GANDHI ACADEMY OF TECHNOLOGY AND ENGINEERING
(Approved By AICTE New Delhi & Affiliated to
BPUT, Rourkela, Odisha)

ENVIRONMENTAL STUDIES

PREPARED BY

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Th5. ENVIRONMENTAL STUDIES

(Common to all Branches)

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	3rd
Total Period:	60	Examination :	3 hrs
Theory periods:	4P / week	Internal Assessment:	20
Maximum marks:	100	End Semester Examination ::	80

A. RATIONALE:

Due to various aspects of human developments including the demand of different kinds of technological innovations, most people have been forgetting that, the Environment in which they are living is to be maintained under various living standards for the preservation of better health. The degradation of environment due to industrial growth is very much alarming due to environmental pollution beyond permissible limits in respect of air, water industrial waste, noise etc. Therefore, the subject of Environmental Studies to be learnt by every student in order to take care of the environmental aspect in each and every activity in the best possible manner.

B. OBJECTIVE:

After completion of study of environmental studies, the student will be able to:

1. Gather adequate knowledge of different pollutants, their sources and shall be aware of solid waste management systems and hazardous waste and their effects.
2. Develop awareness towards preservation of environment.

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	The Multidisciplinary nature of environmental studies	04
2	Natural Resources	10
3	Systems	08
4	Biodiversity and it's Conservation	08
5	Environmental Pollution	12
6	Social issues and the Environment	10
7	Human population and the environment	08
	Total:	60

D. COURSE CONTENTS

1. The Multidisciplinary nature of environmental studies:

1.1 Definition, scope and importance.

1.2 Need for public awareness.

2. Natural Resources:

Renewable and non renewable resources:

2.1 Natural resources and associated problems.

2.1.1. Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction mining, dams and their effects on forests and tribal people.

2.1.2. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.

2.1.3. Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources.

2.1.4. Food Resources: World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers- pesticides problems, water logging, salinity, .

2.1.5. Energy Resources: Growing energy need, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

2.1.6. Land Resources: Land as a resource, land degradation, man induces landslides, soil erosion, and desertification.

2.2 Role of individual in conservation of natural resources.

2.3 Equitable use of resources for sustainable life styles.

3. Systems:

3.1. Concept of an eco system.

3.2. Structure and function of an eco system.

3.3. Producers, consumers, decomposers.

3.4. Energy flow in the eco systems.

3.5. Ecological succession.

3.6. Food chains, food webs and ecological pyramids.

3.7. Introduction, types, characteristic features, structure and function of the following eco system:

3.8. Forest ecosystem:

3.9. Aquatic eco systems (ponds, streams, lakes, rivers, oceans,

estuaries).

4. **Biodiversity and it's Conservation:**

4.1. Introduction-Definition: genetics, species and ecosystem diversity.
4.2. Biogeographically classification of India.
4.3. Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and optin values.
4.4. Biodiversity at global, national and local level.
4.5. Threats to biodiversity: Habitats loss, poaching of wild life, man wildlife conflicts.

5. **Environmental Pollution:**

5.1. Definition Causes, effects and control measures of:

5.1.1 Air pollution.
5.1.2 Water pollution.
5.1.3 Soil pollution
5.1.4 Marine pollution
5.1.5 Noise pollution.
5.1.6 Thermal pollution
5.1.7 Nuclear hazards.

5.2. Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
5.3. Role of an individual in prevention of pollution.
5.4. Disaster management: Floods, earth quake, cyclone and landslides.

6. **Social issues and the Environment:**

6.1. Form unsustainable to sustainable development.
6.2. Urban problems related to energy.
6.3. Water conservation, rain water harvesting, water shed management.
6.4. Resettlement and rehabilitation of people; its problems and concern.
6.5. Environmental ethics: issue and possible solutions.
6.6. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies.
6.7. Air (prevention and control of pollution) Act.
6.8. Water (prevention and control of pollution) Act.
6.9. Public awareness.

7. **Human population and the environment:**

7.1. Population growth and variation among nations.
7.2. Population explosion- family welfare program.
7.3. Environment and human health.
7.4. Human rights.
7.5. Value education
7.6. Role of information technology in environment and human health.

The Multidisciplinary nature of environmental studies

UNIT -1

Definition, Scope and Importance, Need for Public Awareness.

INTRODUCTION:-

The word environment is derived from the French word **'environner'** which means to **'Encircle or surround'**.

- Thus our environment can be defined **as "the Social, Cultural and Physical conditions that surround, affect and influence the survival, growth and development of people, animals and plants"**
- This broad definition includes the natural world and the technological environment as well as the cultural and social contexts that shape human lives.
- It includes all factors (living and nonliving) that affect an individual organism or population at any point in the life cycle; set of circumstances surrounding a particular occurrence and allthe things that surrounds us.

SEGMENTS OF ENVIRONMENT

Environment consists of four segments.

1) Atmosphere- Blanket of gases surrounding the earth.
2) Hydrosphere- Various water bodies present on the earth.
3) Lithosphere- Contains various types of soils and rocks on the earth.
4) Biosphere- Composed of all living organisms and their interactions with theenvironment.

MULTIDISCIPLINARY NATURE OF ENVIRONMENTALSTUDIES

1) The Environment studies is a multi-disciplinary science because it comprises various branches of studies like chemistry, physics, medical science, life science, agriculture, public health, sanitary engineering etc.
2) It is the science of physical phenomena in the environment. It studies about the sources, reactions, transport, effect and fate of physical and biological species in the air, water, soil and the effect of from human activity upon these.
3) As the environment is complex and actually made up of many different environments like natural, constructed and cultural environments, environmental studies is inter disciplinary in nature including the study of biology, geology, politics, policy studies, law, religion engineering, chemistry and economics to understand the humanity'seffects on the natural world.
4) This subject educates the students to appreciate the complexity of environmental issues and citizens and experts in many fields. By studying environmental science, students may develop a breadth of the inter disciplinary and methodological knowledge in the environmental fields that enables them to facilitate the definition and solution of environmental problems.

SCOPE OF ENVIRONMENTALSTUDIES

Environmental studies as a subject has a wide scope. It includes a large number of areas and aspects, which may be summarized as follows:

- Natural resources- their conservation and management
- Ecology and Biodiversity
- Environmental pollution and control

- Human population and environment
- Social issues in relation to development and environment

These are the basic aspects of environmental studies which have a direct relevance to every section of society. Several career options have emerged in these fields that are broadly categorized as:

1) **Research and development in environment:**

Skilled environmental scientists have an important role to play in examining various environmental problems in a scientific manner and carry out R&D activities for developing cleaner technologies and promoting sustainable development.

2) **Green advocacy:**

With increasing emphasis on implementing various Acts and Laws related to environment, need for environmental lawyers has emerged, who should be able to plead the cases related to water, air, forest, wildlife, pollution and control etc.

3) **Green marketing:**

While ensuring the quality of products with ISO mark, now there is an increasing emphasis on marketing goods that are environment friendly. Such products have Eco mark or ISO 14000 certification. Environmental auditors and environmental managers would be in great demand in the coming years.

4) **Green media:**

Environmental awareness can be spread amongst masses through mass media like television, radio, newspaper, magazine, hoardings, advertisements etc., for which environmentally educated persons are required.

5) **Environmental consultancy:**

Many non-government organizations, industries and government bodies are engaging environmental consultants for systematically studying and tackling environment related problems.

❖ **IMPORTANCE OF ENVIRONMENTALSTUDIES**

- The importance of environmental studies is that, the current trend of environmental degradation can be reversed if people of educated communities are organized, empowered and experts are involved in sustainable development.
- Environmental factors greatly influence every organism and their activities.
- At present a great number of environmental issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. These issues are studied besides giving effective suggestions in the environment studies.
- The environment studies enlighten, about the importance of protection and conservation of our natural resources, indiscriminate release of pollution into the environment etc.

Environment studies have become significant for the following reasons:

❖ **Environment Issues being of International Importance:**

It has been well recognized that environment issues like global warming, ozone depletion, acid rain, marine pollution and loss of biodiversity are not merely national issues but are global issues and hence must be tackled with international efforts and cooperation.

❖ **Problems Cropped in the Wake of Development:**

Development, in its wake gave birth to Urbanization, Industrial Growth, Transportation Systems, Agriculture and Housing etc. However, it has become phased out in the developed world. The North, to cleanse their own environment has fact fully, managed to move 'dirty' factories to South. When the West developed, it did so perhaps in ignorance of the environmental impact of its activities. Evidently such a path is neither practicable nor desirable, even if developing world follows that.

