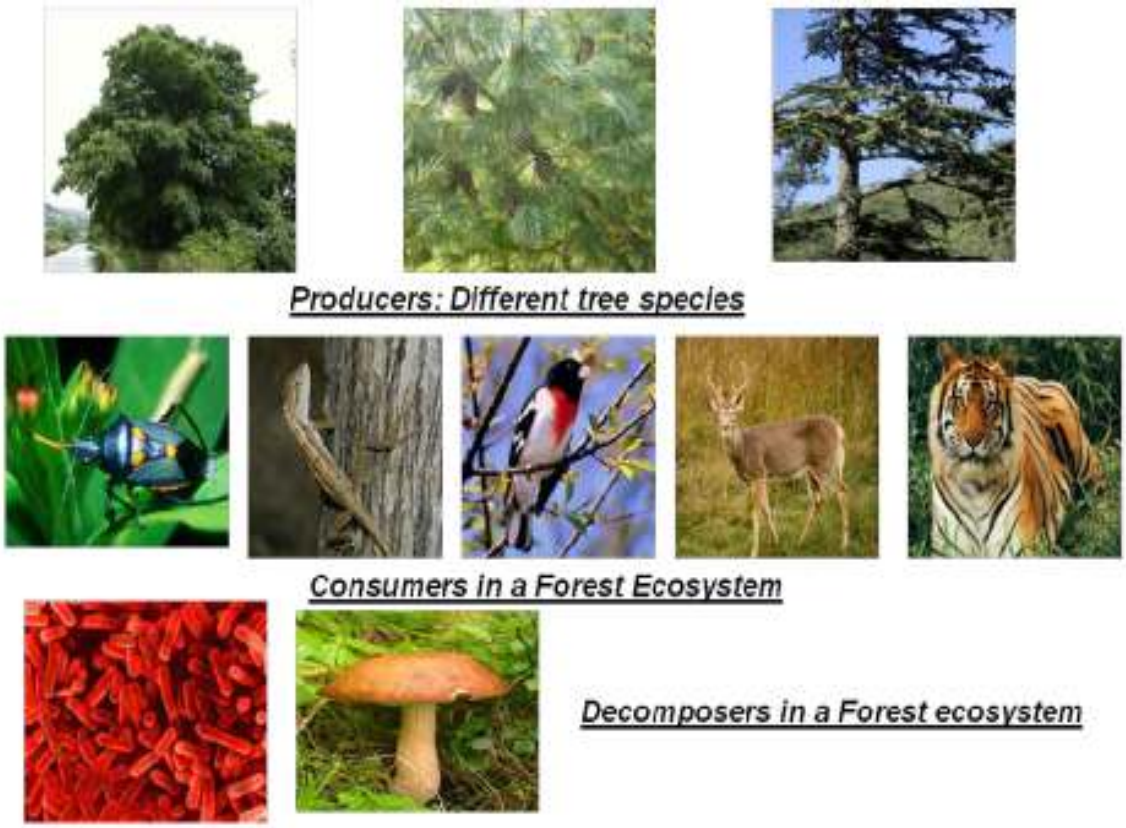
Eg: Birds, Lizards, Frogs, Snakes and Foxes.

c) Tertiary Consumer

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.



Forest Ecosystem

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.

1.2.13 GRASSLAND ECOSYSTEM (TERRESTRIAL ECOSYSTEM)

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.

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.

Grassland Ecosystem

1.2.14 DESERT ECOSYSTEM

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.

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

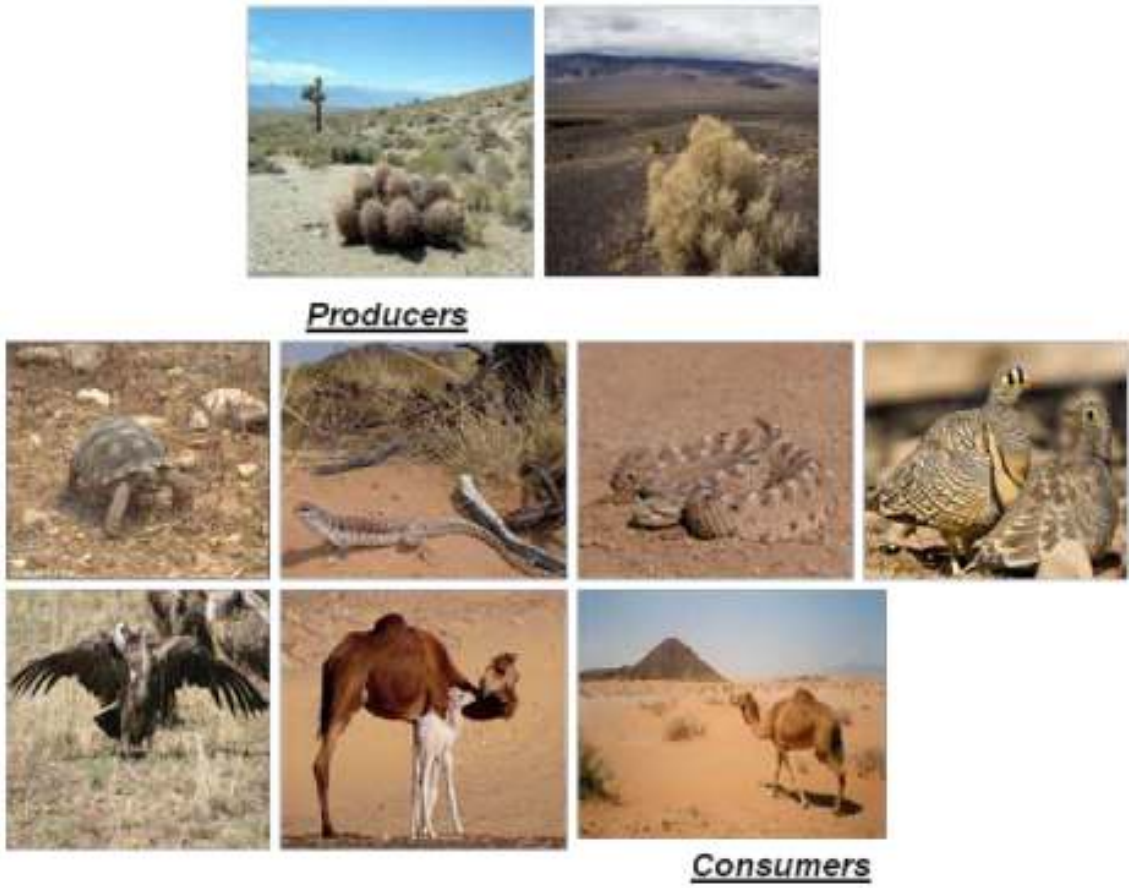
- These include animals such as insects, reptiles which are capable of living in xeric conditions
- Besides some nocturnal rodents, birds & some mammalians like camel etc are also found.

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.



Forest Ecosystem

1.2.15 AQUATIC ECOSYSTEMS

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.

Freshwater Ecosystem

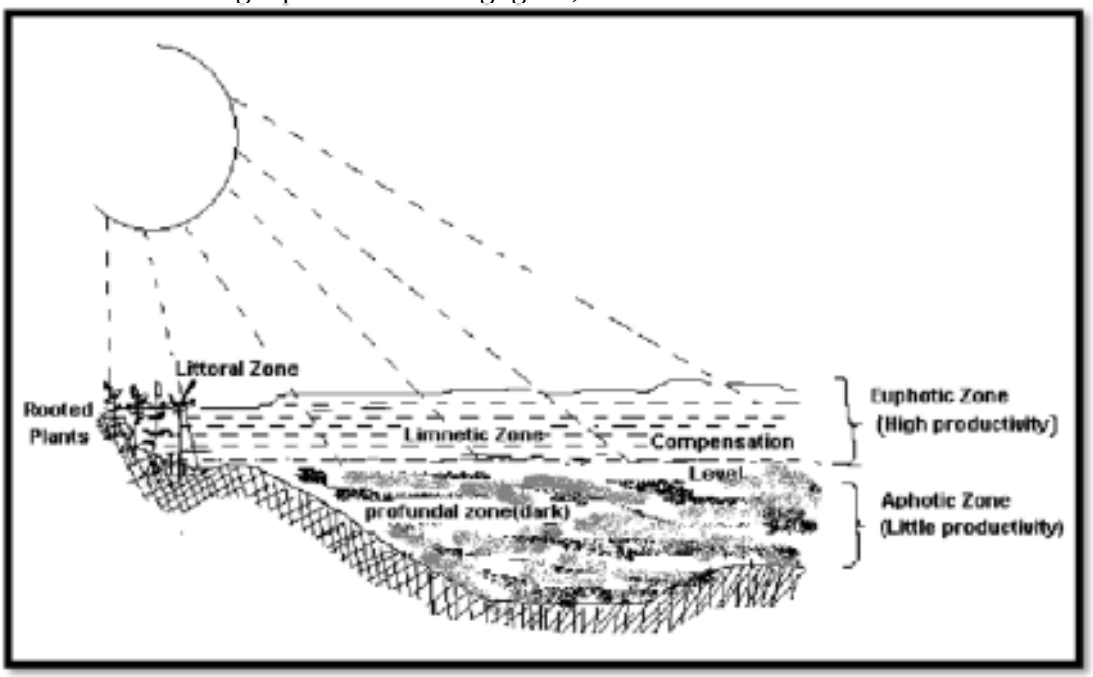
- Freshwater ecosystems cover 0.8% of the Earth's surface and contain 0.009% of its total water.
- Freshwater ecosystems contain 41% of the world's known fish species.
- Aquatic ecosystems perform many important environmental functions. For example:

- 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

1.2.16 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.



Zonation in a lake ecosysteme

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.

1.2.17 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.

Ocean Ecosystem

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.

1.2.18 SIGNIFICANCE OF ECOSYSTEMS

- The food relationship among the different organisms in an ecosystem
- The food chains are the living components of the biosphere
- These are the vehicles of transfer of energy from one level to another
- Through the food chains, transfer of materials and nutrients also takes place
- The movement of some toxic substances (like DDT) in the ecosystem, sprayed to kill the pests and insects, through the various trophic levels, their accumulation at the highest trophic level, etc. can be studied.

1.3 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.

1.3.1 PREREQUISITE DISCUSSIONS

Biologists most often define "biological diversity" or "biodiversity" as the "totality of genes, species, and ecosystems of a region".

It is virtually synonymous with “Life on earth”.

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.

1.3.2 CONCEPTS : 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.
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.
3. **Ecosystem diversity:** It refers to the diversity of a place at the level of ecosystems.

1.3.3 BIOGEOGRAPHIC CLASSIFICATION OF INDIA

Our country can be divided into ten major regions based on the geography, climate and pattern of vegetation seen and the communities of mammals, birds, reptiles, amphibians, insects and other invertebrates that live in them.

Each of these regions contain a variety of ecosystems such as forests, grass lands, lakes, rivers, mountains and hills which have specific plant and animals species.

India’s Biogeographic Zones:

1. The cold mountainous snow covered Trans-Himalayan region of ladakh
2. The Himalayan ranges and valleys of Kashmir, Himachal Pradesh, Uttatkhand, Assam and other North-eastern States.
3. The Terrain, the low land where the Himalayan rivers flow into the plains
4. The Gangetic and Brahmaputra plains.
5. The Thar Desert of Rajastan
6. The semi- arid grassland region of the Deccan plateau, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamilnadu
7. The North eastern States of India
8. The Western Ghats in Maharastra, Karnataka and Kerala
9. The Andaman and Nicobar Islands
10. The long western and eastern coastal belt with sandy beaches, forests and mangroves.

1.3.4 VALUES OF BIODIVERSITY

1. Consumptive use:

Drugs: Many plants are used in primary health care. 70% of modern medicines are derived from plant and plant extracts.

Penicillin – fungus is the source – Antibiotic
Quinine – Chincona bark - Malaria treatment
Morphine – Poppy bark – Analgesic

Fuels: Fire woods are directly consumed by villagers.

Food: A large number of wild plants and wild animals are consumed by human beings as food.

2.Productive use:

Biodiversity products have commercial value. These products are marketed and sold. These are derived from animals and plants.

Animal products: Silk from silk worm, Wool from sheep, Musk from musk deer, Leather from animals

Plant Products: Wood for paper and Plywood, Cotton for textile industry, Pearl for pearl industry

3.Social value:

It refers to the manner in which the bio-resources are used in the society. These are associated with the social life, religion and spiritual aspects of the people.

e.g., Holy plants : Tulsi, Lotus, Neem trees
Holy animals : Cow, snake, bull, peacock

4.Ethical value:

It means that a species may or may not be used but its existence in nature gives us pleasure.

e.g., Holy river : River Ganga
Holy tree : Tulsi, Vengai

5.Aesthetic value:

The beautiful nature of plants and animals insists us to protect the biodiversity. Ex) eco-tourism, colour of butterfly, flowers etc.

6.Optional value:

The optional value of biodiversity suggests that any species may be proved to be a valuable species after someday.

1.3.5 BIODIVERSITY AT GLOBAL, NATIONAL AND LOCAL LEVELS

Global Level:

Conservative estimates of the existing biodiversity is ten million species, but if estimates for insects are correct then it could be around 30 million species, we have till now enlisted about 1.4 million species.

It includes among others about 98% birds, 95% reptiles and amphibians, 90% fish and about 85% higher plants known to exist on this Earth.

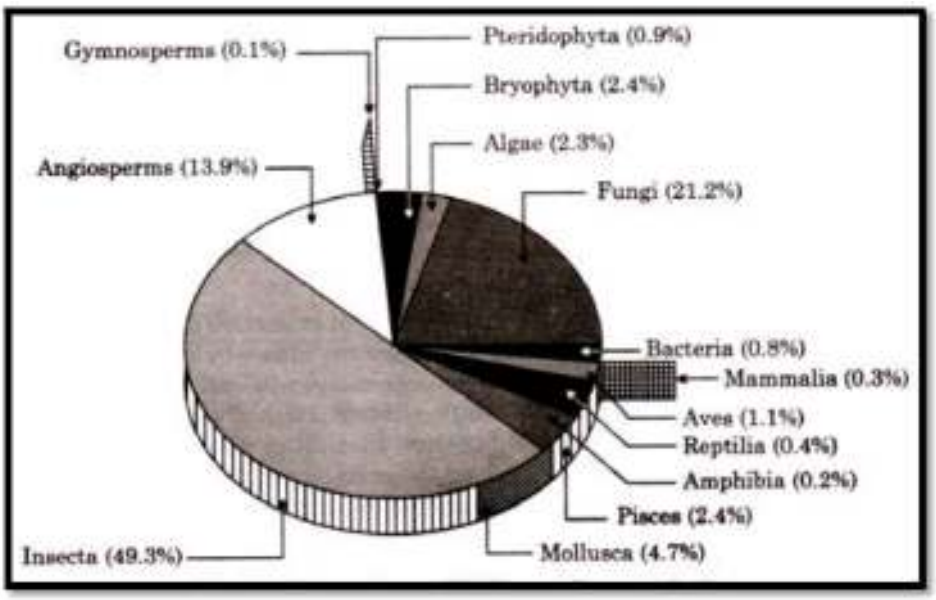
Form of Life	Known Species	Estimated Total Species
Insects and other arthropods	874,161	30 Million species, extrapolated from surveys in forest canopy in Panama, most believed to be unique to tropical forests.
Higher plants	248,400	Estimates range from 275,000 to 400,000 at least 10.15% species believed undiscovered.
Invertebrates (excludes arthropods)	116,873	True invertebrates may number millions of species. Nematodes, eelworms, and roundworms may each comprise more than one million species
Lower plants (fungi and algae)	73,900	Not available
Micro organisms	36,600	Not available
Fish	10,056	21,000 assuming that 10% fish remain undiscovered, the Amazon and Orinoco rivers alone may account for 2,000 additional species.
Birds	9,040	Known species probably account for over 98% of all birds.
Reptiles and Amphibians	8,962	Known species probably account for over 95% of all reptiles and amphibians.
Mammals	4,000	Known species probably account for over 95% of all mammals.
Total	1,390,992	10 million species considered a conservative estimate. If insect estimates are accurate, total exceeds 30 million.

Known and Estimated diversity of life on earth

National and Local Level:

India has over 108,276 species of bacteria, fungi, plants and animals already identified and described. Out of these, 84 percent species constitute fungi (21.2 percent), flowering plants (13.9 percent), and insect (49.3 percent). In terms of the number of species, the insecta alone constitute nearly half of the biodiversity in India.

These species occur on land, fresh and marine waters, or occur as symbionts in mutualistic or parasitic state with other organisms. In the world as a whole, 16, 04,000 species of Monera, Protista, Fungi, Plantae and Animalia have been described so far. However, it is estimated that at least 179, 80,000 species exist in the world, but as a working figure 122, 50,000 species are considered to be near reality. Percentage of Different Biota in India.



Percentage of Different Biota in India

Taxon	Number of Species	Percentage
Bacteria	850	0.8
Fungi	23,000	21.2
Algae	2,500	2.3
Bryophyte	2,564	2.4
Pteridophyta	1,022	0.9
Gymnosperms	64	0.1
Angiosperms	15,000	13.9
Insecta	53,430	49.3
Mollusca	5,050	4.7
Pisces	2,546	2.4
Amphibian	204	0.2
Reptilia	446	0.4
Aves	1,228	1.1
Mammalian	372	0.3
Total	108,276	100.00

Number of Species of Bacteria, Fungi, Plants and Animals

1.3.6 INDIA AS A MEGADIVERSE NATION

Megabiodiversity is a concept first proposed in a paper at the Smithsonian's 1988 biodiversity conference. This approach looks at biodiversity priorities by political units, in this case sovereign nations, rather than by ecosystems. It recognizes that a very small number of units (17 countries out of a global 200+) are home to an inordinately large share of world's biodiversity (USA, Mexico, Columbia, Venezuela, Ecuador, Peru, Brazil, Democratic Republic of Congo, South Africa, India, Madagascar, Malaysia, Indonesia, China, Philippines, Papua New Guinea and Australia).

Most of the megadiversity areas are large, but several, such as those in Madagascar, the Philippines and Ecuador pack high diversity into relatively small land areas. They have enormous responsibility at the same time, they should consider the biodiversity to be one of their most important long term economic assets.

INDIA

India is the seventh largest country in the world and has the second largest population. There is much diversity in the geographical features: the towering Himalayas and the extensive river plains in the north, the Thar desert in the west, the Deccan Plateau in the centre and the south, the coastal plains to the east and west and the numerous islands. The country has 26 states and 6 union territories.

The rising population has forced the rural poor to borrow against the future by depleting the natural resources. It was reported that the population reached one billion people in 2000, comprising about 16% of the world's population. The problem is further compounded by the high cattle population, estimated to be 450 million; most of these animals have a very low productivity but are allowed to graze freely in forest areas, causing the degradation of forests. It was estimated that the cattle population was 18% of the cattle population in the world. This has led to severe erosion, loss of soil, and floods in the lower plains, in addition to the destruction caused by shifting cultivation. As a result, the demographic and economic landscape of the country is plagued with poverty and underemployment.

Agricultural productivity is only 1 ton per ha against the actual capability of 4 ton per ha. How to achieve the optimum land use, including soil and moisture conservation measures, are the main challenges confronting the policy and decision-makers. To reverse the process of degradation and for the sustainable development of forests, the Government has prepared the National Forestry Action Programme (NFAP). Sixty percent of the forests are located in ecologically sensitive zones. These forests need to be managed in a way to ensure that they are ecologically protected and maintained, as well as sustained at the highest productivity level to meet the growing population's burgeoning demands for fuel, food, fodder, and timber.

India is one of the 17 mega diversity countries, commanding 7% of the world's biodiversity and supporting 16% of the major forest types, varying from alpine pastures in the Himalayas to temperate, sub-tropical, tropical forests, and mangroves in the coastal areas. But nearly half of the country's area is degraded, affected by the problems of soil degradation and erosion. The most common forms of degradation are wind and water erosion, and salinity. About 146 million ha are affected by wind and water erosion, and 7 million ha have become degraded due to excessive salts. About 8.5 million ha are under water logging and about 10 million ha are affected by shifting cultivation.

According to the Government statistics, nearly 22%, or 65 million ha, of the country's land have been recorded as forests, but only 19.5% have forest or tree cover, which is much less than the goal of 33% set by the National Forest Policy, 1988.

India currently has 80 National Parks. These National Parks in turn houses largest number of tigers found in the world, largest number of one-horned rhinos found in the world, now almost extinct Asiatic Lions, and a large percent of elephants. These wildlife animals are but only a part of more than 500 species of mammals that have made India their natural

home. Apart from the mammals, India is also blessed with over 2000 species of birds, over 500 species of reptiles and amphibians and around 30000 species of insects including colorful butterflies.

1.3.7 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.

Criteria for determining hot-spots

- Number 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.

1.3.8 THREATS TO BIODIVERSITY

Habitat loss is mainly due to human population growth, industrialization and changes in the land use patterns, poaching of wild life and man wildlife conflicts.

Poaching: Specific threats to certain animals are related to large economic benefits.

Man wild life conflicts: Conflicting situations with wild life starts causing immense damage and danger to man.

1.3.9 ENDANGERED AND ENDEMIC SPECIES OF INDIA

- 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. About62% 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.

1.3.10 CONSERVATION OF BIODIVERSITY

In general biodiversity is generally disturbed by human activities. To solve the problems, it is essential to protect our bio diversity by two ways.

1. In-situ or on-site conversion
2. Ex-situ conservation

In-situ conservation:

- Conservation of species in its natural habitat, in place where the species normally occurs
- The strategy involves establishing small or large protected areas, called protected areas
- Today in world, there are 9800 protected areas and 1500 national parks

Methods:

1. Nature or biosphere reserves (Eg) Nilgiri Bio reserve
2. National parks and sanctuaries (Eg) Mudumalai, vedanthangal
3. On farm and home garden conservation for plants, vegetables and fruits to maintain traditional crop varieties.

Ex- situ conservation:

- It involves maintenance and breeding of endangered plant and animal species under partially or wholly controlled conditions in zoos, gardens and laboratories
- The crucial issue for conservation is to identify those species which are more at risk of extinction.

Methods:

1. Long term captive breeding
2. Shortage term propagation and release
3. Animal translocation and re introductions

4. Seed bank
5. Reproductive technology
    i. Embryo transfer technology
    ii. Cloning

1.3.11 SIGNIFICANCE OF BIODIVERSITY

Biosphere is a life supporting system to the human race. Each species in the biosphere has its own significance.

It is the combination of different organisms that enables the biosphere to sustain human race. Biodiversity is vital for a healthy biosphere.

Biodiversity is must for the stability and proper functioning of the biosphere.

Besides these biodiversity is so important due to having consumptive use values, productive use values, social values, ethical values, aesthetic values and option values.

GLOSSARY

Abiotic: A non-living component of the environment
Biodivetsity: The variety and variability of different living organisms
Biotic: Of or relating to life
Conservation: Not wasting and renewing when possible
Consumers: Organisms which consume protoplasm produced from photosynthesis directly or indirectly
Decomposers: Organisms which utilize energy from wastes or dead organisms and complete the cycle by returning the nutrients to the soil or water and CO2 to air
Ecological Succession: The sequential replacement of one vegetative community by another through a series of stages
Ecosystem: A community of living things interacting with one another and with their physical environment
Endangered Species: A species threatened with extinction
Endemic: Peculiar to a certain region or country; native to a restricted area; not introduced
Producers: Autotrophic organisms which produce protoplasm using inorganic carbon and energy from sun
Species: A group of organisms capable of interbreeding with members of other species

REVIEW QUESTIONS

1. Discuss about Environmental science.
2. What are the important components of environment?
3. What are the functions of producers, consumers and decomposers in ecology?
4. Discuss about ecological succession and its benefits.
5. Make a comparative discussion on threats to biodiversity and how can we contribute to control them.
6. What are the ways a human can make contributions to conserve biodiversity and spread awareness on it?

UNIT – II
ENVIRONMENTAL POLLUTION

2.1 ENVIRONMENTAL POLLUTION

Any undesirable change in the physical, chemical or biological characteristics of any component of the environment (air, water, soil) which can cause harmful effects on various forms of life or property.

2.1.1 PREREQUISITE DISCUSSIONS

Pollution is derived from Latin word 'polluere' which means 'to contaminate' any feature of environment.

Pollution is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals and human beings.

This occurs only when short term economic gains are made at the cost of long term ecological benefits of humanity.

Soil is a natural resource for which there is no substitute. Environmental historian Donald Worster reminds us that fertilizers are not a substitute for fertile soil.

Soil cannot be manufactured with a tank of chemicals. Soil is formed from the parent material by physical and chemical weathering of rocks. Climate and time are also important in the development of soils.

Extremely dry or cold climates develop soils very slowly while humid and warm climates develop them more rapidly. It is a thin covering over the land consisting of a mixture of minerals, organic material, living organisms, air and water that together support the growth of plant life.