❖ **Explosively Increase in Pollution:**

World census reflects that one in every seven persons in this plant lives in India. Evidently with 16 per cent of the world's population and only 2.4 per cent of its land area, there is a heavy pressure on the natural resources including land. Agricultural experts have recognized soils health problems like deficiency of micronutrients and organic matter, soil salinity and damage of soil structure.

❖ **Need for an Alternative Solution:** It is essential, especially for developing countries to find alternative paths to an alternative goal.We need a goal as under:

- A goal, which ultimately is the true goal of development an environmentally sound and sustainable development.
- A goal common to all citizens of our earth.
- A goal distant from the developing world in the manner it is from the over- consuming wasteful societies of the "developed" world.

❖ **Need To Save Humanity From Extinction:**

It is incumbent upon us to save the humanity from extinction. Consequences to our activities cause destructing the environment and depleting the biosphere, in the name of development.

❖ **Need For Wise Planning of Development:**

Our survival and sustenance depend. Resources withdraw; processing and use of the product have all to be synchronized with the ecological cycles in any plan of development. Our actions should be planned ecologically for the sustenance of the environment and development.

❖ **NEED FOR PUBLICAWARENESS**

1. **Growing Population:** A population of over thousands of millions is growingat2.11 per cent every year. Over 17 million people are added each year. It puts considerable pressure on its natural resources and reduces the gains of development. Hence, the greatest challenge before us is to limit the population growth. Although population control does automatically lead to development, yet the development leads to a decrease in population growth rates.

2. **Poverty (very Poor) :** India has often been described a rich land with poor people. The poverty and environmental degradation are mixed with one another. The vast majority of our people are directly dependent on the nature resources of the country for their basic needs of food, fuel shelter and fodder. About 40% of our people are still below the poverty line.

3. **Environment degradation:** has adversely affected the poor who depend upon the resources of their immediate surroundings. Thus, the challenge of poverty and the challenge of environment degradation are two facets of the same challenge.

4. **Agricultural Growth:** The people must be made familiar with the methods to sustain and increase agricultural growth without damaging the environment. High yielding varieties have caused soil salinity and damage to physical structure of soil.

5. **Need to Increase Ground water:** It is essential of rationalizing the use of groundwater. Factors like community wastes, industrial effluents, chemical fertilizers and pesticides have polluted our surface water and affected quality of the groundwater. It is essential to restore the water quality of our rivers and other water bodies. Suitable strategies for conservation of water, provision of safe drinking water and keeping water bodies clean should be developed.

6. Development and Forests: Forests serve catchments for the rivers. With increasing demand of water, plan to harness the mighty river through large irrigation projects were made. Certainly, these would submerge forests; displace local people, damage flora and fauna. As such, the dams on the river Narmada, Bhagirathi and elsewhere have become areas of political and scientific debate. Forests in India have been shrinking for several centuries owing to pressures of agriculture and other uses. Vast areas that were once green stand today as waste lands. These areas are to be brought back under vegetative cover. The tribal communities inhabiting forests, respects the trees, birds and animals give them sustenance. We must recognize the role of these people in restoring and conserving forests. The modern knowledge and skills of the forest department should be integrated with the traditional knowledge and experience of the local Communities. The strategies for the joint management of forests should be evolved in a well- planned way.

7. Degradation of Land: At present out of the total 329 mha of land, only 266 mha possess any potential for production. Of this, 143 mha is agricultural land nearly and 85 suffer from varying degrees of soil degradation. Of the remaining 123 mha, 40 are completely unproductive. The remaining83 mha is classified as forest land, of which over half is denuded to various degrees. Nearly 406 million head of livestock have to be supported on 13 mha, or less than 4 per cent of the land classified as pasture land, most of which is over grazed. Thus, out of 226 mha, about 175 mha or 66 per cent is degraded to varying degrees. Water and wind erosion causes further degradation of almost 150 mha this degradation is to be avoided.

8. Evil Consequences of Urbanization: Nearly 27% of Indians live in urban areas. Urbanization and industrialization has given birth to a great number of environmental problems. Over 30 percent of urban Indians live in slums. Out of India's 3,245 towns and cities, only 21 have partial or full sewerage and treatment facilities. Hence, coping with rapid urbanization is a major challenge.

9. Air and water Pollution: Majority of our industrial plants are using out dated and pollution causing technologies and makeshift facilities devoid of any provision of treating their wastes. A great number of cities and industrial areas have been identified as the worst in terms of air and water pollution. Acts are enforced in the country, but their implement is not so easy. The reason is their implementation needs great resources, technical expertise, political and social will. Again the people are to be made aware of these rules. Their support is indispensable to implement these rules.

❖ INSTITUTIONS INENVIRONMENT

Managing natural resources require efficient institutions at all levels i.e. local, national, regional and global. Among the large number of institutions that deal with environmental protection and conservation, a few well-known organization include government organizations like the BSI and ZSI, and NGOs like the BNHS, WWF-1 *etc*.

Expected questions

1. Short Answer Type Question:

a) Define environment.
b) What are the components of environment?
c) What are the factors that affect the environmental condition?
d) Name biotic and a biotic component.
e) How are environment and human beings related?
f) Write down the basic needs of humans.
g) Write down the main scope of environmental science.
h) In which sphere ozone layer exists.
i) What is the difference between biotic and a biotic component with example?
j) Define environmental science and environmental studies.

2. Long Answer type Question:

a) Environmental study is multidisciplinary in nature. Explain.
b) Discuss the public awareness towards the environmental education.
c) Enumerate the scope and importance of environmental studies.
d) Give the structure of environment.
e) Identify the basic components of environment and explain.

Natural Resources

Unit-2

RENEWABLE AND NONRENEWABLE RESOURCES:

INTRODUCTION

- Natural resources can be defined as 'variety of goods and services provided by nature which are necessary for our day-to-day lives'.
- Eg: Plants, animals and microbes (living or biotic part), Air, water, soil, minerals, climate and solar energy (non- living or a biotic part).
- They are essential for the fulfillment of physiological, social, economic and cultural needs at the individual and community levels.

TYPES OF NATURALRESOURCES

They are of **two types** of resources namely **Renewable** and **Non-Renewable** Resources.

Renewable resources:

- . The resources that can be replenished through rapid natural cycles are known as renewable resource. These resources are able to increase their abundance through reproduction and utilization of simple substances.
  Ex: Plants, (crops and forests) and animals.
- Some examples of renewable resources though they do not have life cycle but can be recycled.
- Ex: Wood and wood-products, pulp products, natural rubber, fibers (e.g. Cotton, jute, animal wool, silk and synthetic fibers) and leather.
- In addition to these resources, water and soil are also classified as renewable resources.

Solar energy although having a finite life, as a special case, is considered as a renewable resource in as much as solar stocks is inexhaustible on the human scale

Nonrenewable resources: The resources that cannot be replenished through natural processes are known as non-renewable resources. These are available in limited amounts, which cannot be increased. These resources include fossil fuels (petrol, coal etc.), metals (iron, copper, gold, silver, lead, zinc etc.), minerals and salts (carbonates, phosphates, nitrates etc.).Once a non-renewable resource is consumed, it is gone forever.

- Non-renewable resources can further be divided into **two categories**, Such as-:

(A) Recyclable and (B) Non-recyclable

A) Recyclable: These are non-renewable resources, which can be collected after they are used and can be recycled. These are mainly the non-energy mineral resources, which occur in the earth's crust (Ex: Ores of aluminum, copper, mercury etc.) and deposits of fertilizer nutrients (e.g. Phosphate sock and potassium and minerals used in their natural state (asbestos, clay, mica etc.)

B) **Non-recyclable:** These are non-renewable resources, which cannot be recycled in any way. Ex: Fossil fuels and uranium, which provide 90 per cent of our energy requirements.

a) Natural resources and associated problems.

- 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 to50 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.

Forest resources:

Use and over-exploitation, deforestation, case studies, Timber extraction mining, dams and their effects on forests and tribal people.

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 13 about 12% thus we need not only to protect our existing forests but also to increase our forest cover.

FUNCTIONS OF FOREST

• It performs very important function both to human and to nature.
• They are habitats to millions of plants, animals and wild life.
• They recycle rain water.
• They remove pollutant from air.
• They control water quality.
• They moderate temperature and weather.
• They influence soil condition and prevent soil erosion.

USES OF FOREST

There are two purposes for which a Forest can used

A. Commercial uses **B.** Ecological uses

A. The direct benefits from forests are (Commercial uses)

(a) Fuel Wood: Wood is used as a source of energy for cooking purpose and for keeping warm.
(b) Timber: Wood is used for making furniture, tool-handles, railway sleepers, matches, ploughs, bridges, boats etc.
(c) Bamboos: These are used for matting, flooring, baskets, ropes, rafts, cots etc.
(d) Food: Fruits, leaves, roots and tubers of plants and meat of forest animals form the food of forest tribes.
(e) Shelter: Mosses, ferns, insects, birds, reptiles, mammals and micro-organisms are provided shelter by forests.
(f) Paper: Wood and Bamboo pulp are used for manufacturing paper **(Newsprint, stationery, packing paper, sanitary paper)**
(g) Rayon: Bamboo and wood are used in the manufacture of rayon (yarns, artificial silk-fibres)
(h) Forest Products: Tannins, gums, drugs, spices, insecticides, waxes, honey, horns, musk, ivory, hides etc. are all provided by the flora and fauna of forests.

B. The indirect benefits from forests are (Ecological uses)

(a) Conservation of Soil: Forests prevent soil erosion by binding the soil with the network of roots of the different plants and reduce the velocity of wind and rain — which are the chief agents causing erosion.
(b) Soil-improvement: The fertility of the soil increases due to the humus which is formed by the decay of forest litter.
(c) Reduction of Atmospheric Pollution: By using up carbon dioxide and giving off oxygen during the process of photosynthesis, forests reduce pollution and purify the environment.
(d) Control of Climate: Transpiration of plants increases the atmospheric humidity which affects rainfall and cools the atmosphere.

(e) Control of Water flow: In the forests, the thick layer of humus acts like a big sponge and soaks rain water preventing run-off, thereby preventing flash-floods. Humus prevents quick evaporation of water, thereby ensuring a perennial supply of water to streams, springs and wells.

REASON FOR DEFICIENCY OF FOREST:

In India the minimum area of forest required to maintain good ecological balance is about 33% of total area. But at present it is only about 12%. So over exploitation of forest material occurs.

Over-exploitation of forests:

Since time immemorial, humans have depended heavily on forests for food, medicine, shelter, wood and fuel. With growing civilization the demands for raw material like timber, pulp, minerals, fuel wood etc. shooted up resulting in large scale logging, mining, road-building and clearing of forests.

Excessive use of fuel wood and charcoal, expansion of urban, agricultural and industrial areas and overgrazing have together led to over-exploitation of our forests leading to their rapid degradation.

Deforestation

Deforestation is the removal of a forest or stand of trees where the land is thereafter converted to a non-forest use. Examples of deforestation include conversion of forestland to farms, ranches, or urban use.

Causes of Deforestation

Main causes responsible for deforestation are as under:

- Felling of trees to meet the ever increasing demand of the cities.
- Grazing by the local cattle, goats, sheep etc. They not only destroy the vegetation but also pull out the roots of plants.
- Meeting out the growing hunger for land. It has hit the ecology of the country badly very soon India is likely to have more of wasteland than productive land.
- The increase in shifting (jhum) cultivation in North east and Orissa has also laid large forest tracts bare.
- Another major cause of deforestation has been the construction of hill roads. Road construction damages the protective vegetation cover both above and below roads.

Consequences of deforestation (or) impacts of deforestation:

1. Economic loss
2. Loss of biodiversity
3. Destructs the habitats of various species
4. Reduction in stream flow
5. Increases the rate of global warming
6. Disruption of weather patterns and global climate
7. Degradation of soil and acceleration of the rate of soil erosion.
8. Induces and accelerates mass movement / landslides.
9. Increases flood frequency, magnitude / severity.
10. Breaks the water cycle
11. Breaks the nutrient cycle

Prevention of deforestation (or) methods of conservation of forests:

1. New plants of more or less of the same variety should be planted to replace the trees cut down for timber
2. Use of wood for fuel should be discouraged.

3. Forest pests can be controlled by spraying pesticides by using aero planes
4. Forest fire must be controlled by modern techniques.
5. Over grazing by cattle must be controlled.
6. Steps should be taken by the government to discourage the migration of people into the islands from main land.
7. Education and awareness programs must be conducted.
8. Strict implementation of law of Forest conservation Act.

Case Study

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

MAJOR ACTIVITIES IN FORESTS:

TIMBER EXTRACTION

Wood used for engineering purposes like building houses, making furniture is called timber. The products derived from timber have been important to many civilizations, and thus it has acquired value within these civilizations. Timber extraction results in deforestation and in the fragmentation of the last remaining forests. It harms valuable species of trees, birds and wild animals. In spite of this, it is sometimes necessary to extract timber, so as to meet the needs of a developing country. During the extraction of timber, cutting, felling and handling should be done selectively, carefully and in a planned manner, in order to save the remaining forests and biodiversity.

Effects of Timber Extraction

The major effects of timber extraction on forest and tribal people include:

1. Poor logging results in a degraded forest.
2. Floods may be intensified by cutting of trees or upstream water sheds.
3. Loss of biodiversity.
4. Climatic changes such as less rain.
5. New logging roads permit shifting cultivators to gain access to logged areas and cut the remaining trees.
6. It results in forest fragmentation which promotes loss of biodiversity because some species of plants and animals require large continuous areas of similar habitat to survive.
7. Exploitation of tribal people by the contractors.
8. Soil erosion especially on slopes occurs extensively.
9. Sedimentation of irrigation systems, floods may be intensified by cutting of trees on upstream.

Case Study-Chipko Movement

The world famous **Chipko Movement**, pioneered by **DasohliGram Swarajya Mandal** in Gopesh war brought about a general awareness about conservation of forests. The first Chipko Movement dates back to 1731, when a village woman named Amrita Bailed the Bishnoi women against the Maharajas men to prevent them from cutting trees. In this attempt to save the trees, she sacrificed her life along with the lives of her husband, three daughters and 363 people. The movement was given this name because the village women embraced or hugged the trees to stop them from being cut. In 1972, in Uttar Pradesh, the Chipko Movement was led by Bachnoi Devi of Advani who protected the hill forests from the contractors axe men.

DAMS:-

Today there are more than 45,000 large dams around the world, which play an important role in communities and economies that harness these water resources for their economic development. Current estimates suggest some 30-40% of irrigated land worldwide relies on dams. Hydropower, another important the use of stored water, currently supplies 19% of the world's total electric power supply and is used in over 150 countries. The world's two most populous countries – China and India –have built around 57% of the world's large dams.

Dams problems

Dams are the massive artificial structures built across the rivers to store water for much beneficial purpose.

Dams are considered a "Temples of modern India". Dams destruct vast area of forest area. India has more than 1600 large dams.

Effects of dams on forest:

- Thousands of hectares of forest will be cleared.
- Killing of wild animals and destruction of aquatic life.
- Spreading of water borne diseases.
- Water logging increases the salinity of the soil.

Ex: Narmada Sagar project it has submerged 3.5 lakhs hectares of forest.

Effects of dam on tribal people

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

Case study- Sardar Sarovar Project:

The World Bank's withdrawal from the Sardar Sarovar Project in India in 1993 was a result of the demands of local people threatened with the loss of their livelihoods and homes in the submergence area. This dam in Gujarat on the Narmada has displaced thousands of tribal folk, whose lives and livelihoods were linked to the river, the forests and their agricultural lands. While they and the fishermen at the estuary have lost their homeland, rich farmers downstream will get water for agriculture. The question is why should the local tribal's be made homeless, displaced and relocated to benefit other people? Why should the less fortunate be made to bear the costs of development for better off farmers? It is a question of social and economic equity as well as the enormous environmental losses, including loss of the biologicaldiversity of the inundated forests in the Narmada valley.

MINING:-

"The process of extracting mineral resources and fossil fuels like coal from the earth is called as mining.**"**

Types of mining

1. Surface mining: Mining of minerals from shallow deposits

2. Underground mining: Mining of minerals from deep deposits

Steps involved in mining

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

The extent of damage by underground mining is more than that of surface mining, which needs enormous amount of land area for its operation and management.

Effects of mining

1. Pollute soil, water and air.
2. Destruction of natural habitat.
3. Continuous removal of minerals leads to the formation of trench where water is logged which contaminates the groundwater.
4. Vibrations cause earthquakes.
5. Produces noise pollution
6. Reduces shape and size of the forest.
7. Increased risk of landslides.
8. Spoils the aesthetic beauty.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.

Water is the most abundant, inexhaustible renewable resource. It covers 70% of the globe in the form of oceans, rivers, lakes, etc. Of this 70%, only 3% is available as freshwater. From this 3%, roughly 2% is frozen in polar icecaps and only a fraction of the remaining 1% is used as drinking water (potable). 90% of the water is utilized for agricultural purposes in India.