The organic portion, which is derived from the decayed remains of plants and animals, is concentrated in the dark uppermost "top soil".

The inorganic portion, which is made up of rock fragments, is formed over thousands of years by physical and chemical weathering of bedrock. We may enhance the soil by helping its processes along, but we can never recreate what we destroy.

Pollution may be local, regional, trans-boundary or global. The agent which causes pollution is called pollutant.

2.1.2 CONCEPTS

Pollutants can be classified as:

1. Degradable or non persistent pollutants: These can be rapidly broken by natural processes. Eg. Domestic sewage, discarded vegetables etc.
2. Slowly degradable or persistent pollutants: These remain in the environment for many years in an unchanged condition and take decades or longer to degrade. Eg:DDT
3. Non degradable pollutants: These cannot be degraded by natural processes. Eg:Toxic elements like lead or mercury and nuclear wastes

Types of environmental pollution:-

1. Air pollution
2. Water pollution
3. Soil pollution
4. Marine pollution
5. Noise pollution
6. Thermal pollution
7. Nuclear hazards

2.2 AIR POLLUTION

Air pollution occurs due to the presence of undesirable solid or gaseous particles in the air in quantities that are harmful to human health and environment.

It can be defined as presence of foreign matter either gaseous or particulate or combination of both in the air which is detrimental to the health and welfare of human beings.

Pollutants that are emitted directly from identifiable sources are produced by natural events can be in the form of particulate matter or gaseous form. These are called primary pollutants Ex: Dust storms and volcanic eruptions and through human activities like emission from vehicles, industries etc.

There are five primary pollutants that contribute to 90% of global air pollution. These are carbon oxides (CO & CO2), N oxides, sulphur oxides, volatile organic compounds and suspended particulate matter.

The pollutants that are produced in the atmosphere, when certain chemical reactions take place among the primary pollutants and with others in the atmosphere are called secondary air pollutants. Eg: Sulphuric acid nitric acid, carbonic acid and acid rain.

Particulates are small pieces of solid material.

Particulate matter can be

1) Natural such as dust, seeds, spores, pollen grains, algae fungi, bacteria and viruses
2) Anthropogenic such as mineral dust, cement, asbestos dust, fibres, metal dust, fly ash smoke particles form fires etc.

2.2.1 Causes of Air pollution

- Air pollution may originate from one or more variety of sources. The natural pollution includes sources such as oceanic aerosol, volcanic emissions, biogenic sources, windblown terrestrial dust and lightening.
- The artificial pollution generates from human activities and includes sources such as fuel burning, refuge burning, transportation, construction of buildings, chemical factories, metallurgical factories and, vehicles.
- The third category includes solvent usage and sources include spray painting and solvent extraction. Automobiles are the first rate of polluters. Industries occupy second position.

2.2.2 Effects of Air Pollution

- Effects on human health: Particulates cause carcinogenic effects, accumulate in lungs and interfere with ability of lungs to exchange gases. Prolongeal exposure causes lung cancer and asthma.
- Effects on plants: Gaseous pollutants enter the leaf pores and damage the leaves of crop plants, interfere with photosynthesis and plants growth and reduces nutrient uptake and causes the leaves to turn yellow, brown or drop off altogether.
- On materials: Air pollutants break down the exterior paint on cars and houses.
- Effect on stratosphere: The upper stratosphere consists of considerable amounts of ozone, which works as an effective screen for UV light. Presence of certain pollutants can accelerate the breakdown of ozone. Depletion of ozone effects human health, food productivity and climate

2.2.3 Control measures

Two approaches

1. Preventive technique
2. Effective control

Effective means of controlling air pollution is to have proper equipments in place. This includes devices for removal of pollutants form fuel gases through scrubbers, closed fuel collection recovery systems.

Using unleaded petrol for vehicles is another way of control. Industries should be carefully located so as to minimize the effect of pollution after considering topography and wind directions.

Mechanical devices such as scrubbers, cyclone separator, bag houses & electro-static precipitators, reducing particulate pollutants.

2.2.4 MECHANISM OF PEROXYACYL NITRATES(PAN) GENERATION

In the atmosphere peroxyacyl nitrates are not generated as they are; they are generated in situ by photochemical reactions having NO_x and VOC as precursors.

Depending on organic radical, peroxyacyl nitrates can be: peroxy acetyl nitrates (PAN): $CH_3C(O)OONO_2$; peroxy propionyl nitrates (PPN): $CH_3CH_2C(O)OONO_2$; peroxy n-butyryl nitrates (PnBN): $CH_3CH_2CH_2C(O)OONO_2$ etc. Among these, PAN plays an important in atmospheric chemistry.

The reactions of PAN formation are based on generation of acetyl radicals by radiation of some VOC (hydrocarbons, alcohols, aldehides). For example:

$$CH_3\text{-}CHO + HO\cdot \rightarrow H_2O + CH_3\text{-}CO\cdot$$

$$CH_3{-}CO\cdot + O_2 \longrightarrow CH_3{-}C(=O){-}O{-}O\cdot$$

$$CH_3{-}C(=O){-}O{-}O\cdot + NO_2 \longrightarrow CH_3{-}C(=O){-}O{-}O{-}NO_2$$

In addition to the reaction with NO_2, peracetyl radical can also react with NO generating NO_2 and CH_3 radicals. These species generate formaldehyde by oxidation.

PAN decomposition occurs only in the presence of NO. The rate of PAN decomposition increases fast with the temperature. In the atmosphere PAN concentration depends on temperature, NO_2/NO ratio (competition between reaction 3 and 4 and VOC availability and reactivity VOC can generate acetyl radicals). Therefore, the relationship between PAN in the air and the emission of its precursors (VOC and NOx) is not linear and, in the same time dependent on O_3, VOC and NOx concentrations.

Acyl radicals having a higher number of carbon atoms (propionyl-, n-buthyryl-) generates PPN or PnBN, and not PAN. Ethanol as direct precursor can be oxidized to acetaldehyde.

PPN/PAN ratio can be an index of the impact of using ethanol as an additive for vehicles fuels compared to using gasoline. Both PPN day variation and ratio PPN/O3 are similar to those for PAN.

2.2.5 FORMATION OF SMOG

Smog is a yellowish fog caused by a mixture of atmospheric pollutants and it consists mainly of fine particles and ozone. The latter is the product of complex photochemical reactions between nitrogen oxides (NOx) and volatile organic compounds (VOC), which are called “precursors”. The main sources of these pollutants are motor vehicles, industrial processes and the heating of buildings.

Fine particles are released directly into the air by motor vehicles, industrial processes and heating, especially wood burning, or are created in the atmosphere following the

chemical reactions of precursor pollutants such as sulfur dioxide (SO2) and nitrogen oxides (NOx) in the air.

Smoggy day in Québec, February 02, 2005

Smog-creating pollutants can originate on the other side of the border or locally. The winds bring the precursor pollutants and ozone from southern Ontario and the central US. These then combine with the contribution from urban areas in Québec.

2.2.6 FORMATION OF OXYGEN

Free oxygen gas was almost nonexistent in Earth's atmosphere before photosynthetic archaea and bacteria evolved, probably about 3.5 billion years ago. Free oxygen first appeared in significant quantities during the Paleoproterozoic eon (between 3.0 and 2.3 billion years ago). For the first billion years, any free oxygen produced by these organisms combined with dissolved iron in the oceans to form banded iron formations. When such oxygen sinks became saturated, free oxygen began to outgas from the oceans 3–2.7 billion years ago, reaching 10% of its present level around 1.7 billion years ago.

The presence of large amounts of dissolved and free oxygen in the oceans and atmosphere may have driven most of the anaerobic organisms then living to extinction during the Great Oxygenation Event (oxygen catastrophe) about 2.4 billion years ago. However, cellular respiration using O2 enables aerobic organisms to produce much more ATP than anaerobic organisms, helping the former to dominate Earth's biosphere. Cellular respiration of O2 occurs in all eukaryotes, including all complex multicellular organisms such as plants and animals.

Since the beginning of the Cambrian period 540 million years ago, O2 levels have fluctuated between 15% and 30% by volume. Towards the end of the Carboniferous period (about 300 million years ago) atmospheric O2 levels reached a maximum of 35% by volume, which may have contributed to the large size of insects and amphibians at this time. Human activities, including the burning of 7 billion tonnes of fossil fuels each year have had very little effect on the amount of free oxygen in the atmosphere. At the current rate of photosynthesis it would take about 2,000 years to regenerate the entire O 2 in the present atmosphere.

2.2.7 CONTROL OF PARTICULATE AND GASEOUS EMISSION

Gaseous effluents, such as flue gases and off-gases, must be monitored carefully in order to control: Plant operation Emission of pollutants, and sometimes both.

Either oxygen or carbon dioxide is monitored, in order to verify the excess of combustion air. This factor determines the thermal efficiency of the boiler plant. The quality of combustion (addressed in detail in *Pollution Control through Efficient Combustion Technology*) can be derived from few parameters, such as CO, TOC or sooting (Ringelmann or Baccharach value).

Pollutants proportion may be measured on the basis of a wide range of general emission parameters. Frequently covered are the values for dust, heavy metals, CO, SO_2, NO_x, C_xH_y, TOC, and HCl (for incinerators). Rarely measured are SO_3, Cl_2 and N_2O. Specific compounds are either process or raw materials related, e.g. fluorides from enamels, phosphoric acid or aluminum production.

The nature and limit values of the parameters to be monitored and the method and frequency of their determination are given in general codes and also in specific conditions, stipulated in operating permits. Detailed procedures vary from country to country, although E.U.-Directives and Federal Codes may decide on minimum requirements and also on measures to be taken (notification, even halting plant operation) in case limit values are being exceeded for a specified time period.

Emissions Control of NOx, SO_2

NOx Control: SCR, and SNCR *Selective Catalytic Reduction (SCR).* The SCR process consists of injecting ammonia upstream of a catalyst bed. It is critical to the design of the SCR to produce efficient and complete mixing prior to the ammonia making contact with the catalyst surface. NOx combines with the ammonia embedded on the catalyst surface, and is reduced to molecular nitrogen through the activation energy of the catalyst. SCR is capable of over 95 percent NOx *reduction (reference Peerless Mfg. Co. Dallas, Tx.*) Titanium Oxide in a homogenous extruded substrate is the SCR catalyst material most commonly used, though vanadium pentoxide, noble metals, or zeolites are also used, depending on the type of fuel and operating temperature of the exhaust gas. The ideal operating temperature for a conventional SCR catalyst is 400 to 750 °F. New catalyst formulations have been developed which extent these temperature ranges. However, with these new catalyst formulations are associated deeper catalyst beds which increase pressure drop, shorter catalyst life, and higher capital cost, etc.

Typically, the catalyst reactor is mounted on a spool piece, located within the exhaust stack or in the discharge duct before the stack section, at a location where the gas temperature of a boiler is typically in the ideal range of 450 to 750 "F. High temperature zeolite SCR catalysts for applications have been developed that permit continuous SCR operation at temperatures as high as 1050 F. High temperature SCR catalysts must be used with applications where exhaust temperature ranges from 850 to 1000 F range.

A certain amount of ammonia slip occurs when using SCR. Ammonia slip is usually limited by permit conditions to 5 or 20 ppm, corrected to 3 percent 02. Ammonia is classified as an air toxic compound in California. Ammonia passing through the SCR and emitted to atmosphere can combine with nitrate (NOx) or sulfate (S04) in the ambient air to form a secondary particulate, either ammonium nitrate or ammonium sulfate. Based on 1995 District data, ambient NOx and S04 concentrations are greater than ambient ammonia concentrations.

SO2 Control SO2 control is briefly discussed for completeness, however not considered applicable in a natural gas only environment.

The wet venturi scrubbing technique is a wet system capable of removing both SO2 and particulate in flue gas from oil fired and coal-fired boilers burning medium- to high-

sulfur fuels. In the basic process, the centrifugal scrubber imparts a spinning motion on the gas passing through, resulting from a tangential entry of the gas stream. The particulate are impacted into the wet scrubbing droplets injected before the venturi. The flue gas passes through a venturi scrubber located downstream of the boiler exhaust; the particulate emissions are embedded and grown in size through the collision mechanism. The cyclonic action then serves to remove the particulate from the gas stream. SO2 is then reacted with the caustic solution (NaOH), which is injected into the spray mechanisms. Cleaned flue gas then passes into the atmosphere through the stack. The process is expected to achieve SO2 reductions of 90%.

The basic process chemistry associated with the SO2 removal, consist of injecting potassium, ammonium, or sodium salt solution into the gas stream. As described above, this application uses Sodium Hydroxide (NaOH) solution. The pH of the entrainment fluid is then controlled, and the resulting salt formations are removed through a blowdown mechanism. The solution is considered wastewater, is not available for further SO2 removal, and is therefore not considered a regenerative process.

2.2.8 MITIGATION PROCEDURES

1) Pre- disaster mitigation can help in ensuring foster recovery from the impacts of disasters.
2) Mitigation measures must ensure protection of the natural and cultural assests of the community
3) Hazard reduction methods must take into account the various hazards faced by the affected community & their desires and priorities
4) Any mitigation programme must also ensure an effective partnership between the Govt, Scientific, private sector, NGOs and the community

The main elements of a mitigation strategy

1) Risk assessment and Vulnerability analysis: This involves the identification of hotspot areas of prime concern, collection of information on past natural hazards, information on the population and infrastructure.
2) Applied research and technology transfer: There is a need to establish or upgrade observation equipment and networks, monitor the hazardous properly, improve the quality of forecasting and warning.
3) Public awareness and training: Training to be given to officials & staff of various Departments involved in state & district level.
4) Institutional mechanisms: There is need to emphasize on proactive and predisaster measures rather than post-disaster response. It is thus essential to have a permanent administrative structure which can monitor the developmental activities across departments and provides suggestions for necessary mitigation measures. The national disaster management centre (NDMC) can perform such a task. Professional like architects, struc tural engineers, doctors and chemical engineers who are involved with management of hazardous chemicals, can be asked to form groups that can design specific mitigation measures.
5) Incentives and resources for mitigation: Provide stable source of funding for all mitigation programs.
6) Land use planning and regulations .
7) Hazard resistant design and construction.
8) Structural and Constructional reinforcement of existing buildings: This can be done by the insertion of walls, specially on chored frames, construction of new frame systems, designing residential electrical equipment above flood level, designing water storage tanks to be able to withstand cyclonic winds, earthquakes & floods.

2.3 WATER POLLUTION

When the quality or composition of water changes directly or indirectly as a result of man's activities such that it becomes unfit for any useful purpose is said to be polluted.

2.3.1 Two types of pollutions:

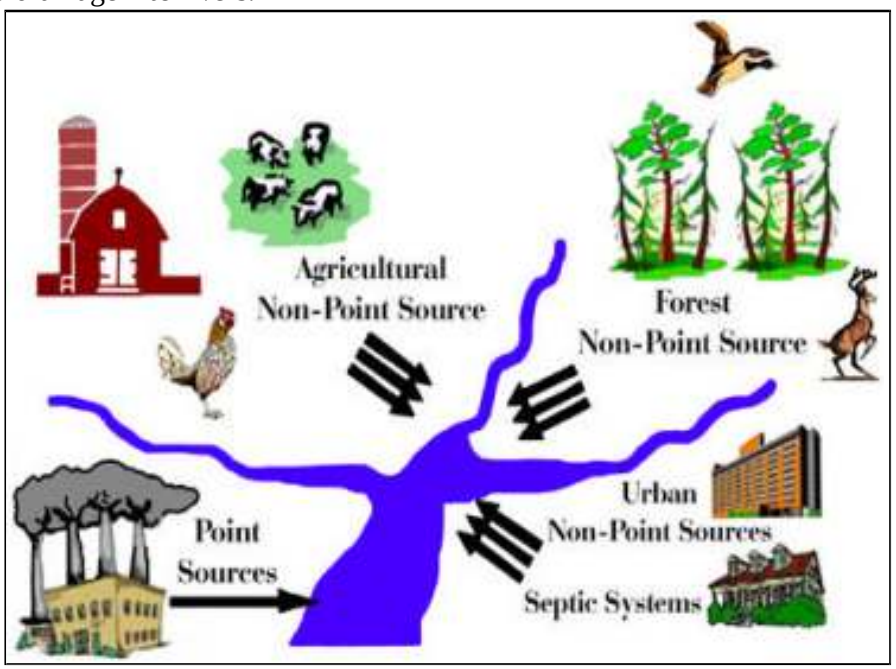
Point source of pollution: This source of pollution can be readily identified because it has a definite source and place, where it enters the water. Eg: Municipal industrial discharges pipes.

Non point source of pollution: When a source of pollution cannot be readily identified such as agricultural runoff, acid rain etc, it is called as non point source of pollution.

2.3.2 Causes of Water Pollution

Disease causing agents

- Oxygen depleting wastes
- Inorganic plant nutrients
- Excess pesticides
- Water soluble organic chemicals
- Variety of organic chemicals
- The sediments of suspended matter
- Water soluble radioactive isotopes
- Hot water released by power plants & industries
- Acid drainage into rivers.



2.3.3 Effects of Water pollution

- Large amount of human waste in water increase the number of bacteria which cause gastro intestinal diseases, Water borne diseases diarrhea, typhoid etc.
- If more organic matter is added to water the O_2 is used up. This causes fish and other forms of O_2 dependent aquatic life dies.
- High levels of organic chemicals (acids, salts& toxic metals) can make the water unfit to drink, harm fish and other aquatic life, reduce crop yields.
- Variety of organic chemicals / oil gasoline, plastics & detergents are harmful to aquatic life and human life.

- Radioisotopes cause birth defects, cancer and genetic damage.
- Hot water because of thermal pollution not only decrease the solubility of O_2 but also changes the breeding cycles of various aquatic organisms.
- Accidental oil spills cause environmental damage.
- NO_3 contamination causes Blue baby disease (Methaemoglobinaceae) and PO_4 contamination causes bone marrow disease.

2.3.4 Control measures of water pollution

- Setting up of effluent treatment plants to treat waste water can reduce the pollution load in the recipient water. The treated effluent can be reused either for gardening or cooling purposes or wherever possible.
- Root zone process has been developed by Thermax by running contaminated water through the root zone of specially designed reed beds. These have the capacity to absorb from the surrounding air through their stomata openings. It creates O2 rich conditions where bacteria and fungi oxidize the wastes.
- Providing sanitation and waste water treatment facility.
- Integrated nutrient management (INM) and integrated pest management (IPM) practices will reduce the effects caused due to excess pesticides.

2.3.5 PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE MARINE WATER

Water is essential to the maintenance of all life. It constitutes 80 per cent or more by weight of active protoplasm. It is the most efficient of all solvents and carries in solution the necessary gases, oxygen and carbon dioxide, as well as the mineral substances necessary to the growth of plants and animals, and it is itself one of the essential raw materials in the manufacture of foods by plants.

Organisms living in the terrestrial environment have devised means, such as impervious integuments, to conserve water, and the land plants have roots and special vascular systems for transport of water to all growing parts. In the marine environment there is freedom from dessication, except at high-tide levels, and therefore no highly specialized means are provided for conservation of water or for its transport in plants.

Also of biological importance are the high heat capacity of water and its high latent heat of evaporation, both of which obviate the danger that might result from rapid change of temperature in the environmental medium. Owing to the high degree of transparency of water it is possible for the sea to sustain plant life throughout a relatively deep layer, and in animals the development of organs of vision and of orientation has progressed to a marked degree.

Sea water is a buffered solution; that is, changes from acid to alkaline condition, or vice versa, are resisted (p. 195). This property is of vital importance to the marine organisms, mainly for two reasons: (1) an abundant supply of carbon can be available in the form of carbon dioxide for the use of plants in the synthesis of carbohydrates without disturbance to the animal life that may be sensitive to small changes in pH, and (2) in the slightly alkaline habitat the many organisms that construct shells of calcium carbonate (or other calcium salts) can carry on this function much more efficiently than in a neutral solution.

The support offered to the bodies of marine organisms by the specific gravity of the surrounding medium obviates the need of special supporting skeletal structure in many forms. Striking examples of these are the jelly fishes, unarmored molluscs, unarmored dinoflagellates, and even the large marine mammals with their heavy skeletons, which could not survive in their present bulky state except in an aquatic habitat. The hard shells of crabs, clams, snails, and so on, doubtless serve as support, especially in some burrowing and intertidal forms, but these hard parts may be looked upon also as protective and as a framework for attachment of muscles used in digging, creeping, or swimming.

2.3.6 PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE TERRESTRIAL WATER

Aquatic organisms and the physical and chemical components of their environment are inseparably inter-related and interact with other. Flow and water chemistry are the primary factors governing life in riverine habitats, and both are closely related to seasonal variations. This is especially true for monsoon rivers such as the Mekong.The key physical and chemical characteristics of aquatic ecosystems are:

Oxygen: dissolved oxygen is a basic requirement for a healthy aquatic ecosystem. The amount of oxygen available for aquatic life depends on the factors that effect how it dissolves in water. Mixing of water allows exchanges of oxygen with the air. In the absence of adequate mixing oxygen levels in deep systems such as a reservoir can become reduced including the formation of layers of differing oxygen concentrations. Discharges of wastes or excessive plant growth caused by nutrient enrichment, followed by death and decomposition of vegetative material. This can use large amounts of oxygen and hence reduce oxygen concentrations in the water. These sources include discharges from forest harvesting, pulp mills, agriculture, effluent from sewage treatment and industrial plants.

Temperature: affects the solubility of many chemical compounds and can therefore influence the effect of pollutants on aquatic life. Increased temperatures increase the amount of oxygen organisms require. Human sources of pollutants that can impact water temperature include industrial effluents, agriculture, forest harvesting, urban developments, and mining.

Alkalinity and acidity: are important characteristics of water that affect its suitability for biota and influence chemical reactions. The ability to withstand changes in acidity or alkalinity, a buffering agent, is a related factor. Many biological processes, such as reproduction, cannot function in water with the incorrect acidic or alkaline properties.

Light: is necessary for photosynthesis, and is often a defining feature when describing habitat. The largest influence that light has on aquatic ecosystems is its influence on plant growth. Shade is also important in determining the nature of habitats.

Substratum: is the organic and inorganic material that makes up the bed of a river, stream or lake etc.. The impact of substrate on aquatic biota depends on substrate particle size, organic content and interaction with other environmental factors. Biodiversity and abundance of organisms tend to increase with substrate stability. Variations in substrate promote biodiversity.

Water velocity: represents perhaps a major environmental factor affecting the biota of running waters.

The physical factors discussed above can vary greatly according to the seasons.

The actual chemical composition of stream and river water depends on the interplay of several variables that are unique to each river catchment and even to tributary sub-catchments. These include:

- climate, the amount, distribution and initial chemical composition of precipitation, and its nearness coastal regions and to industry.
- the nature of the surrounding catchment and movement of water from the catchment to the river related to topography, geology, soils and vegetation and to the contribution of groundwater;
- the distance from headwaters and the season or even time of day and timing of the last rainfall; and
- the influence of human activity and land use in the catchment, such as agriculture, forestry and urbanization..

Increased nutrient concentrations are a serious and well-known consequence of a greater human presence and changing land uses within a watershed. Agriculture increases nutrient levels due to fertilizers and animal wastes, and also by increasing soil erosion. Municipal wastes and fertilizers are significant nutrient sources from urban areas.

Large amounts of organic and inorganic materials can be washed into rivers and transported long distances. Inorganic suspended solids originate from terrestrial sources through soil disturbance followed by heavy rainfall and subsequent bank erosion. The significance of suspended solids relates largely to the effects on light penetration into the water and to the nature of the substrate. The nature of suspended and dissolved materials conveys optical properties that can be used to classify water as:

- Blackwater: is poor in dissolved inorganic and suspended solids, but dissolved organic matter produces a reddish-brown colour. These are typically acidic.
- Whitewater: has high levels of suspended solids with a muddy/silty appearance, as well as high levels of dissolved inorganic solids, tending to be alkaline.
- Clearwater: varies in acidity and has little suspended material..

Pollution can be defined as the release of harmful materials, typically generated through human activity including industry, domestic and agricultural waste, into the receiving environment. Point-source pollution is discharged in the system through a single source. Diffuse-source pollution is mainly the result of agricultural and forestry activities, although it can also occur where there is small-scale mining over a large area.

Aquatic ecosystems undergo constant change and adaptation, and can withstand stress based on their unique physical, chemical and biological properties. Ecosystems may become unbalanced because of man-made factors.

Each species of animal and plant has an optimal range for physical and chemical requirements. Outside this range organisms face increasing stress and eventually die. Even when all physical and chemical characteristics of the environment fall within tolerable limits, production of species can be influenced by various combinations of factors. These different combinations explain the ecological variety that makes each stream unique. The interpretation of these factors requires an integrated approach and an understanding of the interdependent nature of biological systems over time and space.