USE OF SURFACE AND GROUND WATER

Consumptive use: In such uses, water is completely utilized and cannot be reused. Ex: Domestic, industrial and irrigation

Non-consumptive use: In such uses, water is not completely utilized and is reused Ex: Hydropower plant

Other uses:

- Water is used for domestic purposes like drinking, bathing, cooking, washing. etc.
- Water is used in commercial establishments like hotels, theaters, educational institutions, offices, etc.
- Almost 60-70% of fresh water is used for irrigation
- 20-30% of water is used for industrial operations by refineries, iron & steel industries, paper & pulp industries, etc.
- Water plays a key role in sculpting the earth's surface, moderating climate and diluting pollutants.

Over-utilization of surface & ground water

- The rapid increase in population and industrial growth led to severe demand on water resources. After using all available surface water resources to the maximum, human beings began using groundwater to meet their needs.
- The increased extraction of groundwater far in excess of the natural recharge led to decreased groundwater level. The erratic and inadequate rainfall caused reduction in storage of water in reservoirs. This also led to decrease of

groundwater.

- Building construction activities seal permeable soil zone and reduce the area for percolation of rainwater thereby increasing surface runoff.
- If groundwater withdrawal rate is higher than recharge rate, sediments in aquifers get compacted resulting in sinking of overlaying land surface. This is called land subsidence which leads to structural damage in buildings, fracture in pipes and reverses the flow of canals leading to tidal flooding.
- Over-utilization of groundwater in arid and semi-arid regions for agriculture disturbs equilibrium of reservoir in the region causing problems like lowering of water table and decreased pressure in aquifers coupled with changes in speed and direction of water flow.
- Over utilization of groundwater in coastal areas leads to rapid intrusion of salt water from the sea thereby rendering it unusable for drinking and agriculture.
- Over-utilization of groundwater lads to decrease in water level thereby causing earthquake, landslides and famine.
- Over-utilization of groundwater leads to drying-up of dug wells as well as bore wells.
- Due to excess use of groundwater near agricultural fields, agricultural water that contains nitrogen as a fertilizer percolates rapidly and pollutes the groundwater thereby rendering the water unfit for potable use by infants. (Nitrate concentration exceeding 45 mg/L).

FLOOD:-

It is an over flow of water. It happens when the magnitude of flow of water exceeds the carrying capacity of the channel within its bank.

CAUSES OFFLOOD

- Heavy rainfall, melting of snow and sudden release of water from dams. (Flashfloods)
- Reduction in the carrying capacity of the channel.
- Deforestation, mining and over grazing increase the runoff from rains and the level of flood raises.

EFFECT OFFLOOD

- Water spreads in the surrounding area and submerges them.
- Cultivated land gets affected.
- Extinction of civilization.

FLOODMANAGEMENT

- Floods can be controlled by dams.
- Channel management control flood.
- Flood hazards reduced by forecasting or flood warning.
- Flood may also be reduced by reduction of run off by increasing infiltration through appropriate a forestation in the catchment area.

DROUGHT:-

Drought is nothing but scarcity of water, which occurs due to

- Inadequate rainfall
- Late arrival of rainfall
- Excessive withdrawal of groundwater.

- Lack of water for the needs of agriculture, livestock, industry or human population may be termed as a drought. Drought causes serious damages to plants, animals and human life.

CAUSES OF DROUGHT

- When annual rain fall is below normal and less than evaporation, drought is created.
- High population.
- Intensive cropping pattern
- Ex: Maharashtra - There has been no recovery from drought for the last 30 years due to over exploitation of water by sugarcane crop.

EFFECTS OF DROUGHT

- Drought causes hunger, malnutrition and scarcity of drinking water an also changes the quality of water.
- Drought causes widespread crop failure leading to acute shortage of food and adversely affects human and livestock population.
- Worst situation of drought causes desertification.
- Raw materials of agro based industries are critically affected during drought time, hence industrial and commercial growth decreases.
- Drought increases the degradation of natural resources.
- Drought causes large migration of people and urbanization.

DROUGHT MANAGEMENT

- Indigenous knowledge is essential.
- Rain water harvesting system.
- Construction of reservoirs to improve ground water level.
- Modern irrigation technology (drip irrigation) very useful to conserve water.
- Forestation activities also improve the potential of water in the drought area.
- Crop mixing and dry forming are the suitable methods which minimize the risk of crop failures in dry area.

DAMS:-

Dams made significant contributions to human development and the benefits derived from them have been considerable. Large dams are designed to control floods and to help the drought prone areas, with supply of water. But large dams have proved to cause severe environmental damage. Hence an attempt has been made to construct small dams. Multiple small dams have less impact on the environment.

Benefits: Dams ensure a year round supply of water for domestic use and provide extra Water for agriculture, industries and hydropower generation.

Problems: They alter river flows, change nature's flood control mechanisms such as wetlands and flood plains, and destroy the lives of local people and the habitats of wild plant and animal species, particularly are the case with mega dams. Some of the problems are mentioned below.

- Dam construction and submersion leads to significant loss of farmland and forest and land submergence
- Siltation of reservoirs, water logging and salination in surrounding lands reduces agricultural productivity
- Serious impacts on ecosystems - significant and irreversible loss of species and ecosystems, deforestation and loss of biodiversity, affects aquaculture

- Socio economic problems for example, displacement, rehabilitation and resettlement of tribal people.
- Fragmentation and physical transformation of rivers
- Displacement of people - People living in the catchment area, lose property and livelihood
- Impacts on lives, livelihoods, cultures and spiritual existence of indigenous and tribal people
- Dislodging animal populations
- Disruption of fish movement and navigational activities
- Emission of greenhouse gases due to rotting of vegetation
- Natural disasters – reservoirs induced seismicity, flash floods etc. and biological hazards due to large-scale impounding of water – increase exposure to vector bone diseases, such as malaria, schistosomiasis, and filariasis.

SUSTAINABLE WATERMANAGEMENT

- Building several small reservoirs instead of few megaprojects
- Developing small catchment dams and protecting wetlands
- Water conservation measures in agriculture, such as using drip irrigation, control of growing water intensive cash crops; control of water logging.
- Effective rainwater harvesting in urban environments
- Treating and recycling municipal waste water for agricultural use.
- Soil management, micro-catchment development and a forestation permits recharging of underground aquifer, thus reducing the need for large dams
- Preventing leakages form dams and canals and loss in municipal pipes
- Pricing water at its real value makes people use it more responsibility and efficiently and reduces wastage
- In deforested areas where land has been degraded, appropriate soil management practices, making bunds along the hill-slopes and making nalla plugs can help retain moisture and make it possible to vegetate degraded areas
- Use waste water for activities that does not need fresh water –Recycling
- Adopt mini water harvesting models for domestic usage.
- Protect existing tanks
- Develop systematic water management and adopt strict water auditing
- “Save water Campaigns” for public awareness on water scarcity
- Through rainwater harvesting, community based participatory initiatives and holistic watershed management.
- Responsible water usage can only be achieved by empowering local communities and creating local accountability.
- The government should develop policies that protect water resources, promote sustainable watershed management and invest in technologies that will increase efficiency in irrigation, industrial usage and improve water harvesting techniques.

WATERCONFLICTS

1. Conflict through use: Unequal distribution of water led to interstate and international disputes.

National conflicts:

- Sharing of Cauvery water between Karnataka and Tamil Nadu.
- Sharing of Krishna water between Karnataka and Andhra Pradesh
- Siruvani– Tamil Nadu and, Kerala

International conflicts:

Indus – India and Pakistan &Colorado River – Mexico and USA Mineral

Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Resources: Use and exploitation, environmental effects of extracting and using mineral resources.

USE

Mineral Resources in India such as coal, mineral oil, iron-ore, gypsum, limestone, dolomite, mica, bauxite etc. are used for the following purposes.

Coal: Coal has 1 lakhs 20 thousand bi-products like coke, coke gas, Varnish, Colour and Paint, Cement, Fertilizer, Explosive, Nylon, Terylin, Asphalt, Naphtha, Thermocol, Thermal Electricity, Saccarine, Benzal, Polish, Ink etc.

Mineral Oil: It has more than 80 thousand bi-products: Petrol, kerosene, fuel oil, lubricating oil, diesel, nylon, terylin, color and paints, pesticides, explosive, chemicals, plastics, fertilizer.

Iron-ore: Mainly used in iron and steel, Ship-building, Automobile, Railway, Aircraft, Heavy Machine tools, Gypsum: It is mainly used in chemical industries especially in fertilizer and other chemical products.

Limestone and dolomite: Mainly used in Iron & steel, Paper, House-building, Color and Paints, Chemicals, Fertilizer etc.

Mica: Mainly used in electrical goods, decoration, colour and paints, aeronautical engineering, motor transport, medicinal preparation, ornament etc.