2.3.7 WATER QUALITY PARAMETERS – PHYSICAL, CHEMICAL AND BIOLOGICAL

It is a measure of the condition of water relative to the requirements of one or more biotic species and or to any human need or purpose. It is most frequently used by reference to a set of standards against which compliance can be assessed. The most common standards used to assess water quality relate to health of ecosystems, safety of human contact and drinking water.

Standards

In the setting of standards, agencies make political and technical/scientific decisions about how the water will be used. In the case of natural water bodies, they also make some reasonable estimate of pristine conditions. Different uses raise different concerns and therefore different standards are considered. Natural water bodies will vary in response to environmental conditions. Environmental scientists work to understand how these systems function, which in turn helps to identify the sources and fates of contaminants. Environmental lawyers and policymakers work to define legislation with the intention that water is maintained at an appropriate quality for its identified use.

The vast majority of surface water on the planet is neither potable nor toxic. This remains true when seawater in the oceans (which is too salty to drink) is not counted. Another

general perception of water quality is that of a simple property that tells whether water is polluted or not. In fact, water quality is a complex subject, in part because water is a complex medium intrinsically tied to the ecology of the Earth. Industrial and commercial activities (e.g. manufacturing, mining, construction, transport) are a major cause of water pollution as are runoff from agricultural areas, urban runoff and discharge of treated and untreated sewage.

2.3.8 WATER TREATMENT

Water treatment is, collectively, the industrial-scale processes that makes water more acceptable for an end-use, which may be drinking, industry, or medicine. Water treatment is unlike small-scale water sterilization that campers and other people in wilderness areas practice. Water treatment should remove existing water contaminants or so reduce their concentration that their water becomes fit for its desired end-use, which may be safely returning used water to the environment.

The processes involved in treating water for drinking purpose may be solids separation using physical processes such as settling and filtration, and chemical processes such as disinfection and coagulation.

Biological processes are employed in the treatment of wastewater and these processes may include, for example, aerated lagoons, activated sludge or slow sand filters.

2.4 SOIL POLLUTION

Soil pollution is the introduction of substances, biological organisms, or energy into the soil, resulting in a change of the soil quality, which is likely to affect the normal use of the soil or endangering public health and the living environment.

2.4.1 Causes of Soil Pollution

- Soil erosion
- Soil contaminants
- Fertilizers and pesticides
- Excess use of irrigation water

2.4.2 Effects of Soil Pollution

- Food shortage
- Desertification
- Decrease in the extent of agricultural land
- Top soil erossion
- Excess use of irrigation leads to waterlogging and soil salinisation.
- Fertilizer run off leads to the eutrophication of waterways.

2.4.3 Control measures

- Proper soil conservation measures to minimize the loss of top soil
- INM, IPM, using bio pesticides and integrated environment friendly agriculture to reduce pesticides or fertilizers.
- Appropriate water management practices in agriculture
- Keeping the soil surface covered with crop residues or crop cover
- Planting trees as a part of afforestation/ shelter belts/wind breakers
- Cleaning up of polluted soil

2.5 SOLID WASTE MANAGEMENT

- The combined effects of population explosion and changing modern living standards have had a cumulative effect in the generation of a large amount of various types of wastes.
- Management of solid waste is very important in order to minimize the adverse effects of solid wastes.

- Any material that is thrown away or discarded as unwanted is considered as solid waste.

2.5.1 Types

1. Garbage or food waste
2. Rubbish
3. Agricultural waste
4. Industrial waste
5. Hazardous waste

2.5.2 Cause

- Over population
- Affluence
- Technology

2.5.5 Effects

- Health hazard
- Environmental impact

2.5.6 Control measures

Solid waste management include

- The waste generation
- Collection of solid waste
- Disposal of solid waste
- Land fill- Disposal of municipal waste in the upper layers of the earth□s mantle.
- Incineration- Burn highly combustible wastes at very high temperature
- Composting or Bio degradation- Decompose the organic components of the municipal solid wastes.
- Waste utilization
  a) Reuse
  b) Recycling
  c) Reclamation

2.5.7 SIGNIFICANCE OF SOLID WASTE MANAGEMENT

In communities where appropriate sites are available, sanitary landfills usually provide the most economical option for disposal of nonrecyclable refuse. However, it is becoming increasingly difficult to find sites that offer adequate capacity, accessibility, and environmental conditions.

Landfills will always play a key role in solid-waste management. It is not possible to recycle all components of solid waste, and there will always be residues from incineration and other treatment processes that will eventually require disposal underground.

Landfills can actually improve poor-quality land. In some communities properly completed landfills are converted into recreational parks, playgrounds, or golf courses.

2.6 MARINE POLLUTION

Marine pollution is defined as the introduction of substances to the marine environment directly or indirectly by man resulting in adverse effects such as hazardous to human health, obstruction of marine activities and lowering the quality of sea water

2.6.1 Sources

- Municipal waste & sewage from residences and hotels in coastal towns
- Pesticides and fertilizers from agriculture
- Petroleum & oil washed off from roads enter sewage system & finally into seas
- Ship accidents & accidental spillage at

- Off shore oil exploration also pollute the sea water to a large extent
- Dry docking
- Pollution due to organic wastes
- Pollution due to oil
- Tanker accidents
- Volcanic eruptions in the sea.
- Deep sea mining

2.6.2 Effects of marine pollution

- A large amount of organic wastes can also result in the development of 'red tides'. These are phytoplankton blooms because of which the whole area is discolored.
- Commercially important marine species are also killed due to clogging of gills and other structures.
- For salt marshy plants oil slick can affect the flowering, fruiting and germination.
- The coral reefs are the productive ecosystems offer many benefits to people. These coral reefs are threatened by a) the sediments from deforestation carried by the runoffs.
- Drill cuttings dumped on the seabed result in the production of toxic sulphides in the bottom sediment thus eliminating the benthic fauna.

2.6.3 Control measures of marine pollution

- Introduction of sewage treatment plants to reduce BOD of final product before discharging into sea.
- Cleaning oil from surface waters and contaminated beaches can be accelerated through the use of chemical dispersants which can be sprayed on the oil.
- Load on top system reduces oil pollution cleaned with high pressures jets of water.
- Crude oil washing: The clingage is removed by jets of crude oil while the cargo is being unloaded.

2.7 NOISE POLLUTION

Sound is mechanical energy from a vibrating source. Unpleasant and unwanted sound is called noise.

Sound can propagate through air, liquid or solid. Sound is pressure perturbation in the medium through which it travels. Sound pressure creates alternate compression and rarefaction. The number of c and r per unit time is called frequency.

Sound pressure does not produce linear impact on human. A logarithmic scale has been devised.

Noise is measure in terms of SPL which is a log ratio of sound P to a std. P. It has a dimensionless unit decibel (dB). The international reference P is 2X10 power -5 Pa. Sound can affect ears either by loudness or by pitch (frequency). The CPCB has recommended the permissible noise levels for various places.

2.7.1 Sounds and their decibel scale

1. Rocket engine – 180 dB
2. Jet plane take off – 150 dB
3. Threshold of pain – 140 dB
4. Recorded music (max) – 130 dB
5. Construction works, news paper press – 100 dB
6. Motor cycle – 90 dB
7. Ordinary conservation – 70/80 dB
8. Air conditioning unit/ Light traffic – 60 dB
9. Normal living room – 50 dB

10. Library or soft whisper – 30 B
11. Threshold of hearing – 0 dB

2.7.2 Sources of noise pollution

- Industrial units
- Transportation modes
- Construction activities
- Celebrations
- Electric home appliances

2.7.3 Effects of noise pollution

- Interferes communication
- Hearing damage (90 dB)
- Physiological and Psychological disorders

2.7.4 Control of noise pollution

- Reduction in source of noise]
- Noise making machines should be kept in containers with sound absorbing media
- Proper oiling will reduce noise from machinery
- Using silencers – fibrous material
- Planting trees
- Legislation can prevent excess sound production, unnecessary horn blowing etc.

2.8 THERMAL POLLUTION

Thermal pollution is the degradation of water quality by any process that increases the ambient water temperature. The increase in temperature decreases the dissolved oxygen/oxygen supply and affects ecosystem composition.

2.8.1 Causes

- Nuclear power plant
- Domestic sewage
- Hydro electric power

2.8.2 Effects

- Reduction in dissolved oxygen
- Increase in toxicity
- Direct mortality

2.8.3 Control measures

- Cooling towers
- Cooling ponds
- Spray ponds

2.9 NUCLEAR HAZARDS (OR) RADIO ACTIVE POLLUTION

The physical pollution of air, water and soil by radioactive materials are called nuclear pollution.

2.9.1 Causes

- **Natural causes:**
  a. Solar rays
  b. Radio nuclides in earth's crust
  c. Environmental radiation
- **Anthrogeneic causes:**
  a. Medical X-rays
  b. Radio isotopes
  c. Nuclear test
  d. Nuclear installations
  e. Nuclear reactor

2.9.2 Effects

- Causes skin burns, loss of teeth, vomiting, anemia
- Blood cancer
- Brain damage

2.9.3 Control measures

- Radiation exposure protection
- Radiation contamination protection
- Controlled area
- Disposal of radioactive waste

2.10 ROLE OF AN INDIVIDUAL IN PREVENTION OF POLLUTION

- Use stairs instead of elevators
- Use public transportation walk or ride a bicycle
- Plant trees around building
- Turn off lights, television sets and computer when not in use.
- Pay immediate attention to leaks in pipes.
- Install waste saving equipments.
- Recycle glass metal and paper.
- Compost garden waste
- Segregate waste and recycle
- Buy locally made long losing material
- Buy environmentally degradable products.
- Take some bag from home to market to purchase.

2.11 POLLUTION CASE STUDIES

2.11.1 BHOPAL GAS TRAGEDY

The careless siting of industries and relatively poor regulatory controls leads to ill health in the surroundings.

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.

Bhopal gas tragedy plant

2.11.2 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.

Chernobyl Reactor

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.

2.11.3 ENVIRONMENTAL IMPACT OF ICELAND VOLCANIC ERUPTION

The air traffic disruption caused by the Iceland volcano eruption in 2010 highlighted the environmental impacts of atmospheric dust from volcanic eruption.The volcanic ash, in effect pulverized rock, was spewed between 20,000 to 40,000 feet into the atmosphere right where modern aircraft ply their trade. This atmospheric dust not only hinders visibility but can also damage aircraft engines, forcing them to shut down completely. The fact that this disruption is not only affecting the countries of Europe, but has a knock on effect on all worldwide flights that have a European destination. Volcanoes can spew atmospheric dust and gases tens of kilometers into the earth’s atmosphere where prevailing winds can very quickly transport them thousands of kilometers from the original eruption. Volcanic ash can lower visibility in the upper atmosphere and knock out aircraft engines.

Widespread ash from volcanic eruptions increase the Earth’s “Albedo Effect”, cooling the temperature of the lower troposphere while increasing the temperature of the stratosphere.

Volcanic activity is estimated to be responsible for the release of 130 million tonnes of carbon dioxide into the atmosphere annually. Sulfur dioxide, a major ingredient of volcanic activity, is the primary cause of environmentally damaging acid rain. It also forms sulfuric acid mists which causes pulmonary damage to both people and animals. Hydrogen sulfide, a colorless gas with an offensive odor, causes irritation of the upper respiratory tract and pulmonary edema. Atmospheric dust from volcanoes can act as a magnet for other pollutants and water vapor, giving rise to atmospheric hazes and heavy fogs.

2.11.4 CASHEW IN KASARGOD, KERALA POISONOUS NUTS

Endosulfan, a pesticide banned by many countries in the world including India was extensively sprayed aerially in the cashew plantations of Plantation Corporation of Kerala (PCK) spread over 2209 hectares in various divisions of Kasargod district, Kerala. Endosulfan is slated to be phased out globally under the Stockholm Convention 2001, to which India is a signatory. The pesticide is classified as an organochlorine compound and its breakdown products are persistent in the environment, with an estimated half-life of nine months to six years. It is known to potentially bioaccumulate in humans and other animals, in the liver, kidneys and fatty tissue. PCK started using this pesticide in 1979 and unusual health disorders were reported from places like Vaninagar, Adur, Mulleria, Padre etc. The people were unaware that this was a lethal poison.

A study conducted by the Centre for Science and Environment (CSE) confirmed the presence of high quantities of endosulfan in the samples of water, soil, fruits, mother's milk and blood in Kasargode. Further disorders of the central nervous system, cerebral palsy, mental and physical retardation, epilepsy and congenital anomalies like stag horns, liver cancer, blood cancer, infertility, miscarriages, hormonal imbalances, skin diseases and asthma have been reported. All these disorders were traced to endosulfan effects. After mass agitations and several reports by various agencies, the use of endosulfan was banned in Kerala in August 2001. Though, the state government has paid compensations, the rehabilitation of the living victims is really tough and challenging. Reports reveal that approximately, 224 people were critically affected and 226 have a 60percent disability. This tragedy was spread over 20 villages in the state. (Ref: Sushmitha Baskar and .R.Baskar)

2.11.5 GROUNDWATER POLLUTION IN INDIA

An example of groundwater pollution caused by excessive extraction is that fluoride contamination. It has spread across 19 states and across a variety of ecological regions ranging from the Thar desert, the Gangetic plains and the Deccan plateau. Source: When the bedrock weathers the fluoride leaches into water and the soil. surfaced during the last three decades - extraction of groundwater which has resulted in the tapping of aquifers with high fluoride concentrations was noticed during 1970s and the 1980s when there was massive state investment in rural water development for irrigation as well as for drinking. Encouraged by state subsidies on diesel and electricity, people invested in diesel and submersible pumps in a bid to extract groundwater through borewells. This policy aggravated the fluoride problem. Effects: combines with the bones as it has an affinity for calcium phosphate in the bones. Excess intake of fluoride can lead to dental fluorosis, skeletal fluorosis or non-skeletal fluorosis. Correction: - Deflouridation plants and household water treatment kits are stop-gap solutions. (Ref: Sushmitha Baskar & R.Baskar)

2.11.6 MARINE POLLUTION IN TAMIL NADU: OCEANS NOT SPARED

Industrial pollution has threatened the natural habitats of pearls in the pearl banks of Tuticorin coast in the Gulf of Mannar. It has affected fish and other organisms as far as 30 kms south of Tuticorin due to effluents released from chemical industries. Tannery wastes have caused the pollution of coastal waters from Chennai to Vedaranyam. The effect of diversity of phytoplankton ecology of mangrove estuaries of Tuticorin is greatly affected by industrial effluents. The Chennai coastal waters showed high levels of pesticides like DDT,

lindane, endosulphan and heptachlor. The bioaccumulation of these pesticides in marine organisms could pose major health hazards.

2.11.7 NOISE HITS WHALES IN HONG KONG

Studies have shown that shipping traffic in Hong Kong, which is one of the busiest ports in the world with approximately half a million oceanic vessels traveling through its waters every year (including over 10,000 transits by high speed ferries) has caused changes in the dolphin and whale behavior especially in response to fast moving vessels. A special sanctuary was established by the Hong Kong government in 1995, surrounding the islands of Sha Chau and Lung Kwu Chau, an important place occupied by the humpback dolphins. At any given time approximately 200 vessels surrounds this sanctuary. The sanctuary was a measure to mitigate boat traffic and tremendous noise produced. Adjacent to the sanctuary is an airport, where 700 planes descend and take off everyday, directly over the sanctuary. All the above activities have caused high noise input into the natural whale habitat. Noise, a major anthropogenic stress factor has caused a general decline in the whale populations.

GLOSSARY

Pollution: Any undesirable change in the physical, chemical or biological characteristics of any component of the environment (air, water, soil) which can cause harmful effects on various forms of life or property.

Degradable or non persistent pollutants: These can be rapidly broken by natural processes.

BOD: Bio-chemical Oxigen Demand is the dissolved oxygen required to decompose organic matter in water.

COD: Chemical Oxigen Demand is the measure of oxygen equivalent of the organic matter content of the sample water.

Effluents: Waste material discharged into environment which can be treated or untreated.

Solid waste: Any material that is thrown away or discarded as unwanted.

Disssaster: 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.

REVIEW QUESTIONS

1. Discuss the causes, effects and control of various Environmental Pollutions comparitively.
2. Discuss about the solid waste management.
3. What are the causes of water degradation?
4. What is the role of an individual in controlling the pollution?
5. List the standards of sound.

UNIT – III NATURAL RESOURCES

3.1 NATURAL RESOURCES

Any component of the environment which has intrinsic value of its own is called as resource. Any component which can be transferred in a way such that it becomes more valuable and useful is termed as resource.

3.1.1 PREREQUISITE DISCUSSIONS

The main problem associated with natural resources is unequal consumption. A major part of natural resources are consumed in the 'developed' world. The 'developing nations' also over use many resources because of their greater human population.

However, the consumption of resources per capita (per individual) of the developed countries is up to 50 times greater than in most developing countries. Advanced countries produce over 75% of global industrial waste and greenhouse gases.

Energy from fossil fuels consumed in relatively much greater quantities in developed countries. Their per capita consumption of food too is much greater as well as their waste. The USA for example with just 4% of the world's population consumes about 25% of the world's resources.

Producing animal food for human consumption requires more land than growing crops. Thus countries that are highly dependent on non-vegetarian diets need much larger areas for pastureland than those where the people are mainly vegetarian.

Our natural resources can be compared with money in bank. If we use it rapidly the capital will be reduced to zero. On the other hand if we use only the interest, it can sustain us over the longer term. This is called sustainable utilization or development.

The quality of human life and the quality of ecosystems on earth are indicators of the sustainable use of resources. There are clear indicators of sustainable lifestyles in human life. The natural reserves are stock supply, which man utilizes for sustenance and welfare.

3.2 FOREST RESOURCES

A forest can be defined as a biotic community predominant of trees, shrubs or any other woody vegetation usually in a closed canopy. It is derived from latin word '*foris*' means '*outside*'.

India's Forest Cover is 6,76,000 sq.km (20.55% of geographic area). Scientists estimate that India should ideally have 33% of its land under forests. Today we only have about 12% thus we need not only to protect our existing forests but also to increase our forest cover.

3.2.1 Forest Functions:

1) Protective and ameliorative functions
   a. Watershed protection
   b. Erosion control
   c. Land bank
   d. Atmospheric regulation
2) Productive functions
   a. Fodder for cattle
   b. Fuel wood and charcoal
   c. Poles for building homes
   d. Food: (consumptive use)
   e. Sericulture & Apiculture
   f. Medicinal plants for traditional medicines

3) Recreational and educational functions
4) Development functions
    a. Employment functions
    b. Revenue

3.2.2 Commercial uses

- Man depends heavily on a larger number of plant and animal products from forests for his daily needs.
- The chief product that forests supply is wood, which is used as fuel, raw material for various industries as pulp, paper, newsprint, board, timber for furniture items, other uses as in packing articles, matches, sports goods etc.
- Indian forests also supply minor products like gums, resins, dyes, tannins, fibers,etc.
- Many of the plants are utilized in preparing medicines and drugs; Total worth of which is estimated to be more than $300 billion per year.
- Many forests lands are used for mining, agriculture, grazing, and recreation and for development of dams.

3.2.3 Ecological uses

The ecological services provided by our forests may be summed up as follows:

- **Production of Oxygen:** The main green house gas carbon dioxide is absorbed by the forests as a raw material for photo synthesis. Thus forest canopy acts as a sink for carbon dioxide thereby reducing the problem of global warming caused by green house gas CO_2
- **Wild life habitat**: Forests are the homes of millions of wild animals and plants. About 7 million species are found in the tropical forests alone.
- **Regulation of hydrological Cycle**: Forested watersheds act like giant sponges, absorbing the rainfall, slowing down the runoff. They control climate through transpiration of water and seed clouding.
- **Soil Conservation:** Forests bind the soil particles tightly in their roots and prevent soil erosion. They also act as wind breakers.
- **Pollution moderators**: Forests can absorb many toxic gases and can help in keeping the air pure and in preventing noise pollution.

3.2.4 OVER EXPLOITATION OF FORESTS

- Man depends 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. shot up resulting in large scale logging, mining, road- building and clearing of forests.
- Our forests contribute substantially to the national economy.
- The international timber trade alone is worth over US $ 40 billion per year.
- The devasting effects of deforestation in India include soil, water and wind erosion, estimated to cost over 16,400 cores every year.

3.2.5 Ecological Significance of Forests

1) Balances CO_2 and O_2 levels in atmosphere.
2) Regulates earth temperature and hydrological cycle
3) Encourage seepage and reduces runoff losses, prevents drought
4) Reduces soil erosion (roots binding), prevents siltation and landslides thereby floods
5) Litter helps in maintaining soil fertility
6) Safe habitat for birds, wild animals and organisms against wind, solar radiation and rain

3.3 DEFORESTATION

Deforestation refers to the loss of forest cover; land that is permanently converted from forest to agricultural land, golf courses, cattle pasture, home, lakes or desert.

The FAO (Food and Agriculture Organization of the UN) defines tropical deforestation as "change of forest with depletion of tree crown cover more than 90%" depletion of forest tree crown cover less than 90% is considered forest degradation

Deforestation

3.3.1 Causes for Deforestation

- Agriculture: Conversion of forests to agricultural land to feed growing numbers of people
- Commercial logging: Destroys
- The cash crop economy: Raising cash crops for increased economy.
- Mining
- Increase in population: The needs also increase and utilize forests resources.
- Urbanization & industrialization
- Mineral exploration
- Construction of dam reservoirs
- Infrastructure development
- Forest fires
- Human encroachment & exploitation
- Pollution due to acid rain

3.3.2 Environmental effects /Consequences of deforestation

- Food problems
- Ecological imbalance
- Increasing CO2
- Floods leading to soil erosion
- Destruction of resources
- Heavy siltation of dams
- Changes in the microclimate
- Loss of biodiversity
- Desiccations of previously moist forest soil
- Environmental pollution
- Global warming

3.3.3 CONSERVATION

Conservation derived from two Latin words, *con* – together, *servare* – to keep or guard measures, *i.e.* an act of preservation or to keep together.

Concepts in conservation

- Restraining cutting of trees and submerging the forests
- Reforestation

- Afforestation
- Control forest diseases and forest fire
- Recycling forest products
- Replacing forest products

3.4 TIMBER EXTRACTION AND MINING

The major activities in forest area are

1) Timber extraction
2) Mining

The important effects of timber extraction are

i) Thinning of forests
ii) Loss of biodiversity, particularly tree breading species
iii) Soil erosion and loss of soil fertility
iv) Migration of tribal people from one place to another in search of new forest
v) Extinction of tribal people and their culture

Mining is a process of removing ores from area which is very much below the ground level. Mining is done for the extraction of several minerals of metals like Fe, Mn, Au, Ag, etc. The minerals are especially found in thick forests.

Mining can be carried out in two ways

1) Surface mining
2) underground mining or sub-surface mining

The effects of under ground mining on forest reserves are comparatively less than that of surface mining.

3.5 DAMS – BENEFITS AND PROBLEMS

River valley projects with big dams are considered to play a key role in the development of a country. India has large number of river valley projects.

1. These dams are regarded as symbol of national development.
2. Provides large scale employment of tribal people and increase the std. of living of them
3. Contribute for economic uplift and growth
4. Help in checking flood
5. Generate electricity
6. Reduce power and water shortage
7. Provide irrigation water
8. Provide drinking water to remote areas
9. Promote navigation and fishery.

3.6 CASE STUDIES

3.6.1 Desertification in hilly regions of the Himalayas:

- Desertification in Himalayas, involving clearance of natural forests and plantation of monocultures like Pinus roxburghi, Eucalyptus camadulensis etc., have upset the ecosystem by changing various soil and biological properties.
- The area is invaded by exotic weeds. These areas are not able to recover and arev losing their fertility.

3.6.2 Disappearing Tea gardens in Chhota Nagpur :

Following the destruction of forest rain fall declined in Chhota Nagpur to such an extent that tea-gardens also disappeared from the region.

3.6.3 Waning rain fall in Udhagamandalam :

The rainfall pattern was found to fluctuate with wooded land area in the hills. When the Nilgiri mountains had luxuriant forest cover annual rainfall used to be much higher.

3.7 WATER RESOURCES

Water is an indispensible resource. Around 97% of world surface is covered with water. Most of the animals and plants have 60-65% of water in their body.

Unique features of water:

- ❖ High specific heat
- ❖ High latent heat of vapourisation
- ❖ Good solvent for oxygen, nutrients and pollutants
- ❖ Anomalous expansion on freezing
- ❖ High surface tension

Global distribution of water is very much random depending on the geographical conditions. The availability of water decreases in the following order.

- ➲ Tropical rain forest
- ➲ Temperate regions
- ➲ Deserts

Water is used for domestic, irrigation and also industrial purposes. Out of the total available water 75% is used for agriculture, 20% for industrial usage.