Bauxite: Used in aeronautical engineering, chemicals, color and paints, electrical goods, railway coach, Bus and Motor Coach, Electrical wires, Utensils, Furniture, Doors and windows, Coins and Image-making Industry.

Copper: Mainly used in Electrical goods, making Engineering parts, Colors and Paints, Chemicals, Image making, Coins, Telephone etc.

Manganese: Mainly used in iron and steels, and chemical industry, enamel power, glass and electrical equipment's.

Exploitation of Mineral Resources

Exploitation of mineral refers to the use of mineral resources for economic growth. Exploitation of mineral resources at a mindless speed to meet the growing needs of modern civilization has resulted in many environmental problems. Today, about 80% of the world's energy consumption is sustained by the extraction of fossil fuels, which consists of oil, coal, and gas.

ENVIRONMENTAL EFFECTS OF EXTRACTING AND USING MINERAL RESOURCES:-

(a) Mining is hazardous occupation:

1. This occupation involves several health risk dust produced during mining operation are injurious to health and cause lung diseases.
2. Extraction of some toxic or radioactive minerals leads to life threatening hazards.
3. Dynamite explosion during mining is very risky as fumes produced are extremely poisonous.
4. Underground mining is more hazardous than surface mining as there are more chances if accidents like roof falls, flooding and inadequate ventilation etc.

(b) Rapid depletion of high grade minerals:

Increasing demand for high grade minerals has compelled miners to carry out more extraction of minerals, which require more energy sources and produce large amount of waste materials.

(c) Wastage of upper soil layer and vegetation:

Surface mining results in the complete destruction of upper soil layer and vegetation. After extraction, the wastes are dumped in an area which destroys the total surface and vegetation.

(d) Environmental problems:

Over exploitation of mineral resources resulted in many environmental problems like:

1. Conversion of productive land into mining and industrial areas.
2. Mining and extraction process are one of the sources of air, water and land pollution.
3. Mining involves huge consumption of energy resources like coal, petroleum, natural gas etc. which are in-turn nonrenewable sources of energy.
4. Surface mining directly degrades the fertile soil surface thus effect ecology and climate if that particular area.

CASE STUDIES-MINING AND QUARRYING INUDAIPUR

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

{**Food Resources:** World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers- pesticides problems, water logging, salinity }

- Food is essential for growth and development of living organisms. These essential materials are called nutrients and these nutrients are available from variety of animals and plants. There are thousands of edible plants and animals over the world, out of which only about three dozen types constitute major food of humans**.**
- Food is an essential requirement for survival of life. Main components are carbohydrates, fats, proteins, minerals and vitamins.

TYPES OF FOODSUPPLY

- **Crop plants:** Grains mostly **c**onstitute about 76% of the world's food. Ex: Rice, Wheat and Maize
- **Range lands: P**roduces 17% of world's food from trees and grazing animals.
  Ex: Fruits, milk and meat
- **Ocean:** Fisheries – 7% of world's food

WORLD FOOD PROBLEM :-

1. In the earth's surface, 79% is water out of total area. 21% land (forest, desert, mountain and barren land). Less % cultivated land, at the same time population explosion is high therefore world food problem arises.
2. Environmental degradation like soil erosion, water logging, water pollution, salinity affects agricultural land.
3. Urbanization affects agricultural land. Hence production of rice, wheat, corn and other vegetable is difficult.
4. Poor agricultural practices: Poor environmental agricultural practices such as slash and burn, shifting cultivation, or 'rab' (wood ash) cultivation degrade forests.
5. Degradation of agricultural lands: Globally 5 to 7 million hectares of farmland is degraded each year. Loss of nutrients and overuse of agricultural chemicals are major factors in land degradation.
6. Water scarcity is an important aspect of poor agricultural outputs. Salinization and water logging has affected a large amount of agricultural land worldwide.
7. Our fertile soils are being exploited faster than they can recuperate.
8. Forests, grasslands and wetlands have been converted to agricultural use, which has led to serious ecological questions.
9. Use of genetically modified seed variety, without minding the conducive environment for such experimentation,

will seriously affect the land ecosystem.

10. Our fish resources, both marine and inland, show evidence of exhaustion.
11. There are great disparities in the availability of nutritious food. Some communities such as tribal people still face serious food problems leading to malnutrition especially among women and children.
12. Loss of Genetic Diversity: Modern agricultural practices have resulted in a serious loss of genetic variability of crops. India's distinctive traditional varieties of rice alone are said to have numbered between 30 and 50 thousand. Most of these have been lost to the farmer during the last few decades as multinational seed companies push a few commercial types.

TYPES OFNUTRITION

• Nutritious nutrition: To maintain good health and disease resistance, we need large amount of carbohydrate, proteins, fats and smaller amount of micronutrients such as vitamins and minerals such as Fe, Ca and iodine. Food and agricultural organization (FAO) of United Nations estimated that on an average, the minimum calorie intake on a global state is 2500 calories/day.

• Under nutrition: People who cannot buy enough food to meet their basic energy needs suffer from under nutrition. They receive less than 90% of this minimum dietary calorie. Effect of under nutrition: Suffer from mental retardation and infectious diseases.

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

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

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

Changes Caused by Agriculture and Overgrazing

From centuries, agriculture is providing inputs to large number of industries involved in production, processing and distribution of food. Accordingly, agriculture has significant effect on environment. The effects of agriculture on environment can be classified as local, regional, and global level. The agriculture also makes impact on the usage of land generally as follows:

1. Deforestation
2. Soil Erosion
3. Depletion of nutrients
4. Impact related to high yielding varieties (HYV)
5. Fertilizers related problems include micronutrient imbalance, nitrite pollution and eutrophication.
6. Pesticide related problems include creating resistance in pests and producing new pests, death of non-target organisms, biological magnification.
7. Some other problems include water logging, salinity problems and such others.
8. The carrying capacity of land for cattle depends upon micro climate and soil fertility. If carrying capacity is exceeded than land is overgrazed. Because of overgrazing the agricultural land gets affected as follows.
9. Reduction in growth and diversity of plant species.
10. Reduce plant cover leads to increased soil erosion.
11. Cattle trampling leads to land degradation.

TYPES OF AGRICULTURE

(1) Traditional agriculture **(2) Modern (or) industrialized agriculture**

1. Traditional agriculture

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

2. Modern agriculture

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

Effects of Modern Agriculture

For sustainable production modern techniques are used to enhance productivity of different cropping systems under different agro-eco-zones. Adoption of modern agricultural practices has both positive and negative effects on environment. Effects of modern agriculture are briefly discussed under different heads as under:

- **Soil erosion**

Raindrops bombarding bare soil result in the oldest and still most serious problem of agriculture. The long history of soil erosion and its impact on civilization is one of devastation.

- **Irrigation**

Irrigation ensures sufficient water when needed and also allows farmers to expand their acreage of suitable cropland. In fact, we rely heavily on crops from irrigated lands, with fully one-third of the world's harvest coming from that 17% of cropland that is under irrigation. Unfortunately, current irrigation practices severely damage the cropland and the aquatic systems from which the water is withdrawn.

- **Agriculture and the loss of genetic diversity**

As modern agriculture converts an ever-increasing portion of the earth's land surface to monoculture, the genetic and ecological diversity of the planet erodes.

- **Fertilizer-pesticide problems**

On one hand application of artificial chemical fertilizers increases the productivity at faster rate as compare to organic fertilizers, on the other hand application of fertilizers can be a serious problem of pollution and can create number of problems.

- Excessive level of nitrates in ground water has created problems in developed countries.
- Accumulated phosphorous as a consequence of use of phosphoric fertilizer are posing serious threat as residues in domestic water supply and for ecology of river and other water bodies.
- Increased level of phosphates in different water results in eutrophication.
- Effect of chemical fertilizer is long term, therefore leads to net loss of soil organic matter.
- To control insects, pests, diseases and weeds which are responsible for reduction in productivity different chemicals are used as insecticides, pesticides and herbicides. Applications of these synthetic chemicals have great economic values and at the same time cause number of serious problems such as:
- Affects human health which includes acute poisoning and illness caused by higher doses and accidental exposes
- As long term effect, cause cancer, birth defects, Parkinson's disease and other regenerative diseases.
- Long term application of pesticides can affect soil fertility.
- Danger of killing beneficial predators.
- Pesticides resistance and pest resurgence

Water Logging

High water table or surface flooding can cause water logging problems .Water logging may lead to poor crop productivity due to anaerobic condition created in the soil. In India, deltas of Ganga, Andaman and Nicobar Islands and some areas of Kerala are prone to frequent water logging.