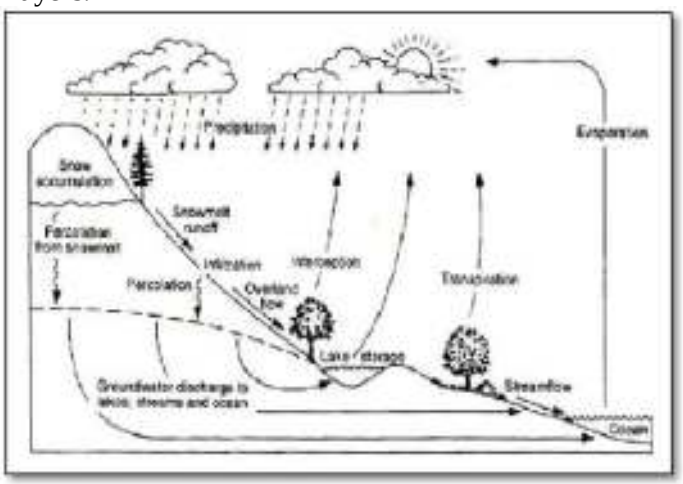
In our country ~93% of water is used for agricultural purposes.

Ground water: 9.86% of fresh water is ground water and it is 35-50% greater than surface water.

Aquifer: The layer of soil which is permeable has the ability to store water is called an aquifer. It is generally made up of gravel, sand etc.

Unconfined aquifer: it is covered by permeable layer. The recharge of this layer is by rainfall or snowmelt.

Confined aquifer: sandwiched between impermeable layers. The recharge is through unconfined aquifer layers.



Water Cycle

3.7.1 OVER UTILIZATION OF GROUND WATER

Over utilization of water leads to rapid depletion of water resources, ground subsidence, lowering of water table and water logging.

Reasons: Economic development, rapid industrial growth and population explosion. The use of ground water and surface water rates which are higher than that of recharge ultimately leads to

- Water scarcity
- Water logging
- Salination
- Alkalization

- Water pollution or contamination
- Creates declining of water levels
- Crops failure and reduction in agricultural production
- Over pumping of ground water create drought, famine and food shortage
- Over pumping of ground water sea water intrusion in coastal aquifers
- Land subsidence may due to over pumping of ground water

Clean water is universal right. It is the responsibility of everyone to ensure the purity of water. Water is a valuable commodity and it has to be conserved.

Surface water: When evaporation and transpiration rates are lower than the rainfall, surface water body like lake, river, pond, streams etc. are formed.

Flood: over flow of water, whenever the water in flow is greater than the carrying capacity of the channels flood occurs.

3.7.2 Causes:

- Heavy rainfall, snow melt, sudden release of water from dams.
- Prolonged down pour leading to overflowing of rivers and lakes
- Reduction in carrying capacity due to obstructions or sediments etc.
- Deforestation, overgrazing, mining increases water run off
- Removal of dense forests from hilly regions

3.7.3 Effects:

- Submerges the flooded area
- Loss of soil fertility due to soil erosion
- Extinction of civilization at costal area

3.7.4 Flood management:

- ✓ Dams and reservoirs can be constructed
- ✓ Embankments and proper channel management
- ✓ Flood way should not be encroached
- ✓ Forecasting or flood warning
- ✓ Decrease of run off by infiltration through afforestation or rain water harvesting etc.

3.7.5 DROUGHT

Unpredictable delay in climatic condition occurring due to monsoon rain failure.

Types:

- Meterological: in order of month or year, actual moisture supply at a given place consistently falls below critical level.
- Hydrological: deficiency in surface and subsurface water supplies
- Agricultural: inadequate soil moisture to meet the need of a particular crop at particular time or susceptibility of crops during different stages in its development
- Socioeconomic: reduction in the availability of food and social securing of people

3.7.6 Causes:

- ❖ Deforestation and lesser rainfalls coupled with cutting of trees for timber leads to desertifictation.
- ❖ Over drafting of ground water, subsidence of soil, drying of wetlands
- ❖ Pollution of soil with solid waste, industrial effluents etc makes land useless and dry
- ❖ Population explosion in man and livestock leads to enhanced requirement of timber, fuel wood, grazing
- ❖ Shifting cultivation

3.7.7 Effects:

- Increase of water in stream pond
- Ground water table get declined
- Loss of agricultural crops
- Loss of biodiversity
- Government spent a lot of money as drought relief fund

3.7.8 Control measures:

- Rain water harvesting
- Watershed management
- Prevent deforestation
- Encourage afforestation

3.8 CONFLICTS OVER WATER

Due to increase in population and decrease in water resources conflicts over water starts Conflicts over the water around world was classified as

- Control of water resources
- Military food resources
- Political resources
- Terrorism
- Military targets
- Development disputes

3.8.1 Causes:

Conflicts through use

1. Shipping traffic in international water
2. Dam construction
3. Construction of power stations
4. Conflicts through pollution-rhine river,Europe
5. Distributional conflict-relative storage

3.8.2 Conflicts management:

- ✓ Enact laws to check practices to control water pollution
- ✓ Sharing river solved by interlinking river
- ✓ Power must be given to national water authority

3.9 DAMS –BENEFITS AND PROBLEMS

Dams are built across the river in order to store water for drinking, agricultural, industrial purpose. Now days they are mainly used for the hydropower production.

Benefits

- River valley projects with big dams play a key role in the development process due to their multiple uses.
- These dams aim at providing employment for tribal people and raising the standard and quality of life.
- Dams can help in checking floods and generate electricity and reduce water and power shortage, provide irrigation water to lower areas, provide drinking water in remote areas and promote navigation, fishery.

Problems

The impacts of big dams can be upstream as well as downstream levels.

The upstream problems include the following:

- Displacement of tribal people
- Loss of forests, flora and fauna
- Changes in fisheries

- Saltation and sedimentation of reservoirs
- Loss of non-forest land
- Stagnation and water logging near reservoir
- Breeding vectors and spread of vector –borne diseases
- Reservoir induces seismicity causing earthquakes
- Microclimatic changes
- Growth of aquatic weeds

Downstream problems include the following:

- Water logging and salinity due to over irrigation
- Microclimatic changes
- Reduced water flow and slit deposition in river
- Flash foods
- Salt water intrusion at river mouth
- Loss of land fertility
- Outbreak of vector-borne diseases like malaria.

3.10 MINERAL RESOURCES

Minerals are naturally occurring substances with definite chemical and physical properties. Mineral is an element or inorganic compound that occurs naturally.

3.10.1 Uses of minerals

- Development of industrial plants and machinery
- Generation of energy e.g. coal, lignite, uranium
- Construction, housing, settlements
- Defense equipments- weapons, settlement
- Transportation
- Communication-telephone wires, cables, electronic devices
- Medical system- particularly in Ayurvedic System
- Formation of alloys for various purposes
- Agriculture- as fertilizers, seed dressings and fungicides
- Jewellery- e.g. Gold, silver, platinum, diamond

3.10.2 Environmental impacts of mineral extraction

Environmental impacts of over extraction of mineral resources:

Depending on the conditions of terrain and depth of ore deposits 2 types of mining operations are carried out.

1. Open cast mining
2. Underground mining.

In both types each steps in mining processing produce several environmental effects such as,

- ❖ Deforestation takes place due to removal of vegetal covers.
- ❖ Great volume of debris has been generated which disrupt the surface and ground water circulation. It also reduces the water carrying capacity of streams very close to mining area.
- ❖ The stacking of over burden and building of soil banks creates problems of landslides.
- ❖ Under ground fire in coalmines is a hazard that is difficult to control.
- ❖ Mining and ore processing normally causes air pollution and water pollution.
- ❖ The acid water generated in coalmines can pose a serious problem of water pollution, which adversely affects the flora and fauna.
- ❖ Deeper excavation of ground causes lowering of water table, which leads to drying of wells or sea water intrusion.

- ❖ In stone quarries, blasting of rocks not only annoying the people nearby, but also cause hazard from fly rocks and dusts and damage to buildings due to vibrations.
- ❖ The disposal of waste material produced after concentrations of ore create increase concentration of heavy metals and toxic elements in the environment.

3.10.3 Impacts of mining:

Mining is done to extract minerals from deep deposits in soil. Environmental damages caused by mining activities are as follows:

Devegetation and defacing of lands: Mining requires removal of vegetation along with underlying soil mantle and overlying rock masses. This results in destruction of landscape in the area.

Subsidence of land: Subsidence of mining areas results in tilting of buildings, cracks in houses, buckling of roads, bending of rail tracks and leaking of gas from cracked pipe lines leading to serious disasters.

Groundwater contamination: Mining pollutes the groundwater. Sulphur, usually present as an impurity in many ores is known to get converted into sulphuric acid through microbial action, thereby making the water acidic.

Surface water pollution: The acid mine drainage often contaminates the nearby streams and lakes. The acidic water, radioactive substances like uranium, heavy metals also contaminate the water bodies and kill aquatic animals.

Air pollution: In order to separate and purify the metal from other impurities in the ore, smelting is done which emits enormous quantities of air pollutants. Oxides of sulphur, arsenic, cadmium and lead etc. shoot up in the atmosphere near the smelters and the public suffers from several health problems.

Occupational Health Hazards: Miners working in different type of mines suffer from asbestosis, silicosis, black lung disease.

Remedial measures

- Adopting eco-friendly mining technology
- Utilization of low grade ores by using microbial – leaching technique. In this method, the ores are inoculated with the desired strains of bacteria like Thiobacillus ferroxidans, which remove the impurities and leave the pure mineral.
- Re-vegetating mined areas with appropriate plants
- Gradual restoration of flora
- Prevention of toxic drainage discharge

3.11 Case studies

3.11.1 Mining and quarrying in Udaipur

- Soap stones, building stone, and dolomite mines spread over 15,000 hectares in Udaipur have caused many adverse impacts on environment.
- About 150 tons of explosives are used per month in blasting.
- The Maton mines have badly polluted the Ahar river.
- The hills around the mines are suffering from acute soil erosion.
- The waste water flows towards a big tank of “Bag Dara".
- Due to scarcity of water people are compelled to use this effluent for irrigation purpose.
- The animals like tiger, lion, deer, and birds have disappeared from the mining area.

3.11.2 Mining in Sariska and Tiger Reserve in Aravallis

- The Aravalli range is spread over about 692 Km in the North-west India covering Gujrat, Rajasthan, Haryana, and Delhi.
- The hill is rich in mineral resources.

- Mining operations within and around the Sariska Tiger reserve has left many areas permanently infertile and barren.
- The precious wild life is under serious threat.

3.12 FOOD RESOURCES

Problems Faced by Food Resources

Overgrazing

- Land degradation
- Soil erosion
- Loss of useful species

Modern agriculture

- High yield variety crops
- Micronutrients imbalance
- Nitrate pollution
- Eutrophication
- Pesticide related problems
- Water logging
- Salinity

3.12.1 WORLD FOOD PROBLEMS

- Problems mainly under nutrition and malnutrition
- Natural calamities:-famine, drought, earthquake, flood, gale, storm
- Disease and medical facilities
- Pest damage:-insects, bacteria, viruses, parasites consume 60% of world□s food production
- Hunger
- Population explosion in rural areas
- Environmental pollution
- Lack of water for irrigation
- Less rainfall due to deforestation
- Livestock overgrazing
- Overfishing

3.13 CHANGES CAUSED BY OVERGRAZING AND AGRICULTURE

Overgrazing: Process of eating away the vegetation along with its roots without giving a chance to regenerate

- ✓ Land degradation-leads to organically poor, dry, compacted soil cannot be used for further cultivation
- ✓ Soil erosion-cover of vegetation gets removed from soil
- ✓ Loss of useful species-good quality grasses and herbs with high nutritive value, when grazed lose even the root stocks which carry the reserve food for regeneration get destroyed which gives raise to secondary species like parthenium, Lantane, Xanthium etc
- ✓ To prevent –match the forage supplement to the herd□s requirement.eg.Switch grass

Modern agriculture: The practice through which specific plant species are cared and managed so as to obtain maximum yield of consumable parts of plants –agriculture makes use of hybrid seeds and selected and single crop variety, high tech equipment and lots of energy subsides in the form of fertilizers, pesticides and irrigation water e.g. green revolution

- ❖ Damage to soil

- ❖ Water contamination
- ❖ Water scarcity
- ❖ Global climate change
- ❖ Water logging-results when soil is over irrigated
- ❖ Soil salinity-increase plant productivity, interferes with water uptake by plants
- ❖ Fossil fuels and pesticides produce air pollution

3.13.1 Impacts related to high yielding varieties:

- Monoculture ie the same genotype is grown over vast areas. Disease spread easily
- Micronutrient imbalance e.g Zinc deficiency-affect soil productivity
- Nitrate pollution-nitrogenous fertilizers applied deep soil contaminates ground water. cause blue baby syndrome methaemoglobinemia- affects infants
- Eutrophication: Over nourishment of lakes due to agriculture field wash out-leads to algal bloom-dead organic matters increases due to decomposition-leads to oxygen demand

3.13.2 Problems associated with pesticide use:

- ➢ Evolution of genetic resistance
- ➢ Imbalance in ecosystem
- ➢ Creation of new pest
- ➢ Persistence, Bioaccumulation and Biomagnification
- ➢ Mobility through soil, water, air, washed away into rivers, streams, when it rains can harm fishes
- ➢ Creating super pest
- ➢ Death of non starget organisms
- ➢ Salinity
- ➢ Water logging

3.13.3 Water logging / salinisation:

Saturation of soil with irrigation water or excessive precipitation. So that water table rises close to surface.

Water logging results when soils are over irrigated without drainage. Occurs in clayey soil, soil root zone becomes saturated with so much water blocking oxygen supply for growth and soil becomes unsuitable.

Carbondioxide and ethylene accumulate around roots affect the plants.

3.14 ENERGY RESOURCES

Growing energy needs: Population explosion, Luxurious life, Industries, Agriculture, mining, transportation, lighting, cooling, heating, building all need energy. Fossil fuels like coal, oil, natural gas produce 95% of energy Sources of energy.

Primary

Renewable energy – resources which can be generated continuously in nature and are in exhaustible and can be used again endlessly.wood, Tidal, Solar, wind, hydropower, biomass, biofuel, geothermal, hydrogen

Non-renewable energy – Resources which have accumulated in nature over a long span of time and cannot be quickly replenished when exhausted.coal, petroleum, natural gas

Secondary: Petrol, electrical energy, coal burning

3.14.1 Use of alternate energy sources: Refers to energy sources which are not based on the burning of fossil fuels or the splitting of atoms.

Solar energy:

- ➲ Total energy from sun per year-35,000 times the energy used by man

- ➲ Used to run car, power plants and spaceships

Energy harvesting devises:

- ✓ Solar heat collectors
- ✓ Solar cells
- ✓ Solar cooker
- ✓ Solar water heater
- ✓ Solar furnace
- ✓ Solar power plants

Wind energy:

Average wind velocity of earth -9 m/sec and power produced when a windmill is facing the wind od 10 miles/hr-50 watts.eg.largest wind farm-Kanyakumari in tamilnadu is generating 380 MW electricity

Hydro power:

- ❖ Comes from damming of rivers and utilization of high pressure, its kinetic energy is transformed into turbine blades and used to generate electricity
- ❖ Minimum water falls height-10 m
- ❖ Hydro power potential of India-4x1011KW/Hr

Tidal Energy:

Uses the natural motion of tides to fill reservoirs which are then slowly discharged through electricity producing turbines.

Ocean thermal energy:

Energy available due to the difference in water temperature. The surface of the tropical ocean and at deeper level is called OTE. A difference of 200c or more is required for operating OTE power plants.

Geothermal energy:

Energy harassed from the hot rocks inside earth. E.g. Natural geysers in Manikaran

3.15 LAND RESOURCE

Land is critically important national resource which supports all living organisms including plants and animals. The soil profile of land determines its ability to serve socio-economic needs.

It has been estimated that more than 5000 million tonnees of top soil is eroded annually along with 5 million tones of nutrients. About 1/3 of this is lost in sea while the rest in reservoirs and rivers leading to flood.

About 38% of the area in India suffers from moderate to high degree of water based erosion. The per capita availability of land in the country has declined from 1.37 hectare in 1901 to 0.33 hectare in 2000. All these lands cannot be utilized for agricultural purpose. Some land would be required for other activities (to maintain urban area).

Effective steps have to be taken for preventing diversion of land suitable for sustainable farming to non-farm uses. Simultaneously, degraded lands and waste lands have to be improved by ecological restoration. The Department of Land Resources was setup in April 1999 by ministry of Rural Development to act as nodal agency for land resource management.

3.15.1 Land Degradation:

Land degradation is defined as the reduction in soil capacity to produce in terms of quality, quantity goods and services. The definition is also based on

1. Sustainability or ability to produce continuously and indefinitely.
2. Quality of land resource that makes it sustainable or resistant to degradation
3. Carrying capacity or the number of people and animals the land can normally support without significant stress.

Landscapes generally undergo degradation but are usually compensated by nature s inherent recovering ability. Whenever degradation occur exceeding nature's restorative capacity, the result will be a disaster.

3.15.2 Man induced landslides:

The hill slopes are prone to land slides, landslips, rockslides etc. These hazardous features have reduced the overall progress of the region as they obstruct the roads, communication media and water flow. There are two types of slides

1. Slides due to natural factors
2. Slides induced by man and his activities

Some of the human activities that cause land sliding are

- Massive deforestation
- Erratic agricultural practices
- Road building
- Unscientific quarrying etc.
- Engineering. Constructions

3.15.3 Soil erosion:

1. Terracing: Terracing reduces soil erosion on steep slopes by concerting the land into a series of broad, level terraces. This retains water for crops at each level and reduces soil erosion by water run off.
2. Contour Farming: This method is adopted for gently sloped land. This involves planting crops in rows across the contour of gently sloped land.
3. Alley Cropping or Agro forestry: In this method crops are planted together in strips or alleys between trees and shrubs that can provide fruits and fuel wood. The trees and shrubs provide shade which reduce water loss by evaporation and preserve soil moisture.
4. Wind Breaks or Shelter Belts: Wind breaks and shelter belts or trees are established to reduce wind erosion and also for retaining soil moisture.

3.16 ROLE OF INDIVIDUAL IN CONSERVATION OF NATURAL RESOURCES

- Natural resources-forest,water,soil,food,mineral and energy
- Overuse of these resources cause problems

3.16.1 Conserve water:

- Don t keep water taps running
- Install water saving toilets
- Check forwater leaks
- Reuse soapy water
- Use drip and sprinkling irrigation
- Conserveenergy
- Turn off lights, fan when not in use
- Use solarcooker for cooking
- Try riding bicycle

3.16.2 Protect soil:

- ✓ Don't uproot plants
- ✓ Grow grass which binds soil andprevent erosion
- ✓ Make compost
- ✓ Use green manure
- ✓ Don t over irrigate
- ✓ Use mixed cropping

3.17 EQUITABLE USE OF RESOURCES FOR SUSTAINABLE LIFE STYLE

- Most developed countries like USA, Canada, Japan, Australia have 22% of natural resources, use 88%.73%of its energy and command 85%of its income
- Less developed countries has 78% of population, 12% Usage of natural resources, 27% of energy, 15% of income
- Gap arises due to increase in population distribution of resources and wealth
- Problem solved by equitable distribution of resources and wealth
- Global consensus has to be reached for more balanced distribution of basic resources like safe drinking water, food, fuel etc. So poor low developed countries able to sustain their life
- Two basic causes of unsustainability are over population in poor countries and over consumption of resources by rich countries generate wastes
- Rich countries lower down their consumption level
- Poor countries fulfilled by providing them resources

GLOSSARY

Advanced waste water treatment: Removel of any dissolved or suspended contaaminants beyond secondary treatment.
Biota: All the species of plants and animals indigenous to a certain area.
DDT: An organochloride used as an insecticide.
EPA: The U.S. Environmental Protection Agency.
Erosion: The wearing of land surface by wind or water.
Liner: Barrier designed to prevent the leaching of contents from a land fill.
MLSS: Mixed liquor suspended solids.
Mobile source: A moving source of pollution, such as car or truck.
Nutients: Essential element or compounds in the development of living things.
Rubbish: Solid waste that doesnot contain food waste.
Sludge: The treatment process as particles in waste -> solids.

REVIEW QUESTIONS

1. Discuss about the forest resources and its conservation.
2. Make a discussion about deforestration and its effect.
3. Disuss about the twin menace.
4. How can we effectively use our mineral resources without exploiting them?
5. How can we follow a sustainable life with equitable use of resources?
6. Discuss about altenate energy resources and their benefits.

UNIT – IV
SOCIAL ISSUES AND THE ENVIRONMENT

4.1 PREREQUISITE DISCUSSIONS

The scope of environmental studies is that, the current trend of environmental degradation can be reversed if people of educated communities are organized and empowered; experts are involved in sustainable development. Environmental factors greatly influence every organism and their activities.

The major areas in which the role of environmental scientists is of vital importance are natural resources, ecosystems, biodiversity and its conservation, environmental pollution, social issues and environment human population and environment.

It is essentially a multidisciplinary approach and its components include Biology, Geology, Chemistry, Physics, Engineering, Sociology, Health Sciences, Anthropology, Economics, Statistics and Philosophy It is essentially a multidisciplinary approach.

An Understanding of the working of the environment requires the knowledge from wide ranging fields.

India is the largest contributor to world population growth, adding about 17 million people every year to an already huge population of over one billion. Although more than two-thirds of India's population still lives in the rural areas, it has experienced rapid urbanization over the last two decades.

4.2 FROM UNSUSTAINABLE TO SUSTAINABLE DEVELOPMENT

Sustainable development has been defined as "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

In other words, when people make decisions about how to use the Earth's resources such as forests, water, minerals, wildlife, etc. they must take into account not only how much of these resources they are using, what processes they used to get these resources, and who has access to these resources.

4.2.1 Concept of sustainable development

- ✓ A symbiotic relationship between consumer human race and producer natural system
- ✓ Compatibility between ecology and economics

4.2.2 Aim of sustainable development

- ➢ Inter generational equity
- ➢ Intra generational technology

4.2.3 Significance of sustainable development

- ➲ Reduce, reuse and recycle of natural resources
- ➲ Providing environmental education and awareness
- ➲ Consumption of renewable resources
- ➲ Conservation of nonrenewable resources
- ➲ Population control

4.3 URBAN PROBLEMS RELATED TO ENERGY

4.3.1 Urbanization:

Movement of human population from rural areas top urban areas for betterment of education, communication, health, employment etc.

4.3.2 Causes:

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

Urban sprawl:

Urban growth is fast, so difficult to accommodate with their limited area .So cities spread into rural areas.

Urban energy requirement:

- ❖ Residential and commercial lighting
- ❖ Public and private transportation
- ❖ Electrical and electronic appliances

4.3.3 Solution: Use public transport instead of motor cycles Energy consumption must be minimized Use solar and wind energy Impose strict laws, penalty, and energy audit

4.4 WATER CONSERVATION

Process of saving water for future utilization is called water conservation.

4.4.1 Water source:

- ✓ Fresh water
- ✓ River
- ✓ Stream
- ✓ Pond
- ✓ Ocean

4.4.2 Need for water conservation:

- ➢ Population increases water requirement also increases
- ➢ Due to deforestation annual rainfall decreases
- ➢ Over exploitation of ground water

4.4.3 Ways of water conservation:

- ➲ Reducing evaporation loss
- ➲ Reducing irrigation loss
- ➲ Reuse water
- ➲ Avoid sewage discharge

4.4.4 Water conservation method:

- ❖ Rain water harvesting
- ❖ Watershed management

4.5 RAIN WATER HARVESTING

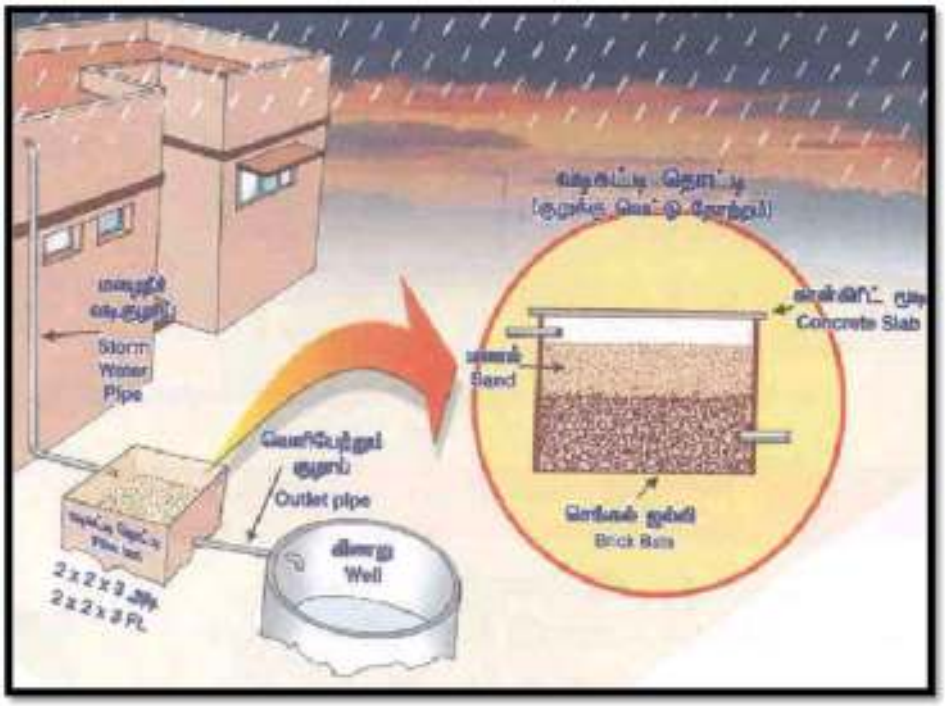
4.5.1 Objective: To meet increasing demands of water Raise water table by recharging ground water Reduce ground water contamination from salt water intrusion.