CAUSES OF WATER LOGGING

- Excessive water supply to the croplands
- Heavy rain
- Poor drainage

MEASURES TO PREVENT WATER LOGGING

- Avoid and prevent excessive irrigation
- Sub-surface drainage technology
- Bio-drainage by trees like Eucalyptus

Salinity

- Due to adoption of intensive agriculture practices and increased concentration of soluble salts leads to salinity. Due to poor drainage, dissolved salts accumulate on soil surface and affects soil fertility. Excess concentration of these salts may form a crust on the surface which may injurious to the plants. The water absorption process is affected and uptake of nutrient is disturbed. According to an estimate, in India, 7 million hectare of land is saline and area is showing in increasing trends due to adoption of intensive agriculture practices.

Case Studies

- Food Centre at Center for Science and Environment (CSE) India reported Pepsi and Coca-Cola companies sold soft drinks with pesticide content 30-40 times higher than EU guidelines permit. At the reported concentrations the pesticides damage the nervous system
- Recent reports from cotton growing belt of Punjab which covers Abohar, Fazalka and part of Bathinda indicates that over use of pesticides for control of insect pest in cotton to enhance productivity has not only affected soil health, but also caused cancer in human being.
- In Delhi, accumulation of pesticides and DDT in the body of mothers caused premature deliveries or low birth weight infants.
- Canal irrigation in Haryana resulted in rising water table followed by water logging and salinity causing low crop productivity thereby huge economic losses.

[Energy Resources: Growing energy need, renewable and non-renewable energy sources, use of alternate energy sources, case studies]

ENERGY DISTRIBUTION IN THE WORLD

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

TYPES OF ENERGY RESOURCES:

1. Renewable energy resource (or) Non-conventional energy resources.

2. Nonrenewable energy resources (or) Conventional energy resources.

1. RENEWABLE ENERGY SOURCES: Energy which can be regenerated or these resources can be generated continuously and are inexhaustible.

Ex: Wood, Solar energy, Wind energy, Hydro power, tidal energy, Geo-thermal energy, etc.

Merits of renewable energy resources

- Unlimited supply
- Provides energy security.
- Fits into sustainable development concept.
- Reliable and the devices are modular in size.
- Decentralized energy production.

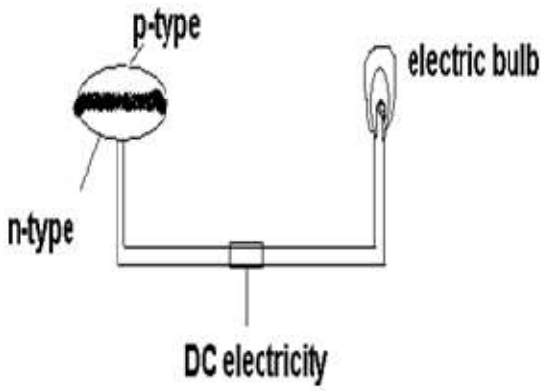
Types of renewable energy resources

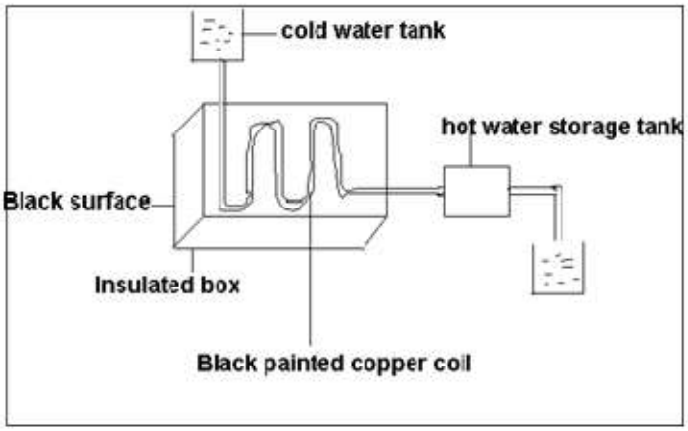
Solar energy: Nuclear fusion reaction of sun produces enormous amount of energy. Several techniques are available for collecting, storing and using solar energy.

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

- Solar cell consists of p- type semiconductor (Si doped with B) and n-type semiconductor (Si doped with P). P-type forms top layer and n-type forms bottom layer.
- Solar rays fall on the top layer, the electrons from valence band promoted to the conduction band which crosses the p-n junction into n-type semiconductor. Potential difference between the two layers is created which causes flow of electrons.

  Uses: It is used in calculators, electronic watches, street light, water pump sets.





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

B. Solar water heater: It consists of insulated box painted with black paint with glass lid. Inside the box black painted copper coil is present. Cold water is allowed to flow, it is heated up and flows out into a storage tank from which water is supplied through pipes.

Wind energy: Moving air is called wind. The energy recovered from the force of the wind is called wind energy its speed is high.

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

b. Wind farms: When a large number of mills are installed and joined together in a definite pattern it forms wind farm. It produces large amount of electricity.

Condition: Minimum speed for wind generator is 15 Km/hr.

Advantages:

- It does not cause air pollution
- Very cheap

Ocean energy:

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

Ocean thermal energy:

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

Condition: Temperature difference should be 200C.

Process: Ammonia is converted into vapors on the surface of warm water; it increases the vapor pressures which rotate the turbine and generates electricity. Deeper level cold water is pumped to cool and condense the vapor in to liquid.

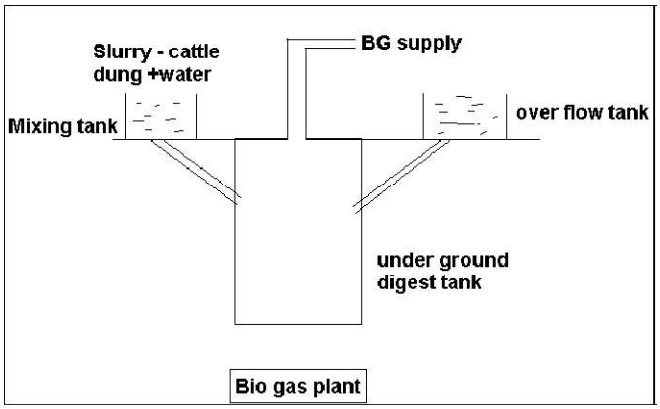
Geo thermal energy:

Temperature of the earth increase sat a of 20 –750C per/km when we move down the earth. The energy utilized from the high temperature present inside the earth is called geo thermal energy.

- **Natural geysers:** Hot water or steam comes out of the ground through cracks naturally is called natural geysers.
- **Artificial Geysers:** Artificially a drill hole up to the hot region and by sending a pipe into it. The hot water or steam is used to rotate the turbine and generate electricity.

Bio Mass energy:

- **Bio mass:** Organic matter produced by plants or animals used as source of energy
- **Bio gas:** Mixture of methane, carbon dioxide and hydrogen sulphide. Methane is the major constituent. It is obtained by anaerobic fermentation of animal dung (or) plant wastes in the presence of water.
- **Bio fuels:** Fuels obtained by the fermentation of biomass. Ex: Ethanol, methanol
- **Ethanol:** Produced from sugar cane. Calorific value is less.
- **Methanol:** Obtained from ethanol Calorific value too less.
- **Gasohol:** Mixture of ethanol and gasoline India trial is going on to use gasohol in cars and buses.
- **Hydrogen fuel:** Hydrogen produced by pyrolysis, photolysis and electrolysis of water. It has high calorific value. Nonpolluting one because the combustion product is water.



Disadvantages:

- Hydrogen is highly inflammable and explosive.
- Safe handling is required.
- Difficult to store and transport.

2. NON RENEWABLE ENERGYSOURCES:

Energy which cannot be regenerated is called as non-renewable.

Coal: It is a solid fossil fuel.

Disadvantages:

- When coal is burnt large amount of CO_2 is released which causes global warming.
- S, N produces toxic gases during burning.

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

Liquefied petroleum gas (LPG): Petroleum gases obtained during FD and cracking can be easily converted into liquid under high pressure as LPG. It is colorless and odorless gas, but during cylindering mercaptans are added to detect leakage.

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

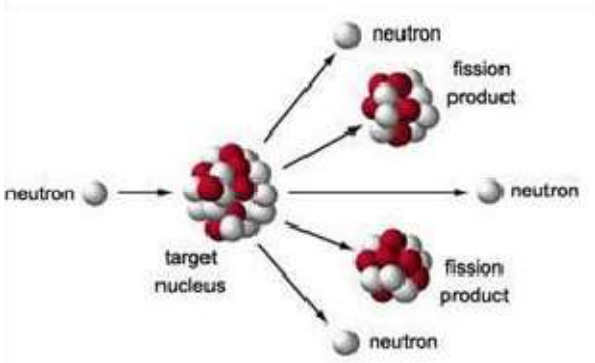
Nuclear energy: Dr.H.Bhabhais a father of nuclear power development in India. 10 nuclear reactors are present in India. It produces 2% of India's electricity. Nuclear energy can be produced by two types of reactions. Nuclear fission and nuclear fusion.