4.5.2 Roof top rainwater harvesting

- ✓ Involves collecting water that falls on roof of house
- ✓ Rainwater from roof top, road surface, play ground diverted to surface tank

4.5.3 Advantages of rainwater harvesting

- ➢ Increases the well water availability
- ➢ Raise ground water level
- ➢ Minimizes soil erosion



Rain Water Harvesting

4.6 WATERSHED MANAGEMENT

It is defined as land area bounded by divide line from which water drains under influence of gravity in to stream, lakes, reservoir. Eg. Pits, dams, Farm, ponds, Himalaya.

Types

1. Micro
2. Mini
3. Macro

The management of rainfall & resultant runoff. Forestry Halt deforestation, provide vegetative cover, degraded land and supplement folder and fuel wood resources available to rural communities Agriculture

- ➲ Aims to increase agricultural productivity in sustained manner and to diversify crop production
- ➲ Major objective shall be achieved through organizing farmers, training camps and exposure visits.
- ➲ Construct check dams, water harvesting tanks, storage tanks and channels , repair of old channels , implementing measures to check soil erosion

4.6.1 Advantages of Watershed projects

- ❖ Improved access to drinking water in project areas during drought
- ❖ Increase in cultivation area leading to increase in employment
- ❖ Increase in crop yield, resulting better income to rural population
- ❖ Improved availability of fodder for animals and increase in milk yield
- ❖ Increase in employment & involvement of women
- ❖ Increase in net returns from all crops.
- ❖ Decrease in soil erosion.
- ❖ Restoration of ecological balance.

4.6.2 Factors affecting watershed projects

- Unplanned land use
- Deforestation
- Droughty climates

4.7 RESETTLEMENT AND REHABILITATION OF PEOPLE

Resettlement – simple relocation or displacement of human population.

Rehabilitation – making, system to work again by allowing, system to function naturally. Includes replacing the lost economic assets, Safeguard Employment, Provide safe land for building Repair damaged infrastructure.

4.7.1 Effects:

- ✓ Loss of land
- ✓ Loss of recourse
- ✓ Unsatisfactory comp[enasation
- ✓ Social and cultura problems
- ✓ Changes in tradition of indigenous people
- ✓ Spread of disease
- ✓ Submergence of valuable forest
- ✓ Waterlogging
- ✓ Extinction of wild life

4.8 ENVIRONMENTAL ETHICS

Over exploitation of forests, land, water as well as various living components of biosphere and failure to tackle the problem of pollution and environmental degradation are exposing the humanly to the thread of a global environment crisis.

It emphasis that real development cannot occur unless the strategies which are formulated are implemented are environmentally sustainable. Even though our government is formulating several rules, regulations, policies, laws, it is the duty of each and every one to protect our nature.

Therefore human beings are ethically responsible for the preservation of the world□s ecological integrity. The environment ethics literally means conscious efforts to protect environment and to maintain its stability from the pollutants.

Following are some of the ways to safeguard environment.

- To sacrifice the consumption of some of the good which reduces environment quality
- Minimize the resource utilization and conservation
- Adopt sustainable and eco friendly development. (e.g) reduction of waste, recycling, waste management and harvesting non conventional energy

If we change as individuals then the society will also change by itself. The society is nothing but an extension of the individual.

4.9 GREEN CHEMISTRY

Green chemistry, also called sustainable chemistry, is a philosophy of chemical research and engineering that encourages the design of products and processes that minimize the use and generation of hazardous substances. Whereas environmental chemistry is the chemistry of the natural environment, and of pollutant chemicals in nature, green chemistry seeks to reduce the negative impact of chemistry on the environment by preventing pollution at its source and using fewer natural resources.

As a chemical philosophy, green chemistry applies to organic chemistry, inorganic chemistry, biochemistry, analytical chemistry, physical chemistry and even chemical

engineering. While green chemistry seems to focus on industrial applications, it does apply to any chemistry choice. Click chemistry is often cited as a style of chemical synthesis that is consistent with the goals of green chemistry. The focus is on minimizing the hazard and maximizing the efficiency of any chemical choice.

The 12 principles are:

1. It is better to prevent waste than to treat or clean up waste after it is formed.
2. Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.
3. Wherever practicable, synthetic methodologies should be designed to use and generate substances that possess little or no toxicity to human health and the environment.
4. Chemical products should be designed to preserve efficacy of function while reducing toxicity.
5. The use of auxiliary substances (e.g. solvents, separation agents, etc.) should be made unnecessary wherever possible and innocuous when used.
6. Energy requirements should be recognized for their environmental and economic impacts and should be minimized. Synthetic methods should be conducted at ambient temperature and pressure.
7. A raw material or feedstock should be renewable rather than depleting wherever technically and economically practicable.
8. Reduce derivatives – Unnecessary derivatization (blocking group, protection/deprotection, temporary modification) should be avoided whenever possible.
9. Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.
10. Chemical products should be designed so that at the end of their function they do not persist in the environment and break down into innocuous degradation products.
11. Analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.
12. Substances and the form of a substance used in a chemical process should be chosen to minimize potential for chemical accidents, including releases, explosions, and fires.

4.10 GREEN HOUSE EFFECT AND GLOBAL WARMING

The raise of earth□s surface temperature due to intense green house effect is called global warming.

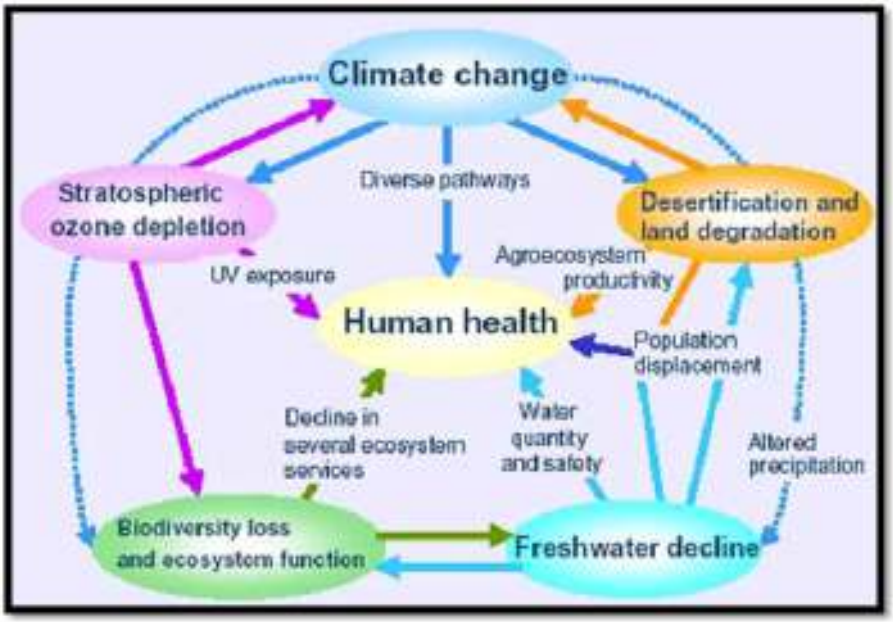
4.10.1 Causes:

Over the last century, the level of carbon dioxide in the atmosphear has increase by 25%, the level of nitrous oxide by 19% and the level of methane by 100%.

These 3 major global warming gases are released into the atmosphear by burning of fossil fuels, industrialization, mining, deforestation, exhaust from increasing automobiles and other anthropogenic activities.

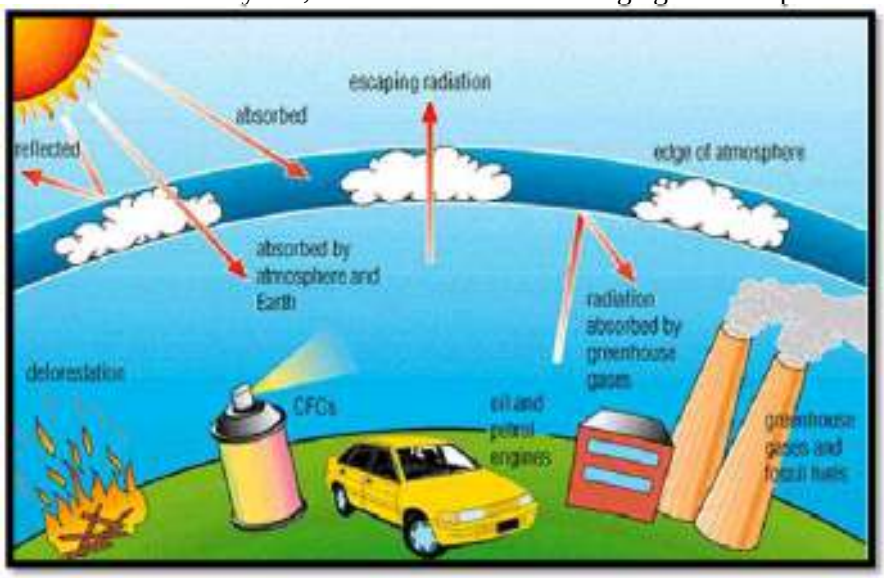
4.10.2 Effects:

- Increase evaporation of surface water – influence climate change
- Leads to declining biodiversity
- Melting of mountain glaciers and polar ice, which cause rise in sea level
- Change the climate and rainfall – reduction in food production
- The biological productivity of ocean also decreased due to warming of earth□s surface
- The biological productivity of ocean also decreased due to warming of earth□s surface



Climate Changes

- With more carbon dioxide in the air, the plants will grow bigger with increase in yield and resulting in the soils getting poor quality
- If proper precautions are not taken, the conc. Of green house gases may double in the atom. With in next 50 years, and will makes the average global temp. to 450 C.



Green House effect

4.11 ACID RAIN

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

4.11.1 Effects of acid rain

1. Human beings

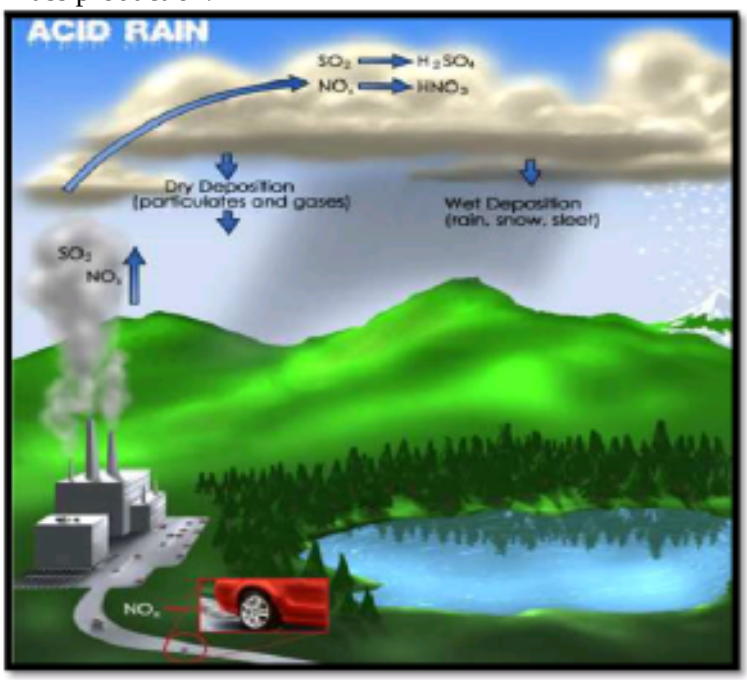
- Destroy life – nervous, respiratory and digestive system
- Causes premature death from heart and lung disorders.

2. On Buildings

Corrosion - Taj Mahal, houses, statues, bridges, metals.

3. On terrestrial and Lake Ecosystem

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



Acid Rain formation

4.11.2 Control measures

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

4.12 OZONE LAYER DEPLETION

Ozone is an important chemical species present in the stratosphere. Its concentration is about 10 ppm. It acts as a protective shield for the life on the earth.

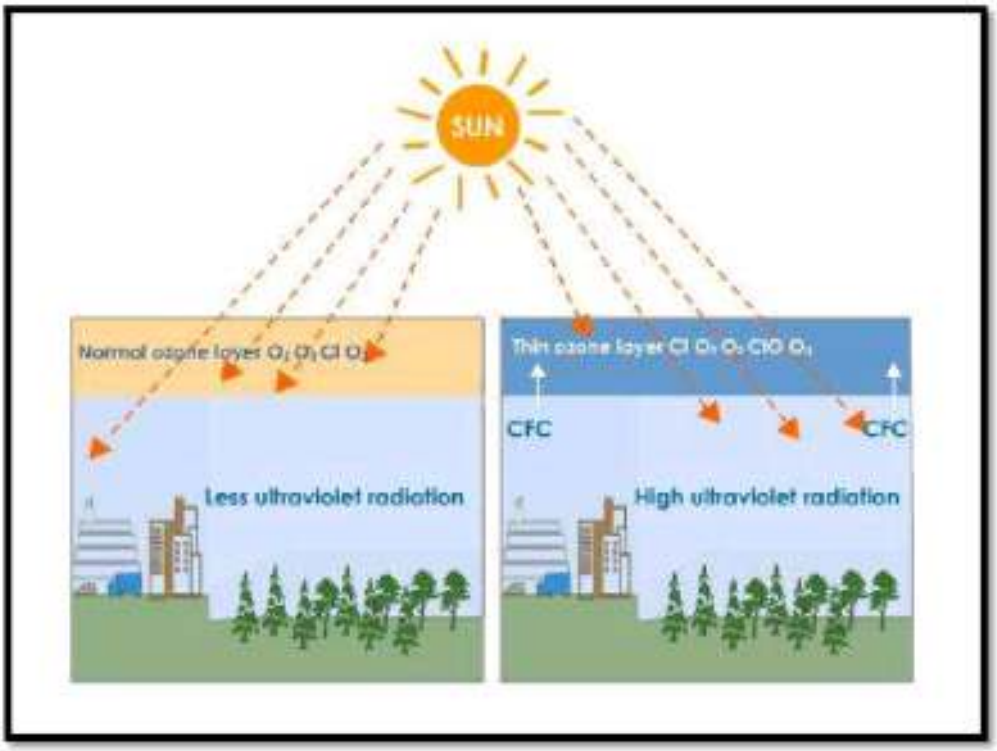
Ozone is produced and also broken down by photochemical reactions, thus maintaining equilibrium.

4.12.1 Causes for ozone layer depletion:

- ❖ Chlorine released from CFC and Bromine released from halogens are the most important chemicals associated with ozone layer depletion
- ❖ The halogens are used in fore extinguishers and CFC are extensively used in air conditioners and refrigerators.
- ❖ Methyl bromide used during packaging of fruits to prevent bacterial action flows out into the atmosphere as soon as the packing is opened. This cause heavy damage to ozone.
- ❖ High altitude aircrafts and chemicals emitted by industrial plants and automobiles.

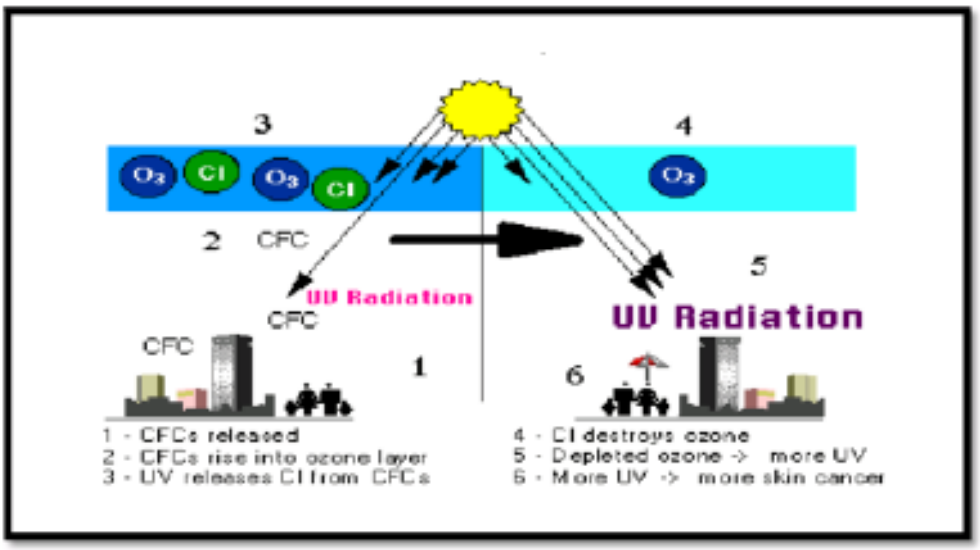
4.12.2 Effects:

- ✓ Marked rise in cause skin cancer
- ✓ Damage immune system



Depletion of Ozone layer

- ✓ Eye ailment such as cataract
- ✓ Shorter life of paints and plastics
- ✓ Restricted growth and crop damage
- ✓ Destruction of aquatic life



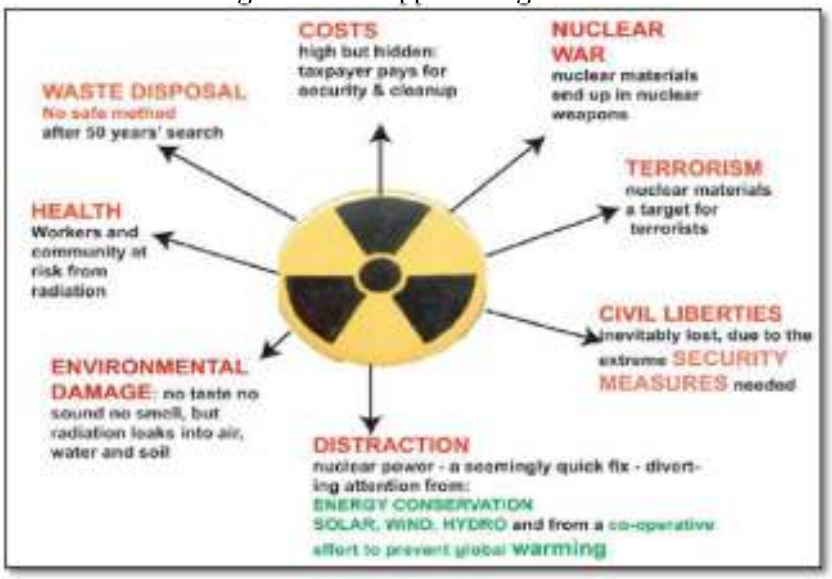
Causes and Effects of O_3 depletion

4.12.3 Control Measures

- Replacing CFCs
- Use of methyl bromide – crop fumig agent

4.13 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.



Effects of Nuclear Hazards

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.

4.14 WASTE LAND RECLAMATION

Any land which is not put to optimal use is defined as waste land. The waste land do not fulfill their life sustain potential wasteland contributes about 20.17% of the total geographical area of India.

4.14.1 Reasons for formation

- Over grazing and over exploitation
- Toxic effluent discharged from sewage and industrial wastes
- Mining activities destroy forest and cultivable land
- Use of pesticides also produce wasteland
- Erosion, desertification, water logging also degrade land

4.14.2 Wastelands can be reclaimed by the following way

- Conserving the soil – land is brought under vegetal cover. This can be done by growing grasses and shrubs
- To reclaim the land/soil, effective participation of the people, voluntary agencies and government is very important

4.15 CONSUMERISM AND WASTE PRODUCTS

Consumerism refers to the consumption of resources by the people. Early human societies used to consume much less resources. But the consumerism has increased to a very large extent.

Consumerism is related to both population size and increase in demands due to change in life style. Population has increased tremendously. World Bank estimates our population to reach 11 billion by 2045.

Two types of conditions of population and consumerism exists.

1. People over – population: When there are more people than available food, water and other resources in an area – causes degradation of limited resources – poverty and under nourishments. Low Developed Countries (LDC) are more prone to these conditions. There is less per capita consumption although the overall consumption is high.

2. Consumption over – population: These conditions occur in more developed countries (MDC). Population size is smaller but the resource consumption is high due to luxurious life style (i.e.) per capita consumption is high. More consumption of resources lead to high waste generation – greater is the degradation of the environment.

4.16 ENVIRONMENT (PROTECTION) ACT, 1986

Central Government is to take action to protect and improve environment and State Government to co ordinate actions.

Central Government to set up

- Std of quality of]air, water or soil
- Maximum permissible limits of concentration of pollutants (including noise pollutant)
- procedures and safe guard for handling hazardous items
- Prohibition of using hazardous items
- Prohibition and restriction of certain industries in certain area
- Procedure and safe guard for prevention of accidents

SPCB is to follow the guidelines provided in schedule VI.

Some are as follows

- ✓ Advises industries for treating the waste water and gases – use of technology – achieve prescribed std.
- ✓ Encourage recycling and reusing the wastes
- ✓ Encourage recovery of biogas, energy and reusable matter
- ✓ Discharge of effluents and emissions into environment is permitted by SPCB after taking into account capacity of the receiving water body
- ✓ To emphasize clean technology to increase fuel efficiency and decrease environmental pollutants

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

Salient features

- Prevention, control and abatement of air pollution
- Air pollution has been defined as the presence of any solid, liquid or gaseous substance (including noise) in the atmosphere in such a concentration that may be or tend to be harmful to human being or any other living creature or plants or property or environment.
- Noise pollution – inserted in 1987
- CPCB & SPCB similar to water pollution board
- Section 20 provides for emission std to auto mobile
- Section 19 provides for State Government to declare "air pollution control area" in consultation with SPCB
- Direction of PCB can be appealed in the appellate authority.

4.18 WATER (PREVENTION AND CONTROL OF POLLUTION) ACT, 1974

Maintaining and restoring the wholesomeness of water by preventing and controlling its pollution.

The salient features and provisions of Act are summed as follows.

- ➲ Maintenance and Restoration of Quality – surface and ground water
- ➲ Establishment of central PCB and state PCB

- Confers powers and functions to CPCB and SPCB
- The act provides for funds, budgets, accounts and audits of the CPCB & SPCB
- The act provides penalties for the defaulters and duties and powers

4.19 WILDLIFE [PROTECTION] ACT, 1972

Land mark in the history of wildlife legislation. 1976 the powers are transferred from state to central government. [I B of W L] was created in 1952 in our country which after WLA, 1972, took up the task of setting National parks and sanctuaries.

Wildlife [protection] Act

- Defines wild life related terminology
- Provide appointments of advisory Board, wildlife warden, their powers & duties etc.
- Prohibition of hunting of endangered species [was first] mentioned.
- List of endangered species is provided.
- Guides central 200 authorities.
- Provides grants for setting up of national parks, wild life sanctuaries etc.
- The Act imposes ban on trade & commence of scheduled animals.
- Provides legal proves to officers to punish the offenders.
- Provide captive breeding programme for endangered species.
- Many conservation projects for endangered species were started under this act.

4.19.1 DRAW BACKS OF WILD LIFE (PROTECTION) ACT

- ✓ Fall out of Stockholm conference not localized
- ✓ Ownership certificate of animals article – illegal trading
- ✓ Trade through J & K. This act not applicable to J&K
- ✓ Offender to get just 3 years imprisonment and or Rs.25000/- fine.

4.20 FOREST (CONSERVATION) ACT, 1980

It deals with conservation of forest and includes reserve forest, protected forest and any forest land irrespective of ownership.

Salient features

- ✓ State government can use forest only forestry purpose.
- ✓ Provision for conservation of all types of forests. Advisory committee appointed for funding conservation
- ✓ Illegal non-forest activity within a forest area can be immediately stopped under this act. Non forest activity means clearing land for cash-crop agriculture, mining etc.

However construction in forest for wild life or forest management is exempted from non forestry activity.

4.20.1 DRAW BACKS OF THE FOREST (CONSERVATION) ACT, 1980

- Inheritance of exploitative and consumerist elements of the British period
- Tribal people (i.e.) inhabitants of forest are left by the act
- Instead of attracting public support (tribal) it has intrigued in the human rights.
- Protection of trees, birds and animals have marginalized poor people.

4.21 THE BIOMEDICAL WASTE (MANAGEMENT AND HANDLING) RULES; 1998 AND AMENDMENTS

Government of India have notified the Biomedical Waste [Management and Handling] Rules, 1998 as amended in 2000 under Environment [Protection] Act, 1986. The Tamilnadu Pollution Control Board enforces this rule. The Tamilnadu Pollution Control

Board has inventorised 317 Government Hospitals and 1835 private hospitals. There are about 92,000 hospital beds all over the State.

There are 10 categories of Biomedical waste as per schedule-I of Biomedical Waste (Management and Handling) Rules, 1998. Health care facilities are required to treat the Biomedical wastes as per the methods prescribed in Schedule-I in compliance with the standards prescribed in Schedule-V. In this regard health care facilities are required to provide requisite treatment and disposal facilities either individually or collectively within the time frame prescribed in the Schedule-VI.

I. The common bio medical waste treatment and disposal facility consists of [as prescribed in the Biomedical wastes (Management & Handling) Rules, 1998 & 2000]. the following :-

An autoclave with temperature & pressure maintained at 135 0C, 31 psi & 30 minutes cycle. In the initial 15 minutes, the temperature & pressure to be maximum to create a vacuum for full autoclaving with residence time of not less than 30 minutes to ensure full destruction of pathogens. Medical waste shall be subjected to a minimum of one pre vacuum pulse to purge the autoclave of all air. The autoclave should completely and consistently kill the approved biological indicator at the maximum design capacity of each autoclave unit.

Incinerator for destruction of body parts/anatomical waste and pathological waste. Incinerator shall have two-chamber facility to attain a temperature of 1100 0C in the secondary chamber with proper scrubber facility and automatic stack monitoring facilities. The temperature of primary chamber shall be 800 + 50 0C. The secondary chamber gas residence time shall be atleast 1 second at 1050 + 50 0C.

Compactor for compaction of the autoclaved waste to ensure atleast 50% volume reduction. Sanitary landfill for safe disposal of autoclaved and compacted waste with compatible liners and leachate collection facility. Shredder to shred the autoclaved materials. The facility also consists of vans with compartments for keeping the segregated waste and transporting it in a safe manner.

Effluent Treatment Plant

A fully equipped laboratory

II. Since biomedical waste incinerators cause emission and there are frequent public complaints from similar installations, the siting of biomedical waste facility becomes crucial. Individual treatment facilities within hospitals in corporations and towns are not advisable as the health care facilities are often located in densely populated areas and the population in the vicinity is at the risk of exposure to emissions and complaints. keeping environmental concerns in view, such facilities should be located atleast 500 m away from any habitations and water bodies.

So far 11 common facilities have been identified for the private sector health care units in the State at

1. Thenmelpakkam - Kancheepuram District
2. Chennakuppam - Kancheepuram District
3. Orattukuppai – 1 - Coimbatore District
4. Sengipatti - Thanjavur District
5. Kandipedu - Vellore District
6. Thangavur - Salem District
7. Coonoor - Nilgiris District

8. Muthuvayal - Ramanathapuram District
9. Orattukuppai - 2 - Coimbatore District
10. Ettankulam - Tirunelveli District
11. Undurumikkidakulam - Virudhunagar District

The above eight facilities are under operation.
The last three are nearing completion.

4.22 SCHEME OF LABELING OF ENVIRONMENTALLY FRIENDLY PRODUCTS (ECOMARK)

Eco-Mark is an eco-labelling scheme which was constituted by the Government of India in 1991 for easy identification of environment-friendly products.

4.22.1 Objectives of the Scheme:

The specific objectives of the scheme are as follow:

1. To provide an incentive for manufacturers and importers to reduce adverse environmental impact of products.
2. To reward genuine initiatives by companies to reduce adverse environmental impact of their products.
3. To assist consumers to become environmentally responsible in their daily lives by providing information to take account of environmental factors in their purchase decisions.
4. To encourage citizens to purchase products which have less harmful environmental impacts
5. Ultimately to improve the quality of the environment and to encourage the sustainable management of resources.

4.22.2 Eco-Mark Logo:

The Eco-Mark logo is that of an earthen pot as indicated in the figure below.

Eco-Mark Scheme of India Logo

4.22.3 Scope of Eco-Mark:

The Eco-Mark scheme initially covered about 16 product categories covering a wide range of products. i.e. the Criteria for evaluating products under these categories were initially analyzed and identified. At a later point, a 17^{th} category was included.

The product criteria were developed using a cradle-to-grave approach keeping in mind full life-cycle considerations of the environmental impact of the product i.e. all stages

from raw materials to manufacturing, usage and disposal were analyzed and evaluated to determine the criteria.

4.22.4 Unique feature of the Eco-Mark vis-a-vis other Eco-Labels

Eco-Mark is unique when compared to other eco-labels in one aspect; it also necessitated meeting the quality requirements of BIS (Bureau of Indian Standards)

4.22.5 Three Committees set-up for the Eco-Mark Scheme

1. A Steering Committee in the Ministry of Environments and Forests
2. A Technical Committee in the Central Pollution Control Board (CPCB)
3. Bureau of Indian Standards (BIS) for assessment and certification purposes

4.22.6 Association with International Bodies:

Central Pollution Control Board (CPCB) is a member of GEN (Global Ecolabelling Network) and has been a member since 2000. However the Eco-Mark scheme was not very effective in India, and as such eco-labelling as a concept is still relatively unknown. The government has tried to revitalize the scheme many times, but the efforts have not borne fruit. In spite of the wide range of product categories, there were very limited applications for the Eco-Mark label. In the 18 years since its inception, less than 20 companies have obtained the Eco-Mark label.

4.23 ENVIRONMENTAL LEGISLATION

1972 June 5th – Environment was first discussed as an agenda in UN conference on Human Environment. There after every year 5th June is celebrated as Environment Day.

Constitutional Provisions:

Added in 1976 – Article 48A – "The state shall endeavor to protect and improve the environment and to safeguard forests and wildlife of the country" Article 51A (g): "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures". By these two articles one constitution makes environment protection and conservation as one of our fundamental duties.

4.23.1 ENFORCEMENT OF ENVIRONMENTAL LEGISLATION – MAJOR ISSUES

- Target of 33% of land to be covered by forest not achieved
- Rivers turning to open sewers
- Big towns and cities polluted
- Wild life endangered
- EFP (Effluent Treatment Plant) or Air Pollution Control devices are expensive – leads to closure of units. Government should provide subsidy for small units.
- Pollution control laws not backed up by policy pronouncements or guidelines
- Chairman of PCB – political nominee. Hence political interference.
- Involving public in decision making envisaged by policy statement of the ministry of environment and forest (1992) is only in paper.

4.24 CENTRAL POLLUTION CONTROL BOARD (CPCB)

Advices Central Government in matters – prevention and control of water pollution

- Co ordinates SPCB and provide technical assistance and guidance
- Training programs for prevention and control of pollution by mass media and other ways
- Publishes statistical and technical details about pollution
- Prepares manual for treatment and disposal of sewerage and trade effluents

- Lays STD for water quality parameters
- Plans nation-wide programs for prevention, control or abatement of pollution
- Laboratories for analysis of water, sewage or trade effluents

4.25 STATE POLLUTION CONTROL BOARD (SPCB)

SPCB has similar functions as SPCB and governed by CPCB

- SPCB advises state government w.r.t. location of any industry that might pollute
- Lays std for effluents to take samples from streams, wells or trade effluents or sewage passing through an industry. Samples taken are analysed at recognized labs. If the sample is not confirming to the water quality std, then the unit is neglected
- Every industry to obtain consent from PCB before commencing an effluent unit by applying in prescribed form with fee.

4.26 PUBLIC AWARENESS

- Environmental sensitivity in our country can only grow through a major public awareness campaign.
- This has several tools-the electronic media, the press, school and college education, adult education, which are all essentially complementary to each other.
- Green movements can grow out of small local initiatives to become major players in advocating environmental protection to the Government.
- Policy makers will only work towards environmental preservation if there is a sufficiently large bank of voters that insist on protecting the environment.
- Orienting the media to project pro-environmental issues is an important aspect.
- Several advertising campaigns frequently have messages that are negative to environmental preservation.

4.27 DISASTER MANAGEMENT

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.

4.27.1 FLOOD: Submergence of waste areas of land under water for many days in continuation **Causes**

- Heavy rainfall
- Sudden Snow melt
- Clearing of forest for agriculture
- Industries increase the value and rate of water discharge after a storm

Effects

- Damage to building and property
- Soil erosion is the major loss of agriculture
- Any product submerged by flood water cannot be rescued

Control measures

- Building wall prevent spilling out the flood water over flood plains
- Advance meteorological information will prevent flood damage
- Reduction of run off by increasing infiltration through appropriate forestation eg.flood in Bangladesh 1974

4.27.2 EARTHQUAKE: Earthquake is the motion of the ground surface caused by wave motion starting from a focal point

Causes

- Underground nuclear testing

- Volcanic eruption
- Pressure of manmade dams, reservoir and lakes
- Movements of plates of earth

Effects

- Cause Tsunami
- Deformation of ground surface
- In hilly and mountain areas may cause landslides which damage the settlement and transport system
- Depending on the severity of the quake collapses house and people died in 1000 eg. Earthquake in Bhuj town

Control measures

- Government can inform the earthquake prone zone and caution residence
- Building should be designed to withstand tremors

4.27.3 CYCLONE: Cyclone is meteorological phenomena intense depressions forming over the open oceans and moving towards the land.

Effects

- Depends on the intensity of the cyclone
- Damage to human life crops roads, transport, communication could be very heavy

Control measures

- Planting more trees on hostel areas
- Construction of dams
- Radar system is used to detect cyclone e.g. Cyclone in AP

4.27.4 LANDSLIDES: The movement of earth materials like coherent rock, mud, soil and debris from higher region to lower due to gravitational pull is called landslide.

Causes

- Earthquake, shock, vibration
- Deep water ground mining
- Movement of heavy vehicles on the unstable sleepy region

Effects

- Increase erosion of soil
- Block the roads
- Damage the houses, crop yield, life stock

Control measures

- Planting of deep rooted vegetation
- Encouragement for construction of bridges water ways
- Create national parks, sanctuaries biosphere. e.g. landslides in U.P

4.28 SIGNIFICANCE OF DISASTER MANAGEMENT

Disasters management requires government intervention and a proper planning as well as funding.

Their worst effects can be partially or completely prevented by preparation, early warning, and swift, decisive responses.

Disaster management reduces the occurrence of disasters and to reduce the impact of those that cannot be prevented.

The government White paper and Act on Disaster Management define government National and Provincial as well as Authorities Local of roles the management.

Disaster management forces come into action as soon as a disaster strikes and helps individuals, and trained are process.

GLOSSARY:

Environmental ethics: A search for moral values and ethical principles in human reltions with the natural world.
Incineration: The process of burning wastes under controlled conditions.
Landfilling: The placemnt of wastes into the land under controlled conditions to minimize their migration or effect on the surrounding.
NGO: Non-Governmental Organization.
Upcycling: Turning waste into more valuable products.
Water table: The top layer of the zone of saturation; undualates according to the surface topography and subsurface structure.
CFCs: Chlorofluorocarbons.

REVIEW QUESTIONS

1. Discuss about the sustainable development.
2. What are the urban problems related to energy?
3. What are the methods of water conservation?
4. Discuss about wasteland reclamation.
5. Discuss coparitively on environmental acts.

UNIT – V
HUMAN POULATION AND THE ENVIRONMENT

5.1 PREREQUISITE DISCUSSIONS

The main problem associated with natural resources is unequal consumption. A major part of natural resources are consumed in the 'developed' world. The 'developing nations' also over use many resources because of their greater human population.

However, the consumption of resources per capita (per individual) of the developed countries is upto 50 times greater than in most developing countries.

Global consumption of water is doubling every 20 years, more than twice the rate of human population growth.

Habitat loss is mainly due to human population growth, industrialization and changes in the land use patterns, poaching of wild life and man wildlife conflicts.

The mega extinction spasm is related to human population growth, industrialization and changes in the land use patterns in India.

5.2 POPULATION GROWTH

Stone Age was quite stable. Droughts, outbreak of diseases lead to human deaths.

In 14th century A.D experienced large scale mortality due to plague – about 50% of people in Asia and Europe died due to the disease.

Science and technological advancement has increased the expectancy of human. People started living with good sanitation food and medical facilities increase in population exponentially.

In agriculture based families children are said to be assets who help the parents in fields. Therefore, in developing countries the population increase is at a rate of 3.4% per year.

5.2.1 Population characteristics and variation among nations:

1. Exponential growth: 1,3,5…… If a quantity varies by a fixed % 10^1, 10^2 etc.
2. Doubling Time Td = 70/r 2%
3. Total Fertility Rate (TFR) is 1.9 developing countries. 4.7 developing countries and 6.1 in 1950
4. Infant mortality: % of infants died out of those born in a year last 50 years.
5. Replacement level: Under low life expectancy and high infant mortality 2.7 in developing countries and 2 in developed countries.
6. Life expectancy: The average no. of years a new born baby is expected to live.
    a. The life expectancy of global males and females has risen from 40 to 55.5 years.
    b. In India 22.6 and 23.3 in 1900 & 60.3 and 60.5 in 2000.
    c. In Japan and Sweden 77-77.4 & 82-84 years.

5.3 POPULATION EXPLOSION

Population explosion means the tremendous increase in the number of people. It is a known fact that the increase of population is playing vital role of all environmental damage.

Most of our natural resources are under threat because of the population growth. If the exploitation of resource is going on in this trend, the resources will be exhaust shortly.

Population explosion increase disease, economic inequity and environmental abuse. Therefore we need population stabilization to achieve good health, education and prosperity.

Reason for population explosion:

- ✓ Increase in birth rate in developed countries due to illiteracy
- ✓ Invention of modern medical facilities reduces mortality rate.

5.4 FAMILY WELFARE PROGRAMME

- Population explosion must be differenced
- Population is not controlled will deplete all resources
- Family planning
- Allows couples to describe their family size and also time spacing of their offspring
- Provide importance, knowledge and benefits of their small family to people
- Education in held and family welfare system
- Sex education awareness

WHO estimated 50% of worlds married couples adopted family planning measures, 300 million couples not assessed to family planning

5.5 ENVIRONMENT AND HUMAN HEALTH

Environment is defined as man along with his surroundings, which consists of biotic, abiotic and sociological components. Therefore, when we cause danger to these components, which surrounds us, they in turn affect our health.

The environmental dangers created by man are many: Population explosion, unregulated urbanization, creating water, air and landscape pollution, deforestation, desertification, use of pesticides in agriculture etc.

Every one of these has implications for the health of the individual as well as society as a whole. None can be ignored because the scale of potential calamity is increasing day by day.

Health hazards may be arising from: water contamination or pollution, air pollution, use of pesticides enters through food chain, radiation effect of nuclear water, diseases caused from improper disposal of solid wastes and also due to noise pollution.

5.6 HUMAN RIGHTS

1. Human rights means that a human being must enjoy on this earth
2. Foundation of human was laid in 13th century. But positive hopes for all people for a happy, dignified and secured living condition wee raised only after "Universal Declaration of Human Rights (UNDHR) by UNO on 1012.1948
3. It highlights on protection to all individuals against injustice and human right violation
4. UNDHR defines specific rights to life, liberty, security, freedom of thought, association, freedom of movement right of equal pay for equal work, right to form or join union, right to health care, education etc.
5. Universal declaration rights are universal but disparity between developing and developed countries.
6. Poverty and population leads to violation of human rights.
   WHO estimates
   i. -One out of every five is malnourished, lacks clean drinking water, lacks hygienic conditions and health facilities.
   ii. -one out of 3 lack fuel for cooking
   iii. -1/5 is desperately poor
   iv. -every year 40 million people die due to contaminated water
7. Acute scarcity of employment
8. Merit of universal education and child labour prevention is of much less importance than his struggle for existence
9. Developed and developing country gives importance only to "respect to human rights" and "non social – economic rights" respectively.

5.7 VALUE EDUCATION

Education is one of the most important tools in bringing about socioeconomic and cultural progress of a country. The objective of education should not be merely coaching the students to get through the exams with good results and get some good job.

Education does not simply mean acquiring information but using the resources within the limits of ethical value.

The scientific and technological advancements have shrunk the world into a village. But in the drive to development man has become too materialistic, self centered and over ambitious.

Value based education has a very significant role in providing proper direction to youth to inculcate positive attitude and to teach them the distinction between right and wrong. It teaches them to be compassionate, peace loving, helpful, generous and tolerant so that they can move towards more harmonious, peaceful, enjoyable and sustainable future.

Value education help in arriving value based judgements based on practical understanding of various natural principles. Value education increases awareness about our national history, our cultural heritage, national pride, constitutional rights and duties, national integration, aommunity development and environment.

It is crucial to the retention of national identity, peaceful and harmonious society. Education should give overall development of the student personality. The main of education is to produce citizens with sound character and health.

Good citizens are the only hope for the progress and prosperity of the country. Life based upon good principles is an essential requisite. Therefore moral education should be included in the school curriculum.

The curriculum should provide enough opportunity for pupils to acquire a considerable amount of knowledge that is essential for morally responsible living in our democratic society.

Value education shall prepare individuals for participation in social life and acceptance of social rules. Schools should provide a healthy environment for sharing responsibilities of community life and relationships.

Value based environmental education: Environmental education is something that every person should be well versed with.

The principles of ecology and fundamentals of environment help to create a sense of earth citizenship and a sense of care for the earth and its resources - a sense of commitment towards the management of the resources in a sustainable way so that our children and grand children too have a safe and clean planet.

Following the Supreme Court directives 1998 environmental education has been included in the curriculum right from the school stage to university level. The objective of it is to make everyone environment literate.

Let us see how environmental education can be made value based one.

1. Preparation of text books materials on environmental education – to built a positive attitude towards environmental factors.
2. Social values like love, tolerance, compassion can be woven into environmental education. This will help to nurture all forms of life and biodiversity.
3. Cultural and religious values: Our culture and religions teach us not to exploit nature – but to perform such functions which project and sacred nature. Therefore these values can be added up with environmental education.
4. Env. Education should stress on earth centric views rather than human centric view such that it include the ethical values.

5. Global values: Stress on the concept human is part of nature and all natural processes are interlinked and they are in harmony. If this harmony is disturbed it may lead to imbalance in ecology and catastrophic results.
6. Spiritual values: highlights on self contentment, discipline, reduction of wants etc. This will reduce our consumerist approach

If the mentioned values are incorporated in environmental education, the goal of sustainable development and environmental conservation can be easily attained.

Value based environmental education can bring about a total transformation of our mind set, our attitudes and life style to protect nature.

5.8 HIV/AIDS

The Human Immuno-deficiency Virus (HIV) causes Acquired Immunodeficiency Syndrome (AIDS) through contact with the tissue fluids of infected individuals, especially through sexual contact.

It is not a disease but a weakness in the body that results in the body being unable to fight off illnesses. The immune system of a person with AIDS is weakened to such a point that medical intervention is necessary to prevent or treat the deterioration in the body and the entire system.

AIDS is the most serious stage of HIV infection. It results from the destruction of the infected person's immune system.

As it reduces an individual's resistance to disease, it causes infected individuals to suffer from a large number of environment-related diseases and reduces the ability of infected individuals to go about their normal lives.

It saps their strength, leads to skin lesions (Karposi's sarcoma) and they become increasingly vulnerable to any air- or water-borne pollutant, until they eventually die. Our immune system is our body's defense system.

Cells of our immune system fight off infection and other diseases. If the immune system does not work well, we are at risk for serious and life-threatening infections and cancers. HIV attacks and destroys the disease-fighting cells of the immune system, leaving the body with a weakened defense against infection and cancer.

HIV/ AIDS has a serious impact on the socioeconomic fabric of society. By 2002, India had an estimated 3.97 million infected individuals.

HIV in India is rapidly moving from being a primarily urban disease to rural communities. Research in Nepal has shown a linkage between rural poverty, deforestation and a shift of population to urban areas resulting in a rising number of AIDS patients. Prior to 1992, it was mainly seen in males who migrated to urban centers.

5.8.1 HIV Test

The only way to know infected person is to be tested for HIV infection. Many people who are infected with HIV do not have any symptoms at all for many years.

The following may be warning signs of infection with HIV:

- Rapid weight loss, dry cough
- Recurring fever or profuse night sweats, profound and unexplained fatigue
- Swollen lymph glands in the armpits, groin, or neck, diarrhea that lasts for more than a week, white spots or unusual blemishes on the tongue, in the mouth, or in the throat
- Pneumonia, red, brown, pink, or purplish blotches on or under the skin or inside the mouth, nose, or eyelids
- Memory loss, depression, and other neurological disorders

However, no one should assume they are infected if they have any of these symptoms. Each of these symptoms can be related to other illnesses. Again, the only way to determine whether a person is infected is to be tested for HIV infection.

The symptoms of AIDS are similar to the symptoms of many other illnesses. AIDS is a medical diagnosis made by a doctor based on specific criteria established.

5.8.2 Transmission of HIV

HIV transmission can occur when body fluids of an infected person enters the body of an uninfected person. The most common ways that HIV is transmitted from one person toanother:

- By having sexual intercourse with an HIV- infected person
- By sharing needles or injection equipment with an injection drug user who is infected with HIV
- From HIV infected women to babies before or during birth, or through breastfeeding after birth
- HIV can also be transmitted through transfusions of infected blood or blood clotting factors.
- Some health care workers have become infected after being stuck with needles containing HIV infected blood or, less frequently, after infected blood contact with the worker's open cut or through splashes into the worker's eyes or inside his or her nose.

5.8.3 Prevention

- ✓ However, the most important measure to prevent AIDS is the proper use of condoms that form a barrier to the spread of the virus.
- ✓ Using disposable needles
- ✓ Transfusion of uninfected blood
- ✓ Organizing AIDS education on prevention and management of disease.

5.9 WOMEN AND CHILD WELFARE

There are several environmental factors that are closely linked to the welfare of women and children. Each year, close to eleven million children worldwide are estimated to have died from the effects of disease and inadequate nutrition.

Most of these deaths are in the developing world. In some countries, more than one in five children dies before they are 5 years old.

Seven out of ten childhood deaths in developing countries can be attributed to five main causes, or a combination of them.

These are: pneumonia, diarrhea, measles, malaria and malnutrition. Around the world, three out of every four children suffer from at least one of these conditions.

Most respiratory diseases are caused by or are worsened by polluted air. Living in crowded, ill- ventilated homes with smoky, open fires can trigger respiratory conditions, especially in children.

There are strong connections between the status of the environment and the welfare of women and children in India.

Women and girls are often the last to eat, as their role in traditional society is to cook the family meal and feed their husband and sons first. This leads to malnutrition and anemia due to inadequate nutrition.

The girl child is given less attention and educational facilities as compared to boys in India. Thus, they are unable to compete with men in later life.

This social-environmental divide is a major concern that needs to be corrected throughout the country.

5.9.1 Poverty-environment-malnutrition

There is a close association between poverty, a degraded environment, and malnutrition. This is further aggravated by a lack of awareness on how children become malnourished.

The Department of Women and Child Development was set up in the year 1985 as a part of the Ministry of Human Resource Development to give the much needed impetus to the holistic development of women and children.

As the national machinery for the advancement of women and children, the department formulates plans, policies and programmes; enacts/amends legislation, guides and coordina tes the efforts of both governmental and non-governmental organizations working in the field of Women and Child Development.

Besides, playing its nodal role, the Department implements certain innovative programmes for women and children. These programmes cover welfare and support services, training for employment and income generation, awareness generation and gender sensitization.

These programmes play a supplementary and complementary role to the other general developmental programmes in the sectors of health, education, rural development etc.

All these efforts are directed to ensure that women are empowered both economically and socially and thus become equal partners in national development along with men.

5.9.2 CHILD DEVELOPMENT

Government of India proclaimed a National Policy on Children in August 1974 declaring children as, “supremely important assets”. The policy provided the required framework for assigning priority to different needs of the child.

The programme of the Integrated Child Development Servic es (ICDS) was launched in 1975 seeking to provide an integrated package of services in a convergent manner for the holistic development of the child.

For the holistic development of the child, the Department has been implementing the worlds largest almost unique and outreach programme of Integrated Child
Development services (ICDS) providing a package of services comprising of the following:

- Supplementary nutrition,
- Immunization,
- Health check-up and referral services,
- Pre-school non- formal education.

5.10 ENVIRONMENTAL IMPACT ANALYSIS (EIA)

Environmental impact assessment is the formal process used to predict the environmental consequences (positive or negative) of a plan, policy, program, or project prior to the decision to move forward with the proposed action. Formal impact assessments may be governed by rules of administrative procedure regarding public participation and documentation of decisionmaking, and may be subject to judicial review. An impact assessment may propose measures to adjust impacts to acceptable levels or to investigate new technological solutions.