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

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

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

Ex: Isotopes of hydrogen combine to form helium molecule.



Tidal Power

The surface of earth is 71.11% covered by water bodies especially oceans. The tides in water rise and fall due to the gravity of sun and moon. Since we know about how the position of moon changes we can predict the rise and fall of tides. This rise and fall of tides can be utilized by setting up small dams and passing water through the turbines to generate power.

Advantages of tidal energy

- The source of power generation is free and renewable.
- The power generated is clean and does not cause any pollution.

CASE STUDY

- **Wind energy in India:** India generating 1200 MW electricity using the wind energy. Largest wind farm situated near Kanya kumari in Tamilnadu. It produces 380 MW electricity.
- **Hydrogen fuel car:** General motor company of china discovered a experimental car (fuelH2) can produce no emission only water droplets and vapors come out of the exhaust pipe. This car will be commercially available by2010.
- **Land Resources:** Land as a resource, land degradation, man induces landslides, soil erosion, and desertification.
- Land is a very valuable resource. It provides food, fiber, wood, medicine and other biological materials needed for food. Soil is a mixture of inorganic materials and (rocks and minerals) and organic materials (dead materials and plants).
- Top soil is classified as a renewable resource as it is continuously regenerated by natural processes at a very slow rate. However, if the rate of erosion is faster than the rate of renewal, the soil becomes a non-renewable resource.

Uses of land resources

- Land provides food, wood, minerals, etc.
- Land nurtures plants and animals that provide us food and shelter
- Land may be used as watershed or reservoir.
- Land acts as a dustbin for the wastes generated by modern society.
- Land is used for constructing buildings and industries.
- Land degradation- Landslides, Soil erosion and Desertification

LAND DEGRADATION

Land degradation is the process of deterioration of soil or loss of fertility of soil.

EFFECTS OF LAND DEGRADATION

- Soil texture and structure are deteriorated
- Loss of soil fertility due to loss of valuable nutrients
- Increase in water logging, salinity, alkalinity and acidity problems
- Loss at a social, economic and biodiversity level

CAUSES OF LAND DEGRADATION:-

- **Population:** With the increase in population, more land is needed for producing food, fibre and fuel wood leading to increasing pressure on the limited land resources. Therefore the land gets degraded due to over exploitation
- **Urbanization:** Increased urbanization due to population growth reduces the agricultural land. To compensate for loss of agricultural land, new lands comprising of natural ecosystems such as forests are cleared. Therefore, urbanization leads to deforestation which in-turn affects millions of plant and animal species.
- **Fertilizers and Pesticides:** Increased application of fertilizers and pesticides are needed to increase farm output in new lands thereby leading to pollution of land, water and soil degradation.
- **Damage to top soil:** Increase in food production generally leads to damage of top soil through nutrient depletion.
- Water-logging, soil erosion, salination and contamination of the soil with industrial waste cause land degradation.

LANDSLIDES

- Landslides are the downward movement of a slope composed of earth materials such as rock, soil or artificial fills. Landslides are also called rock-slide, debris-slide, slump, earth-flow or soil-creep.
- During construction of roads and mining activities huge portions of mountainous fragile areas are cut down and thrown into adjacent areas and streams. These land masses weaken the already fragile mountain slopes leading to man-induced landslides.

EFFECTS OF LANDSLIDES:

- Landslides increase the turbidity of nearby streams, thereby reducing their productivity
- Destruction of communicative links
- Loss of habitat and biodiversity
- Loss of infrastructure and economic loss

CAUSES OF LANDSLIDES

1. Removal of vegetation - Deforestation in slopes creates soil erosion leading to landslides.
2. Underground mining activities cause subsidence of the ground
3. Movement of heavy vehicles in areas with unstable slopes causes landslides.
4. Addition of weight by construction on slopes causes landslides.
5. Over exploitation of groundwater also leads to landslides.

SOIL EROSION

Soil erosion is the process of removal of superficial layer of soil. Soil erosion removes soil components and litter.

Harmful effects of soil erosion

1. Soil fertility is lost
2. Loss of soil ability to hold water and sediment
3. Sediment runoff can pollute water courses and kill aquatic life

Types of soil erosion

1. Normal erosion: This is caused by the gradual removal of topsoil by natural processes. The rate of erosion is slow.

2. Accelerated erosion: This is caused by man-made activities. In this case, the rate of erosion is much faster than the rate of formation of soil.

CAUSES OF SOIL EROSION

1. **Water:** Water affects soil erosion in the form of rain, run-off, rapid flow or wave action
2. **Wind:** Wind is an important climate agent that carries away the fine particles of soil thereby contributing to soil erosion.
3. **Biotic agents:** Overgrazing, mining and deforestation are the major biotic agents causing soil erosion. These processes disturb the top soil thereby exposing the soil to various physical forces inducing erosion
4. Landslides cause soil erosion
5. Construction of dams, buildings and roads removes the protective vegetal cover leading to soil erosion

SOIL CONSERVATION PRACTICES

1. **Conservational till farming or no-till farming:** Traditionally, land is ploughed to make a planting surface. This disturbs the soil and makes it susceptible to erosion. The no-till farming method makes minimum disturbance to the top soil by making slits in the unplugged soil. Seeds, fertilizers and water are injected in these slits.
2. **Contour farming:** In this method, crops are planted in rows along contours of gently sloped land. Each row acts as a small dam to hold soil thereby slowing water runoff.
3. **Terracing:** In this method, steep slopes are converted into a series of broad terraces that run across the contour. This retains water for crops and reduces soil erosion by controlling runoff.

4. Alley cropping or Agro forestry: This method involves planting crops in strips or alleys between rows of trees or shrubs that provide fruits and fuel wood. Hence, when the crop is harvested, the soil will not be eroded as the trees and shrubs remain on ground holding the soil particles.

5. Wind breaks or shelter belts: In this technique, trees are planted in long rows along the boundary of cultivated land which block the wind and reduce soil erosion. Wind breaks help in retaining soil moisture, supply wood for fuel and provide habitat for birds.

DESERTIFICATION

1. Desertification is a progressive destruction or degradation of arid or semi-arid lands to desert.
2. Desertification leads to conversion of range-lands or irrigated croplands to desert like conditions in which agricultural productivity falls.
3. Desertification is classified by de-vegetation, depletion of groundwater, salination and soil erosion.

EFFECTS OF DESERTIFICATION

Almost 80% of the productive land in the arid and semi-arid regions is converted into desert.
Approximately 600 million people are threatened by desertification.

CAUSES OF DESERTIFICATION

1. **Desertification:** Lack of vegetation prevents the rainfall from soaking into the ground resulting in poor recharge of groundwater. Eventually this results in soil erosion and loss of fertility.
2. **Over-grazing:** Increase in cattle population coupled with repeated grazing at the same location results in depletion of vegetation in the area. Eventually, the land becomes loose and prone to soil erosion and formation of a desert.
3. **Water management:** Over-utilization of groundwater, particularly in the coastal regions, results in saline water intrusion into aquifers thereby making water unfit for irrigation.
4. **Mining and quarrying:** These activities are responsible for loss of vegetative cover and denudation of extensive land area leading to desertification.
5. **Climate change:** Climate change manifests in the form of failure of monsoons, irregular monsoons and frequent droughts thereby leading to desertification
6. **Pollution:** Excessive use of fertilizers and pesticides to increase yield and disposal of toxic wastes into land leads to desertification.

b) Role of individual in conservation of natural resources.

Role of an individual in conservation of natural resources Conservation of energy:

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

Conservation of water:

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

Conservation of soil:

1. Grow different type plants i.e trees, herbs and shrubs.
2. In the irrigation process, using strong flow of water should be avoided.
3. Soil erosion can be prevented by sprinkling irrigation.

Conservation of food resources:

1. Cook required amount of food.
2. Don't waste the food; give it to someone before spoiling.
3. Don't store large amount of food grains and protect them from damaging insects.

Conservation of forest:

1. Use non timber product.
2. Plant more trees.
3. Grassing must be controlled
4. Minimize the use of paper and fuel.
5. Avoid the construction of dam, road in the forest areas.

c) Equitable use of resources for sustainable lifestyles.