The purpose of the assessment is to ensure that decision makers consider the environmental impacts when deciding whether or not to proceed with a project. The International Association for Impact Assessment (IAIA) defines an environmental impact assessment as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made". EIAs are unique in that they do not require adherence to a predetermined environmental outcome, but rather they require decision -

makers to account for environmental values in their decisions and to justify those decisions in light of detailed environmental studies and public comments on the potential environmental impacts.

The EPBC(The Environment Protection and Biodiversity Conservation) Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places-defined in the EPBC Act as matters of 'national environmental significance'. Following are the eight matters of 'national environmental significance' to which the EPBC ACT applies:

- World Heritage sites
- National Heritage places
- RAMSAR wetlands of international significance
- Listed threatened species and ecological communities
- Migratory species protected under international agreements
- The Commonwealth marine environment
- Nuclear actions (including uranium mining)
- National Heritage.

5.11 ROLE OF INFORMATION TECHNOLOGY IN ENVIRONMENT AND HUMAN HEALTH

The understanding of environmental concerns and issues related to human health has exploded during the last few years due to the sudden growth of information technology. The computer age has turned the world around due to the incredible rapidity with which IT spreads knowledge.

IT can do several tasks extremely rapidly, accurately and spread the information through the world's networks of millions of computer systems. Information technology has also increased the pace of discovery.

The capacity of establishing and maintaining worldwide databases has linked environmental, researches around the globe. The advancement in computer, communication, satellite and other technological developments have enabled engineers or environmentalists to gather relevant information simultaneously from many sources.

The information is utilized for developing and early warning system and to forecast any eventuality much earlier. A large amount of information is easily available through Remote Sensing technology, Geographical Information System (GIS) and Global Positioning System (GPS) that is being used for various environmental studies.

Ministry of Environment, Government of India has established a Environmental Information System (ENVIS) in 1982. This has been established as a decentralized information system network whose purpose is collection, storage, retrieval and dissemination of environmental information to decision makers, policy makers, planners, scientists, engineers, environmentalists, researchers and general public all over the country.

The ENVIS network has its focal point in the Environmental ministry along with thirteen subject oriented centers, known as ENVIS Centers, set up in the various institutions, organizations of the country in the priority areas of environment like pollution control, toxic chemicals, energy and environment, environmentally sound and mangroves, corals and lagoons, media and environment etc.

New communication links are particularly vital to make use of such information Sources as Geographic Information Systems (GIS), a computerbased system for gathering, manipulating, and analyzing environmental data.

GIS databases are commonly established with information obtained from remote surveys via satellite and a variety of atmospheric and ground level surveys. GIS software

packages and databases, which have almost unlimited applications, have a crucial relevance for national and local environmental management and learning.

GIS allows for the simulation of hypothetical models of environmental management and can demonstrate how subUe changes in one element of a landscape may have a powerful effect elsewhere.

GIS is a tool to map Land use patterns and document change by studying digitized top sheets and/or satellite imagery. Once this is done, an expert can ask a variety of questions which the software can answer by producing maps which helps in land use planning.

Online healthcare information about Medicare and various related web sites guide consumers to a wide variety of health information available including the full text of clinical practice guidelines, and consumer brochures developed. A number of centers for disease control & prevention are functioning and the public health service maintains their websites.

The Internet with its thousands of websites has made it very simple to get the appropriate environmental information for any study or environmental management planning. This not only assists scientists and students but is a powerful tool to help increase public awareness about environmental issues.

Specialized software can analyze data for epidemiological studies, population dynamics and a variety of key environmental concerns. The relationship between the environment and health has been established due to the growing utilization of computer technology.

This looks at infection rates, morbidity or mortality and the etiology (causative factors) of a disease. As our knowledge expands, computers wilt become increasingly efficient.

5.12 APPLICATION OF COMPUTERS IN THE FIELD OF ENVIRONMENT & HUMAN HEALTH

1. Unknown parameters can be stimulated by computer techniques
2. EIA(Environmental Impact Assessment) problems can be analyzed
3. Inventories of emission sources are compiled and maintained
4. Net-work analysis, statistical analysis and the status of environmental pollutions can be high lighted
5. Comprehensive administrative system can be developed by using computer network techniques.

Remote sensing-Graphical Interface System are useful for coral reef mapping and ocean resources. They are also useful to access the loss of biodiversity/hot spots etc.

GLOSSARY:

Population explosion: Growth of a population at exponential rates to a size that exceeds environmental carrying capacity.
Birth rate: The number of live births per 1,000 population in a given year.
Growth rate: Tthe number of persons added to a population in a year.
Population ageing: The trend where more people live to reach old age while fewer children are born.
Human rights: Human rights are righrs a person has, simply because he or she is a human being.
NRCVE: The National Resource Centre on Value Education.
HIV: Human Immunodeficiency Virus, that causes AIDS.
AIDS: Acquired Immuno Deficiency Syndrome, a result of HIV virus.
EIS: Environmental Information Systems.

REVIEW QUESTIONS

1. Discuss about the population growth and variation among nations.
2. What is population explotion?
3. Discuss about family welfare programme.
4. Discuss the women and child welfare.
5. What are the role of information technology in environment and human health?

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QUESTION BANK
PART – A (QUESTIONS WITH ANSWER)
UNIT-I ENVIRONMENT, ECOSYSTEM & BIODIVERSITY

1. Define Environment?

Physical, chemical and biological presence of living and non-living things outside an individual species is called as its environment. According to ISO 14001, environment can be defined as, "Surroundings in which an organization operates, including air,water,land, natural resources,flora,fauna,humans and inter relation".

2. What are all the categories of environment?

The main categories of environment are biotic and abiotic environments. The abiotic environment can further be classified into atmosphere (air),lithosphere(soil),and hydrosphere(water). The biotic environment is called as biosphere.

3. Write the components of environment?

1. Air(Atmosphere)
2. Land(Lithosphere)
3. Water(Hydrosphere)

4. Mention any two awareness programme of environmental issuses to student?

1. Participating in seminars and courses related to environment issues.
2. Discussion with people about the environmental problems.

5. Define ecosystem?

Ecosystem has been defined as a system of interaction of organisms with their surroundings. Numerous dynamic interaction are occurring with in an ecosystem and these are complex.

6. List any four characteristics of ecosystem?

(i). Ecosystem is the major ecological unit
(ii). It contains both biotic and abiotic components.
(iii). The boundary of the ecosystem is not rigidly defined and it is flexible.
(iv). Through the biotic and abiotic components nutrient cycle and energy flow occur.

7. What are the different types of ecosystem?

1. Natural Ecosystem
2. Artificial Ecosystem
3. Incomplete Ecosystem

8. What are the biotic components of an ecosystem?

1. Producers (Autotrophs)
2. Consumers (Heterotrophs)
3. Decomposers

9. What are the autotrophs?

Producers or Autotrophs are organisms that are capable of making their required food themselves. (Auto =self, troph=feeder). Green plants, grasses, mosses, shrubs, etc., are some of the examples of autotrophic components.

10. Define heterotrophs?

Those organisms which depend on others (Producers-Autotrophs) for their energy requirements are known as Consumers or Heterotrophs. Since the animals are not having chlorophyll, they are unable to produce their own food.(Hetero=other,troph=feeder).

11. List the abiotic components of an ecosystem?

1. Climatic factors-Solar radiation, Temperature, Wind, Water current, rainfall, etc.
2. Physical factors-Light, Fire, pressure, etc.,

3. Chemical factors – Acidity, Salinity, Inorgaanic nutrients, etc.,

12. Differentiate between Kinetic energy and Potential energy?

Kinetic energy is the energy possessed by virtue of its motion from one place to another. This is measured by the amount of work done in bringing the body to rest.

13. Define ecological succession?

Ecological succession is defined as the process in which communities of plant and animal species in a particular area are replaced over time by a series of different and often more complex communities.

14. Define primary succession?

The succession taking place in areas that have not already been occupied by any community is known as primary succession.

15. Define secondary succession?

Development of a new community in an area where the previously existing community was removed and the ecological conditions are favourable is termed as secondary succession.

16. What do you know about autogenic succession and allogenic succession?

Allogenic succession (Allo=outside, genic=related) is the type of development occured in the ecosystem due to the interaction of external physical forces acting on it. Autogenic succession (Auto=inside, self propelling) is the type of development occured in the ecosystem due to the developmental process generated with in the system.

17. What are the characteristics of pioneer species?

1. It has less population.
2. Its nutrient requirement is very less.
3. The rate of growth should be as low as possible.
4. It should be more dynamic to face interspecific and intraspecific competitions.

18. Define seral stage?

Seral stage is defined as the development of secondary community from the pioneers. Each seral stage appears, grows and finally disappears as the environmental changes occur. Each seral stage has its particular community called seral community.

19. What are the three theories related to climax communities?

1. Mono climax theory
2. Poly climax theory
3. Climax pattern theory.

20. What do you know about food chain and food web?

A food chain is a picture or model that shows the flow of energy from Autotrophs to a series of organisms in an environment. The network like interaction of organisms is called as food web.

21. Name three types of food chains?

a. Grazing food chain
b. Detrius or Decomposer food chain
c. Parasitic food chain

22. Define ecological pyramids?

The representation of amount of energy stored in the bodies of living thing is Called as Ecological pyramids.

23. What is a forest?

A forest is a living community of various species of trees and smaller forms of vegetation. This type of biome contains moderate to high average annual rainfall.

24. How can you classify forests?

1. Tropical rain forests

2. Temperate forests
3. Polar (or) Boreal forests

25. What do you know about grasslands?

Grasslands are grassy, windy, partly-dry biome. Almost one- fourth of the Earth's land area is covered by grassland. Any more, the land would become a forest. Any less, the land would become a desert. The grasslands mostly separate forests from deserts. Most of the grasslands are found in the interiors of continents and rain shadows.

26. What are the types of grasslands?

1. Tropical grasslands (Savannah)
2. Temperate grasslands
3. Polar grasslands (Tundra)

27. List the three types of savannahs?

a. Climatic savannah
b. Edapic savannah
c. Derived savannah.

28. What are major human impacts on grasslands?

1. Conversion of grassland to cropland
2. Overgrazing of grassland by farm animals.
3. Damage by oil production, air and water pollution and vehicles movement.

29. How do the desert plants adopt to the climate?

Most of the plants have the ability to lack of rainfall. They have widespread roots which are close to the surface. This enables the roots to absorb water quickly, before it evaporates. Plants like 'Cactus' survives because of their thick waxy layer on the outside of its stems and leaves. This helps to retain water and protect tissues severe sunlight.

30. What are the different types of desert biome?

1. Hot and dry deserts
2. Semiarid deserts
3. Coastal deserts
4. Cold deserts.

31. Define freshwater?

Freshwater is defined as water with less than 1% salt concentration. Plants and animals live in freshwater are adjusted to its low salt concentration.

32. How can you differentiate ponds and lakes?

Ponds are small fresh water bodies surrounded by land and lakes are large fresh water bodies surrounded by land. Most of the ponds are seasonal and exist for just few months of a years or more.

33. What are the different zones of ponds?

1. Littoral zone,
2. Limnetic zone, and
3. Profundal zone.

34. What are estuaries?

The place where freshwater streams or rivers connect together with the salt water are called estuaries.

35. List the importance of estuaries?

These are important as nursery sites for many kinds of fish and crustaceans like flounder and shrimp

Mixing of many pollutants in the ocean is prevented by the action of trapping of sediments which are carried by the river.

36. What are coral reefs?

Corals are animals, which contain algae called zooanthellae and tissues of animal polyp. A reef is a rocky outcrop rises from the sea floor which is made up of calcareous material, concealed by the coral animals themselves and by red and green algae. Since reef waters tend to be nutritionally poor, corals obtain the required energy from the photosynthetic algae that live in the reef.

37. What are the three basic forms of coral reef?

1. Fringing reefs
2. Barrier reefs
3. Atolls

38. Define biodiversity?

Biodiversity is defined as 'richness of species (micro- organisms, plants and animals) occurring in a given habitat'. It is the sum of genes, species and ecosystems.

39. What are the three types of biodiversity?

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

UNIT II ENVIRONMENTAL POLLUTION

1. Define Air pollution?

Air pollution may be defined as the presence of impurities in excessive quantity and duration to cause adverse effects on plants, animals, human beings and materials.

2. What are the different sources of air pollution?

The two main sources of air pollution are

a. Natural Sources

b.Man made or anthropogenic sources

Natural sources include dust storms, volcanoes, lightening sea salt, smoke, forest fires, etc.

The man made sources are agricultural activities, industrial growth, domestic wastes, automobile exhausts, etc,

3. What do you know about particulate?

In general the term 'particulate' refers to all atmospheric substances that are not gases. They can be suspended droplets or solid particles or mixtures of the two. Particulates can be composed of materials ranging in size from 100mm down 0.1 mm and less. The chemical composition of particulate pollutants is very much dependent upon the origin of the particulate.

4. What are the prime sources of particulate matter?

i. Coal fired power plants

ii. Automobiles

5. Define suspended particulate matter?

Suspended Particulate Matter(SPM) is a complex mixture of small and large particles with size less than 100u varying origin and chemical composition.

6. Differentiate between Mist and Fog? Mist

Mist is made up of liquid droplets generally smaller than 10um which are formed by condensation in the atmosphere or are released from industrial operations.

Fog is similar to mist but the droplet size bigger(> 10u) and water is the liquid.Fog is sufficiently dense to incomprehensible vision.

7. What are gaseous pollutants?

These are toxic and poisonous gases such as carbon monoxide, chlorine, ammonia, hydrogen sulphate, sulphur dioxide, nitrogen oxides and carbon dioxide.

8. What are the major sources of air pollution from automobiles?

The major sources of air pollution from automobiles are

- Exhaust pipe ->70%
- Crank case emission ->20%
- Evaporations from fuel tank and Carburettor ->10%

9. What are effects of air pollution on animals?

Animals take up fluorides of air through plants. Their milk production falls and their teeth and bones are affected. They are also prone to lead poisoning and paralysis.

10. List some of the effects of air pollution on physical properties of atmosphere?

- Decrease in the visibility reduction of Solar radiation
- Effects on weather conditions
- Effects on atmospheric constituents

11. Briefly describe about the impacts of carbon monoxide on human health?

At lower doses, they can impair concentration and neurobehavioral function whereas in higher doses they can cause heart pain and even death. When inhaled it has the ability to combine with haemoglobin of blood and reduce its ability in transfer of oxygen to the brain, heart, and other important organs. But carboxyaemoglobin contents of blood depend on the CO contents of the air inhald, time of exposure and the activity of the person inhaling. It is particularly dangerous to babies and people with heart disease.

12. How air pollution can be controlled at source?

- Proper use of the existion equipment
- Change in process
- Modification or Replacement of equipments
- Installation of controlling equipments

13. What are the gaseous control equipments?

- Wet and dry adsorption
- Combustion or Catalytic incineration

14. What are the particulate control equipment?

- Gravitational settling chambers
- Cyclone separators
- Fabric filters (or) Bag filters
- Electrostatic precipitators
- Wet scrubbers (or) Wet collectors

15. What are bag filters?

Bag filters are the woven or non-woven fabrics used to filter the particulate laden gases. These generally of tubular shape or envelope shape. Its efficiency is about 99% and it can be used to remove particular small as 0.0mm

16. What are the factors to be considered in selection of type or fabrie in fabrie filters?

- Temperature of the gas
- Costiveness or abrasiveness of the particles

17. Name dome of the types of wet scrubbers?

1. Spray towers
2. Centrifugal scrubbers
3. Venturi scrubbers and
4. Packed bed columns

18. Define water pollution?

Water pollution is defined as any physical,chemical or biological change in quality of water that has a harmful effect on living organisms or makes the water unsuitable for needs.

19. How can you differentiate point? Source from non-point source of pollution?

Point sources discharge pollutant at a specific place through pipe lines, sewer lines, or ditches into water bodies.

Non point sources discharge pollutants from large and scattered area. These sources have no specific location.

20. What are the effects of in organic substances in water?

- Makes the water unfit for drinking and other purposes.
- Corrosion of metals exposed to such waters.
- Causes skin cancers, damages to spinal,CNS, liver and kidneys.
- Reduces crop yield.

21. How do the nutrients from agricultural fields affect the watershed?

Enrichment of nutrients (Eutrophication) from surrounding watershed affects the penetration of light through the water, causing damage to the characteristic of water and aquatic life.

22.Define soil pollution?

Soil pollution is defined as the introduction of substances, biological organisms, or energy into the soil, resulting in a change of the soil quality, which is likely to affect the normal use of the soil or endargering public health and the living environment.

23. Define marine pollution?

Marine pollution is defined as "Introduction by man, directly or indirectly, of substances or energy in to the marine environment (including estuaries) resulting in such destructive effects harm to living resources, hazard to human health, hindrance to marine activities including fishing, impairment of quality for use of sea-water, and reduction of amenities."

24. What is the cause of noise pollution?

- Road traffic noise
- Air traffic noise
- Rail traffic noise
- Domestic noise
- Industrial noise
- Incompatible land use

25. How can you define thermal pollution?

Thermal pollution can be defined as 'the excessive raising or lowering of water temperature above or below normal seasonal ranges in streams, lakes, or estuaries or oceans as the result of discharge of hot or cold effluents in to such water'.

26. What are solid wastes?

The wastes generated and discarded from human and animal activites that are normally solid are called as solid wastes.

UNIT III NATURAL RESOURCES

1. Define deforestation?

Deforestation refers to the removal of the forest vegetation.

2. List the Causes of deforestation?

1. Slash and Burn farming.
2. Commercial agriculture.

3. Cattle ranching and livestock grazing.
4. Mining and petroleum exploration.
5. Infrastructure development.
6. Fuel wood collection.
7. Tree Plantations.

3. Define Surface water?

Precipitation that does not soak into the ground or return to the atmosphere by evaporation or transpiration is called surface water. It forms streams, lakes, wetlands, and artificial reservoirs.

4. What is Groundwater?

The subsurface area where all available soil and rock spaces are filled by water is called the zone of saturation, and the water in these pores is called ground water.

5. What is Rock?

Rock is any material that makes up a large natural, continuous part of the earth's crust. Some kinds of rock, such as limestone (calcium carbonate, or CaCO3) and quartzite(silicon dioxide or SiO2), contain only one mineral,but most rocks consist of two or more minerals.

6. Give the classification of Mineral Resources?

Energy resources (coal,oil,natural gas, uranium, and geothermal energy; metallic mineral resources (iron,copper,and aluminium) and nonmetallic minerals resources(salt,gypsum,and clay, sand, phosphates, water, and soil).

7. Classify food production?

There are two types of food production

1. Industrialized Agriculture
2. Traditional Agriculture

8. Define Traditional Agriculture?

Traditional Agriculture can be classified as Traditional Subsistence agriculture and Traditional Intensive agriculture. Traditional Subsistence agriculture produces enough crops or live stock for a farm family's survival and in good years, a surplus to sell or put aside for hard times. In Traditional Intensive agriculture farmers increase their inputs of human and draft labour, fertilizer, and water to get a higher yield per area of cultivated land to produce enough food.

9. List some of the food resources available in the world?

Major food sources available in the world to cater the human's hunger are 12 types of seeds and grains, 3 root crops, 20 common fruits and vegetables, 6 mammals, 2 domestic fowl, few fishes and other forms of marine life,etc.

10. Classify energy resources?

Available conventional energy sources can be divided into two categories

1) Renewable Energy Sources
2) Non Renewable Energy Sources

11. Draw the flow chart of petroleum fractionation process?

Fuel gas, Propane Gasoline Kerosene Furnace Diesel Lubricants Asphalt Butane liquefied gas oil Heated crude oil.

12. Write the advantages and disadvantages of petroleum as a energy resources?

As a source of energy petroleum has many advantages

1) It is relatively cheap to extract and transport
2) It requires little processing to produce desired products and
3) It has relatively high net and useful energy yield.

However it has certain disadvantages also,

1) Produces Environmental pollution

2) Oil spills, in ocean cause water pollution and is expensive to clean up.

13. Write short notes on petroleum gas?

It is the mixture of three hydrocarbons butane, propane and ethane. The main constituent of petroleum gas is butane. The above gases are in gaseous state in ordinary pressure but they can be liquefied under high pressure. So it is called as LPG. (Liquefied petroleum Gas).

A domestic cylinder contains 14 kg of LPG. A strong smelling substance called ethyl mercaptian is added to LPG gas cylinder to help in the detection of gas leakage.

14. What is fission neutrons?

The fission process is accompanied not only by the release of energy also it releases neutrons called as fission neutrons.

15. Name the several types of nuclear reactors?

1. Light water Reactor(LWR)
2. Heavy water Reactor(HWR)
3. Gas Cooled Reactor(GCR)
4. Boiling Water Reactor(BWR)
5. Pressurised Water Reactor(PWR)
6. Liquid Metal Fast Breeder Reactor(LMFBR)

16. List some of the renewable energy sources?

1. Solar energy
2. Wind energy
3. Hydro energy
4. Geo-thermal energy
5. Ocean thermal energy
6. Biogas

17. Write short notes on Tidal energy?

Tides, the alternate rise and fall of sea water possess lot of energy. The identified tidal power potential in India is around 9000 MW. Currently France, Russia, china and Canada are effectively utilizing the tidal energy to produce 2 to 3% of their energy demand.

18. Narrate the advantages and disadvantages of the Hydel power?

Hydel power has the following advantages.

1. Clean Source of energy
2. Provides irrigation facilities
3. Provides drinking water to the people living around

It also has some environmental and socio-economic problems like submerged forests and agricultural land, loss of biodiversity, water logging and silting etc.

19. Define Soil Erosion?

Soil erosion is the movement of soil components, especially surface litter and top soil, from one place to another. The two main movers are flowing water and wind.

20. Write short notes on Desertification?

It is a problem where by the productive potential of arid or semiarid land falls by 10% or more and is caused mostly by human activities. Desertification is classified into three categories

1. Moderate - Having 10 to 25% drop in productivity
2. Severe - Having 25 to 50% drop in Productivity
3. Very Severe- Having 50% or more, creating huge gullies and sand dunes.

21. List some ways to protect soil?

1. When the buildings are constructed, all the trees shall be saved.

2. Setting a composite bin and it shall be used for producing mulch and soil conditioner for yard and garden planets.

3. Organic methods can be used for growing vegetables.

4. Strictly enforcing laws and policies that minimizes soil erosion, salt buildup and water logging.

22. What is equitable use of resources?

The Equitable use of resources is a concept that deals with the rational use of resources so that a harmony between man's resource requirement and its availability can be established.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

1. State the declaration about the sustainable development?

The Rio declaration states that, "human beings are at the center or concern for sustainable development. They are entitled to a health and productive life in harmony with the nature. Rvery generation should leave air., water and soil resources without any pollution as pure as it came to the Earth."

2. Define sustainable development?

Sustainable Development is defined as,' the development to meet the needs of the present without compromising the ability of future generations to meet their own needs.'

3. What are the three important components of sustainable development?

The three important components of sustainable development are

i. Economic development (like industrial development, creating job opportunities, utilization of natural resources for developing the quality of life)

ii. Community development (providing food, shelter, cloth, education, and other essentials for the human beings).

iii. Environmental protection (providing clear air, water and environment for the present and future generations and utilization of resources in a sustainable manner).

4. Define sustainable development indicators?

Sustainable development Indicators (SDI) are various statistical values that collectively measure the capacity to meet present and future needs. SDI will provide information crucial to decisions on national policy and to the general public.

5. What are the uses of sustainable development indicators?

The indicators are used by decision makers and the policy makers at all levels in order to monitor the progress towards attaining sustainable development. These are also used to increase forcus on the sustainable development.

6. Define sustainability?

Sustainability can be defined as the ability of a society or ecosystem to continue functioning into the indefinite future without being forced into decline through complete loss of its strength or overloading of key resources on which that system depends.

7. Define resistance stability and resilience stability?

Resistance stability is the ability of a system to remain stable in the face of stresses and Resilience stability of the system to recover from the disturbance occurred due to the activities happened.

8. List some of the characteristics of a sustainable society?

i. All the material processes will be designed to be of cyclic nature.

ii. There will not be any waste material or pollution of air, water, land and environment.

iii. The output from one system will be used as input to other systems.

iv. Only renewable energy will be used in the society, either directly or in the forms of hydro-power, wind power solar power and biomass.

v. The human population will be either stable stable in size or gradually Declining.

9. Define urbanisation ?

Urbabisation is defined as 'the process movement of human population from rural areas to urban areas in search in search of better economic interests with better education, communication, health, civic facilities and other day to day needs.'

10. What are problems or discomforts faced by rural people?

- Lack of modernization of agricultural sector
- Lack of job opportunities
- Poor life style
- Poor health facilities
- Poor education facilities
- Poor transportation facilities
- Poor availability of energy

11. What are the uses of energy in an urban areas?

Energy is used in an urban area for the following.

(a) For industrial activities
(b) For transportation
(c) For water apply
(d) For building & commercial use
(e) For cleaning of pollutants
(f) For essential services.

12. Define water conservation. Also indicate some of the water conservation techniques?

The production, development and efficient management of water resources for beneficial use is called as water conservation. The following are some of the techniques for water conservation.

Rain water harvesting Watershed management Construction of storage reservoirs Reuse of industrial wastewater Better agricultural practices.

13. What do you know about watershed?

A watershed is defined as the geographic area from which water in a particular stream, lake or estuary originates. It includes entire area of land that drains into the water body. It is separate from other system by high points in the area such as hills or slopes.

14. What is watershed management ?

Watershed management is a process aimed at protecting and restoring the habitat and water resources of a watershed, incorporating the needs of multiple stakeholders.

15. What are the impacts of human activities on watershed?

(a) Alteration of water course
(b) Addition of pollution sources
(c) Urbanisation
(d) Securing of channels.

16. What are the two important principles of watershed management?

The two important principles of watershed management are:

1) To preserve the environment, and
2) To use the most cost-effective means to achieve this goal.

17. Name some of the factors causing relocation of people?
    (a) Development activities
    (b) Natural and man-made disasters
    (c) Conservation initiatives.
18. Define resettlement and rehabilitation?

Resettlement is defined as the process of simple relocation or displacement of human population without considering their individual, community or societal needs. Rehabilitation is defined as the process of replacing the lost economic assets,rebuilding the community system that have been weakened by displacement, attending to the psychological trauma of forced separation from livelihood.

19. How do you define term 'Environmental Ethics'?

Environment Ethics is the branch of ethics which is analyzing about human use or Earth's limited resources.

20. What are the factors that influence climate change on the earth?

Climate change on the earth is influenced by the following factors.

- Variations in the Earth's orbital characteristics.
- Atmospheric carbon dioxide variations.
- Volcanic eruptions
- Variations in solar output.

21. List out any four effects of climate change?

1. Mean sea level is increased on an average of around 1.8mm per year.
2. Many ecosystems of the world have to adapt to the rapid change in global temperature.
3. The rate of species extinction will be increased.
4. Human agriculture, forestry, water resources and health will be affected.

22. Define Global warming?

Global warming is defined as the increase in temperature of the earth, which causes more changes in climate.

23. How can global warming be controlled?
    i. Reduction in consumption of fossil fuel such as coal and petroleum.
    ii. Use of biogas plants.
    iii. Use of nuclear power plants. iv. Increasing forest cover.
    v. Use of unleaded petrol in automobiles.
    vi. Installation of pollution controlling devices in automobiles and industries.
24. What are the two principal acids present in acid rain?
    Sulphuric acid ($H2SO_4$) and
    Nitric acid (HNO_3).
25. Define wet deposition and dry deposition. Is there any difference in damage due to these two types of deposition?

Wet deposition refers to acidic rain, fog, and snow. As this acidic water flowers over and through the ground, it afferts plants and animals in many ways. Dry deposition refers to acidic gases and particles. About half of the acidity in the atmosphere falls back to earth through dry deposition. Both wet and dry deposition can cause the same damage.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

1.How the population problem in India is analysed?

India's population problem may be viewed from three aspects

1. The absolute size of population
2. The rate of growth of the population

3. The age structure of the population.

2. What is population explosion?

Population explosion means the rapid population growth which is unexpected and unimaginable. The graph of recent population growth is referred to as a 'J' curve as it follows the shape of that letter, starting out low and skyrocketing straight up.

3. List the effect of population explosion?

Enormous increase in population results in

1. Increased consumption of resources available in the environment and depletion of the same quickly.
2. Due to over –consumption of natural resources, the environment gets deteriorated and polluted.
3. There will be desertification, deforestation, soilerosion, loss of fertility and poor productivity.
4. Mass poverty, poor per-capital availability of food for consumption and prevalence of disease on large scale.
5. Rapid urbanization resulting in growth of slums in cities and towns.
6. Inefficient management and ineffective control at all levels leading to poor quality of life.

4. What is health?

Health is considered as a quality of life that enables the individual to live most and serve best.

5. Define wellness?

Wellness is a state of optional well being. Wellness emphasizes each individual's responsibility for making decisions that will lead not only to the prevention for disease but to the promotion of a high level of health.

6. Name some health related fitness components?

1. Muscular strength and endurance
2. Flexibility
3. Body composition
4. Cardio-vascular endurance

7. Define Demography?

It refers to the science of dealing with the study of size, composition and territorial distribution of population; it includes study of natality,fertility,mortality, migration, and social mobility.

8.What is vital statistics?

Vital statistics are referred to systematically collected and compiled data relating to vital events of life such as birth, death, marriage, divorce,adoption,etc. Vital statistics are an indication of the given situation and help us in answering many health-related queries.

9.Name the fundamental rights of an Indian citizen?

1. Right to equality
2. Right to freedom of Speech and Activity
3. Right against Exploitation
4. Right to Freedom of Religion
5. Cultural and Educational Rights
6. Right to Constitutional Remedies.

10.Write short notes on common property resources?

Our environment has a major component that does not belong to individuals. There are several commonly owned resources that all of us use as a community. The

water that nature recycles, the air that we all breathe, the forests and grasslands which maintain our climate and soil, are all common property resources.

11.What is HIV and AIDS?

HIV stands for Human Immuno-deficiency Virus and is a virus that can damage the body's defence system so that it cannot fight off certain infections.

AIDS stands for (Accquired Immuno Deficiency Syndrome). An HIV infected person receives a diagnosis of AIDS after developing one of the AIDS indicator illness, A positive HIV test result does not mean that person has AIDS. A diagnosis of AIDS is made by a physician using certain clinical criteria (Eg: AIDS indicator illnesses).

12.What is opportunistic infection?

Infection with HIV can weaken the immune system to the point that it has difficulty fighting off certain infections. These types of infections are known as "opportunistic infections" because they take the opportunity to weaken the immune system which causes illness of the body.

13. List the means of HIV transmission.

There are four main ways in which HIV can be passed on:

1. By having vaginal, anal or oral sex without a condom with someone who has HIV.
2. By using needles, syringes or other drug-injecting equipment that is infected with HIV.
3. From a woman with HIV to her baby (before or during birth) and by Breast feeding.
4. By receiving infected blood, blood products or donated organs as part of medical treatment.

14. Name some tests available to find HIV infection?

In addition to the EIA or ELISA and Western blot, other tests now available include:

- Radio Immuno Precipitaion Assay (RIPA)
- Dot –blot immuno binding assay
- Immuno fluorescence assay
- Nucleic acid testing
- Polymerase Chain Reaction (PCR)

15. List the special features of Comprehensive programme on women and child welfare?

1. Personality
2. Reduction of Deprivation
3. Co-ordinational Effectivity
4. Maternity and Motherhood

16. What is information?

The term "information" has been defined by Eliahu Hoffinan as: "an aggregate (Collection and accumulation) of statements, or facts or figures which are conceptually by way of reasoning, logic,ideas, or any other mental "mode operation" interrelated/connected.

17. Name Some applications of IT in health?

Apart from helping in the administration of hospitals, IT is playing a key role in the health industry. On the, medical care, the IT has varied applications right from the diagnosis, where there are latest tools like CT scans, Ultrasound Sonography etc. which use IT as their basis for diagnosis of ailments. Most of the ICU's (Intensive Care Units) are now using computers to monitor the progress and condition of the patient, undergoing treatments.

Apart from this, with help of IT, expert opinions from doctors away from the place can be sought with help of IT tools like video conferencing etc. Apart from this can be used in the analysis and research on various potential medicines /drugs to be used in medical treatments.

18.List the applications of IT in environment?

a. Remote Sensing
b. Geographic Information System (GIS)
c. Global Positioning System(GPS)
d. Meterology

19.What is meant by sewage sickness?

The phenomena of soil getting clogged when the sewage is applied continuously on a piece of land is called sewage sickness

20.What are the preventive methods for sewage sickness?

- Primary treatment of sewage
- Choice of land
- Under drainage of soil
- Giving rest to land and Rotation of crops

21.Define dilution factor?

The dilution factor is defined as the ratio of the amount of river water to the amount of the sewage.

22.List various natural forces of self purification?

- Physical forces
- Chemical forces

23.What are the factors affecting the reduction ?

- Temperature
- Turbulence effect of wind
- Hydrographic
- Available dissolved oxygen
- Rate of re -aeration

24.What is meant by prim lake pollutant ?

The phosphorus which contains in domestic sewage as well as in the industrial waste which affect the water quality of the lake and its called prim lake pollutant

25.What is meant by de-oxygenation curve?

The curve which represents (or) showing the depletion of D.O with time at the given temperature.

PART – B

UNIT-I ENVIRONMENT, ECOSYSTEM & BIODIVERSITY

1. Explain the components, characteristics and biodiversity of Forest ecosystem.
2. Explain the structure and functional features of aquatic, desert, grassland ecosystem.
3. Explain the two models of energy flow in an ecosystem.
4. Discuss the value of biodiversity.
5. Explain a) Carbon and Nitrogen cycles. b) Sulphur and Phosphorus cycles.
6. What are the threats faced by biodiversity. What are the solutions for the threats?
7. Explain In-situ and Ex-situ conservation of biodiversity.

UNIT II ENVIRONMENTAL POLLUTION

1. Mention the sources, effects & control of various air pollutants.
2. Briefly describe the sources effects and control of noise pollution.
3. Enumerate with example the major sources & control of surface and ground water pollution.
4. Explain the method of sewage water treatment
5. Explain the methods of disposal of municipal solid waste.

UNIT III NATURAL RESOURCES

1. Discuss the major causes & consequences of deforestation?
2. Enumerate the various benefits and drawbacks of constructing dams.
3. What are the uses and over-exploitation of water? Explain with a case-study.
4. What are the environmental impacts of mineral extraction? Explain.
5. Write short notes of (i) Tidal energy (ii) Bio-gas (iii) Nuclear energy.
6. Explain the land resources & various types of land degradation.
7. Explain the major impacts of timber extraction and mining.
8. Explain as an individual how you will conserve natural resources
9. Discuss in detail the impacts of over-grazing & agriculture

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

1. Bring out the activities of NGO's on environmental protection.
2. Discuss about the Forest Act, 1980 and its amendment –1992.
3. Describe about Water Act – 1974.
4. Discuss the modern techniques of rain water harvesting.
5. Discuss the water shed management practices.
6. Discuss the agenda for sustainable development.
7. Write in detail about global warming.
8. Explain the mechanism of Ozone layer depletion
9. Describe the important waste land reclamation practices.
10. Write notes on (i) Floods (ii) Landslides (iii) Cyclones.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

1. What is meant by population explosion? Discuss the Indian Scenario.
2. Discuss the influence of environmental parameters and pollution on human health.
3. What is Universal declaration of Human rights? What is its importance in achieving the goals of equity, justice & sustainability?
4. What are the objectives & elements of Value-education? How can the same be achieved?
5. What is the role of ENVIS & GIS in dissemination of environmental information and environmental management?
6. Explain the role of Information Technology in environment & Human health.
7. Explain the population characteristics & variations among nations.
8. Discuss the salient features of Draft declaration of Human Rights on environment.

UNIVERSITY QUESTION PAPERS

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER-DECEMBER 2009

ENVIRONMENTAL SCIENCE AND ENGINEERING

(Regulation 2008)

Answer All Questions

Part – A (10x2=20)

1. State the significance and scope of environmental education.
2. Define environmental impact statement.
3. What is food web?
4. 'India is a mega – diversity nation' – Account.
5. What is meant by thermal pollution?
6. State the role and responsibility of an individual in the prevention of pollution.
7. What is acid rain?
8. Define the concept of sustainable development.
9. Define population equation.
10. What are the effects of population explosion?

Part – B (5x16=80)

11. (a) (i) Explain any two conflicts over water, confining to our nation. (8)
(ii) Discuss the impacts of handling the mineral resources for extraction and subsequent utilization, on the environment. (8)

Or

(b) (i) Discuss in detail the causes and consequences of overexploitation of forest resources. (8)
(ii) Give a brief account of renewable energy resources and their significance. (8)

12. (a) (i) Give an account of energy flow in ecosystem. (8)
(ii) Describe the biotic component of an ecosystem. (8)

Or

(b) (i) Discuss the importance of biodiversity. (8)
(ii) Write informative notes on 'Insitu' conservation. (8)

13. (a) (i) What is noise? Describe briefly the effects of noise on human health. (8)
(ii) Suggest measures to control air pollution. (8)

Or

(b) Write short notes on :
(i) Land filling method for solid waste. (8)
(ii) Disaster management. (8)

14. (a) (i) Give a brief account of Global Warming. (8)
(ii) Bring out the various details of Wasteland Reclamation Practices.(8)

Or

(b) (i) Write a note on Waste shed management. (4)
(ii) Discuss briefly on Environment (protection) act 1986. (4)
(iii) Write briefly on Bhopal disaster and chernobyl disaster. (8)

15. (a) Describe briefly
(i) The factors that affect human population growth rate.(6)
(ii) Human rights. (5)
(iii) Value education. (5).

Or

(b) (i) Discuss the factors influencing family size. (8)
(ii) Write a note on the various methods of family planning. (4)
(iii) What is AIDS? How to prevent it? (4)

B.E./B.Tech. DEGREE EXAMINATION, APRIL-MAY2010

ENVIRONMENTAL SCIENCE AND ENGINEERING

(Regulation 2008)

Answer All Questions

Part – A (10x2=20)

1. What are the three effects of deforestation?
2. Suggest three damages caused by use of fertilizer.
3. Name the various ecosystems.
4. Suggest three important features of forest ecosystem.
5. Suggest four important sources of air pollution.
6. Give two effects of noise pollution on human being.
7. What is acid rain? Explain.
8. Give two effects of global warming.
9. Give any two schemes of human health program initiated by Indian Government on effects of population growth.
10. What are the advantages of family welfare program?

Part – B (5x16=80)

11. (a) Explam the various renewable energy sources in the earth.

Or

(b) Discuss the following:
(i) Land Resources.
(ii) Land degradation.
(iii) Soil Erosion and desertification.

12. (a) Explain the structure and function of Ecosystem with neat sketch.

Or

(b) Explain the values of Biodiversity.

13. (a) Discuss the method of solid waste management by sanitary and land filling and thermal means.

Or

(b) Explain various disaster management measures during Cyclone, floods, earthquake and landslides.

14. (a) What is global warming? Explain the measures to prevent it. Also explain the effects of global warming.

Or

(b) Explain the effects of nuclear effects with two case studies.

15. (a) Explain in detail various health schemes initiated by Indian Government.

Or

(b) Explain the role of Information Technology on Environmrntal protection and Human Health Protection.

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER-DECEMBER 2010

ENVIRONMENTAL SCIENCE AND ENGINEERING

(Regulation 2008)

Answer All Questions

Part – A (10x2=20)

1. What are the types of grasslands ecosystem?
2. Define Species diversity.
3. What do you understand by soil pollution?
4. What are the causes of noise pollution?
5. List the causes of deforestation.
6. List the advantages and disadvantages of the hydel power.
7. Define urbanization.
8. How can global warming be controlled?
9. What is population explosion?
10. What are HlV and AIDS?

Part – B (5x16=80)

11. (a) (i) Discuss briefly the structural and functional components of an ecosystem.(8)
    (ii) Write down the ecological succession and ecological pyramids. (8)

    Or

    (b) (i) Classify and explain the value of biodiversity. (8)
    (ii) Write about in-situ and ex-situ conservation of biodiversity. (8)
12. (a) (i) What do you know about Tsunami? Explain the formation of tsunami. (8)
    (ii) Explain the different stages municipal sewage treatment. (8)

    Or

    (b) (i) Explain clearly the stages of solid waste management. (8)
    (ii) Explain the sources and effects of thermal pollution. (8)
13. (a) (i) Explain the following in detail
        1) Desertification (4)
        2) Land degradation (4)
    (ii) Explain the various Conventional energy resources.(8)

    Or

    (b) (i) Explain the following in detail
        1) Mineral Resources (4)
        2) Food Resources (4)
    (ii) Discuss in detail the over-exploitation of forests.(8)
14. (a) (i) Explain the powers and functions of state pollution control board.(8)
    (ii) Explain the wild life protection act.(8)

    Or

    (b) (i) Explain the 'Ozone' and Ozone layer depletion. (8)
    (ii) Discuss the energy requirement in detail for sustaining urban life. (8)
15. (a) (i) Write about the role of IT in environment and human health.(10)
    (ii) Mention the causes of HIV transmission.(6)

    Or

    (b) (i) Discuss the necessity of formation of women self help group. (6)
    (ii) Explain the need for value education. (6)
    (iii) Write about child welfare. (4)

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER-DECEMBER 2011

ENVIRONMENTAL SCIENCE AND ENGINEERING

(Regulation 2008)

Answer All Questions

Part – A (10x2=20)

1. Differentiate between food chain and food web.
2. Define Genetic diversity and species diversity.
3. Classify the sources of Air pollution.
4. What is marine pollution?
5. Define Food security.
6. What are the factors that contribute to land degradation?
7. What is sustainable development?
8. State the effects of Acid rain?
9. Define the term doubling time in connection with population growth.
10. Differentiate between HIV and AIDS.

Part – B (5x16=80)

11. (a) (i) Explain the role of producers, consumers and decomposers in an ecosystem. (8)
(ii) What are the major factors that are responsible for the loss of biodiversity? Explain. (8)

Or

(b) Explain the characteristic features of
(i) Forest ecosystem. (8) (ii) Aquatic ecosystem. (8)

12. (a) (i) Explain the activated sludge process with a flow diagram. (8)
(ii)What is BOD? Explain how BOD is determined for a wastewater.(8)

Or

(b) (i) What is noise? How is noise pollution controlled? Suggest suitable steps. (8)
(ii) Discuss the role of an individual in pollution prevention. (8)

13. (a) (i) Explain the environmental effects of Deforestation.(8)
(ii) Discuss the benefits and problems of dams.(8)

Or

(b) (i) Enumerate the adverse effects of Modern Agriculture on soil and water sources.(8)
(ii) What is renewable energy? Write a brief note on an y two renewable energy sources.(8)

14. (a) (i) Discuss the ways to minimize radiation exposure in case of a nuclear accident. (8)
(ii) Explain the salient features of the Environment (Protection) Act, 1986. (8)

Or

(b) (i) Discuss the chemistry of ozone depletion. (8)
(ii) What is rain water harvesting? How are the rain water harvesting methods classified? Briefly explain. (8)

15. (a) (i) Draw a typ ical population pyramid of developing country and discuss.(8)
(ii) Explain the Environmental problems posed by population explosion.(8)

Or

(b) (i) Explain the steps that are being taken in India to impart value education (8)

(ii) Discuss the role of Information Technology in the protection of Environment and Human Health. (8)

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER-DECEMBER 2013

ENVIRONMENTAL SCIENCE AND ENGINEERING

(Regulation 2008/2010)

Answer All Questions

Part – A (10x2=20)

1. What is an eco system?
2. Differentiate between food chain and food web.
3. Define the term Noise pollution.
4. What is a cyclone?
5. Mention the major environmental impacts of Mining.
6. What are the changes caused by overgrazing?
7. What is Environmental Ethics?
8. List the objectives of Forest Conservation Act.
9. What do you mean by doubling time.
10. What is Value Education?

Part – B (5x16=80)

11. (a) (i) Explain the role of producers, consumers and decomposers in an ecosystem. (8)

(ii) What is the importance of protecting Biodiversity on earth.(8)

Or

(b) (i) Explain the various components and functions of Forest ecosystem. (8)

(ii) Identify and explain the major threats to the biodiversity of India. (8)

12. (a) (i) Explain the major water pollutants and their effects. (8)

(ii). List and explain the methods of waste management in the order of preference. (8)

Or

(b) (i) Discuss the source, effects and control measures of thermal pollution. (8)

(ii). What is earth quake? Write its effects. What measures shouldbe takento mitigate the disaster. (8)

13. (a) (i) Discuss the effects timber extractionon forest and tribal people(8).

(ii) What is land degradation? Mention the factors responsible for land degradation . (8)

Or

(b) (i) Enumerate the adverse effects of Modern Agriculture on soil and water sources.(8)

(ii) What is renewable energy? Write a brief note on an y two renewable energy sources.(8)

14. (a) (i) What are the major urban problems related to energy?. (8)

(ii) Briefly discuss the salient features of the Environment (Protection) Act, 1986. (8)

Or

(b) (i) What is watershed? Critically discuss the objective and practices of water shed management (8)

(ii) Write shortnotes on Nuclear accidents and holocaust. (8)

15. (a) (i) Explain the term 'Population Explotion'. Enumerate its effects. (8)

(ii) Discuss role of Information Technology in the protection of Environment and Human health.(8)

Or

(b) (i) Describe the various schemes launched for woman and child welfare in India. (8)

(ii) What are the modes of transmission of HIV? And how can it be prevented? (8)

Reg. No. :

Question Paper Code :

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2011

Sixth Semester

Petroleum Engineering

GE 2021 — ENVIRONMENTAL SCIENCE AND ENGINEERING

[Common to Fifth Semester – Aeronautical Engineering, Automobile Engineering, Electronics and Communication Engineering, Mechanical Engineering, Production Engineering – Fourth Semester Biomedical Engineering – Third Semester – Computer Science and Engineering, Civil Engineering and Information Technology]

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions

PART A — (10 × 2 = 20 marks)

1. Define environment and ecosystems.
2. What is the major significance of biodiversity?
3. What are the general causes of air pollution?
4. Define recycling.
5. What is meant by green house effect?
6. Define the terms
   (a) COD,
   (b) BOD,
   (c) toxicity
7. How to overcome global warming in India.
8. What are the air pollution and prevention control acts in India and mention at least four?
9. Define population momentum.
10. What is environmental resistance?

PART B — (5 × 16 = 80 marks)

11. (a) Explain the structure and functions of the following

(i) Forest eco systems

(ii) Grass land eco systems

(iii) Desert eco systems

(iv) Aquatic eco systems.

Or

(b) Discuss the biodiversity at global, national and local levels.

12. (a) Explain the control and prevention measures of municipal solid wastes in your area.

Or

(b) Write about one of the industrial waste water treatment techniques, with a neat schematic diagram.

13. (a) What are the natural resources availability in India and discuss any two of them.

Or

(b) Discuss the world food problems in detail and how does it affects other resources.

14. (a) Write short notes on

(i) Role of NGO

(ii) Acid rain

(iii) Ozone layer depletion

(iv) Water conservation

Or

(b) (i) Explain in brief about the Indian pollution regulations.

(ii) Describe the functions of state board and central board according to pollution Control.

15. (a) The world's population in 10,000 years ago has been estimated at about 5 million. What exponential rate of growth would have resulted in the population in 1850, which is estimated to have been 1 billion? Had that rate continued, what would be the population in the year 2010?

Or

(b) Discuss the role of information technology in environment and human health.

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 20461

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2012.

Eighth Semester

Marine Engineering

GE 2021/GE 32/HS 1201/10177 GE 001/080100016/080280015 —
ENVIRONMENTAL SCIENCE AND ENGINEERING

(Common to Sixth Semester – Petroleum Engineering, Fifth Semester – Mechanical Engineering, Aeronautical Engineering, Automobile Engineering, Electronics and Communication Engineering and Production Engineering – Third Semester – Computer Science and Engineering, Civil Engineering and Information Technology and Fourth Semester – Biomedical Engineering)

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Ecosystem.
2. Write about ecological pyramids.
3. Explain the term photo-chemical smog.
4. Write any four source of water pollution.
5. Define BOD_5.
6. What is population pyramid? Explain.
7. Name any four Natural Resources.
8. Why value education is important?
9. How nuclear waste disposed safely?
10. List various Clean Air Act Amendments.

PART B — (5 × 16 = 80 marks)

11. (a) Explain the structure and functions of all Ecosystems.

Or

(b) (i) Explain the conservation of biodiversity in Global level. (8)

(ii) What is Food chain? How it is important to nation? (8)

12. (a) (i) Write briefly the impact of Air pollution on humans. (10)

(ii) What is Thermal pollution? Explain. (6)

Or

(b) Explain the role of an individual in prevention of pollution and Disaster Management with suitable recent case study.

13. (a) (i) What is Deforestation? Write the effects of deforestation. (8)

(ii) Write briefly the Environmental issues caused by mineral resources. (8)

Or

(b) Explain the role of alternate energy sources in pollution control with case studies.

14. (a) Define water Reuse and conservation and explain the methods adopted to conserve water in industries.

Or

(b) Explain various prevention and control of pollution Act used in Air, water and nuclear waste disposal.

15. (a) Explain the role of information technology in environmental field with suitable case study.

Or

(b) Write short notes on (4 × 4 = 16)

(i) Effect of modern agriculture.

(ii) Population growth and explosion.

(iii) Noise pollution.

(iv) Conservation of biodiversity.

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