Equitable Use of Resources for Sustainable Life Style

1. Urbanization has changed the life style of middle class population in developing countries creating more stress on the use of natural resources.
2. It has been estimated that More Developed Countries (MDC) of the world constitute only 22% of world's population but they use 88% of natural resources. These countries use 73% of energy resources and command 85% of income and in turn they contribute very big proportion of pollution.
3. On the other hand less developed countries (LDCs) have moderate industrial growth and constitute 78% of world's population and use only 12% of natural resources, 27% of energy and have only 15% of global income.
4. In this age of development the rich have gone richer and the poor is becoming poorer. This has lead to unsustainable growth. There is an increasing global concern about the management of natural resources.
5. The solution to this problem is to have more equitable distribution of resources and income. Two major causes of un sustainability are over population in poor countries and over consumption of resources by rich countries. A global consensus has to be reached for balanced distribution of natural resources.
6. For equitable use of natural resources more developed countries/rich people have to lower down their level of consumption to bare minimum so that these resources can be shared by poor people to satisfy their needs.

Expected Questions

1. Short Answer Type Question:

a) What are natural sources? Classify them.
b) What are renewable resources?
c) Define non-renewable resources.
d) What are the problems associated with the exploitation of natural resources?
e) What is the function of forest resources?
f) What is the various location of water?
g) What are mineral resources? How these are exploited?
h) What are the food resources? Discuss the food problems.
i) Give two examples of renewable resources.
j) Mention the causes of deforestation.
k) How forest resources are exploited?
l) What are the primary natural resources?
m) What is the role of Dam in forest?

2. Long Answer type Question:

a. Describe various kinds of natural resources. Distinguish between renewable and non-renewable natural resources, and conventional and non-conventional natural resources.
b. What is meant by equitable use of resources for sustainable use? How can be natural resources be prevented from being deleted? What are the measures to conserve non-renewable natural resources?
c. Discuss the role of individual in conservation of natural resources.
d. Discuss how the land resources are degraded.
e. Describe the use and over-utilization of surface and ground water.
f. What are the food problems? How these are solved?
g. Discuss the use and over exploitation of forest resources.
h. Describe the use of alternative energy sources
i. Write short notes on
   i. Dam's benefits and problems.
   ii. Soil erosion and desertification.
j. Discuss the environmental effects of extracting and using mineral resources with case studies.

ECOSYSTEMS

UNIT - 3

ECOLOGY:

- The term was first coined by Hons Reiter and Haekelin1869.
- The term ecology (Okekologie) is originated from two Greek words Oikos (eco) – means "house" (or) place of living and "ology" means "the science of (or) the study of. Hence, ecology is the branch of science that deals with the study of the pattern of relations between the organism and their environment.

(OR)

- Ecology is the study of interactions among organisms (or) group of organisms with their environment.

(OR)

- Ecology is the study of ecosystems.
- Concept of an eco-system.

ECO SYSTEM:

- In 1935, the British ecologist A.G.Tansleycoined the term "ecosystem".
- The term **"eco system"** is made up of two Greek words. "Eco" means ecological sphere (or) house (or) place of living (or) surroundings (or) Environment, w here living organism does exist while **"system"** means "group of organisms joined in regular and interdependent manner. Hence,
- A group of organisms interacting among them and with environment is known as ecosystem.

(OR)

- A system of interaction of organisms with their surroundings (i.e., environment) is called as "ecosystem".

Examples: Pond, lake, ocean, forest and desert…. etc. are some of the examples of the ecosystems.

- Structure and function of an eco-system.

CHARACTERISTICS OF ECO SYSTEM

- Eco system is the basic functional unit of ecology.
- It contains both biotic and a biotic components.
- The function of ecosystem is related to the cycling of matter (materials) and flow of energy.
- The amount of energy needed to maintain an ecosystem depends on its structure.
- Ecosystem passes from a less complex state to more complex state, which is called as **"Ecological succession".**

CLASSIFICATION OF ECOSYSTEM:

The ecosystem can be generally classified into two types:

1. Natural Ecosystem 2. Artificial Ecosystem

1. NATURALECOSYSTEM:

- A natural ecosystem is developed and governed by nature.
- These are capable of operating and maintaining themselves without any major interference by man.

The following are the two types of natural ecosystem based on their habitat.

- Terrestrial Ecosystem.
- Aquatic Ecosystem.

1) Terrestrial Ecosystem:

- This ecosystem is related to land.

Examples: Grassland ecosystem, Forest ecosystem, and Desert ecosystem etc.

2) Aquatic Ecosystem:

- This ecosystem is related to water, it is further sub divided into two types based on salt content.

i. Fresh Water Ecosystem:

- Running Water Ecosystems

Examples: Rivers, streams (small narrow rivers)

- Standing Water Ecosystems Examples: Pond, Lake Well etc.

ii. Marine Ecosystem:

Examples: seas and sea shores <land along the edges of sea>

2. MAN MADE (OR) ARTIFICIAL ECOSYSTEM:

- An artificial ecosystem is created and maintained by man for his different needs.

Examples: Reservoirs, Artificial lakes and gardens, etc.

STRUCTURE (OR) COMPONENTS OF ANECOSYSTEM:

- The term structure refers to various components. So, the structure of an ecosystem explains the relationship between the Abiotic (non-living) and the biotic (living) components.
- Each and every ecosystem has two major components are:
  i. Biotic (living) components.
  ii. Abiotic (Non-living) components.

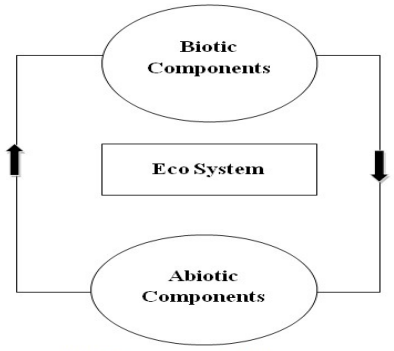


Fig: Components Of Ecosystem

1. Biotic Components: The living component of an ecosystem is called **"Biotic component".**

Examples: Plants (Producers) , Animals (Consumers) and Micro Organisms (Decomposers)

- The biotic components of an ecosystem are classified into three types based on how they get their food.

A. Producers (Autotrophs) :Plants
B. Consumers (Heterotrophs) : Animals
C. Decomposers (Saprotrophs): Micro Organisms.

A. Producers (or) Autotrophs (Auto=self, troph=feeder)

- Self-food producing organisms are known as Autotrophs. Examples: All green plants and trees.
- Producers synthesize their food themselves through photosynthesis. Hence they are also called **"Photo Autotrophs".** (photo =light)

B. Consumers (or) Heterotrophs (Hetero = other, troph=feeder:

- Consumers are organisms, which cannot prepare their own food and depend directly (or) indirectly on the

producers.

Examples: Plant Eating Species: Insects, rabbit, goat, deer, cow etc.

Animals Eating Species: Fish, lions, tigers etc.

- Depending upon the food habits the consumers are divided into four types.

A. Herbivores (or) Primary Consumers (Plant Eaters)

B. Carnivores (or) Secondary Consumers (Meat Eaters)

C. Omnivores (or) Tertiary Consumers (With plant & meat eaters)

D. Detritivores (dead organism eaters)

A. Herbivores: (Herbi= the green plant &Vorare= to devour)

- Animals that eat only plants are called Herbivores.
- They directly depend on the plants for their food. So they are called Plant eaters.

Examples: Insects, goat, deer, cow, horse etc.

B. Carnivores: (Carne = flesh meat &Vorare= todevour)

- Animals that eat other animals are called carnivores.
- They directly depend on the herbivores for their food.

Examples: Frog, cat, snake &foxes etc.

C. Omnivores: (Omni = whole comes from "ohm" & Vorare = to devour)

- Animals that eat both plants and animals are called omnivores.
- They depend on both herbivores and carnivores for their food.

Examples: humans, tigers, lions, rats and fox etc.

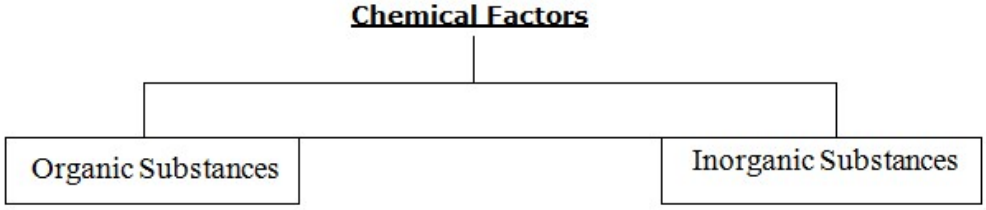
D. Detritivores: (Detritifeeder)

- Animals that eat dead organisms and waste of living are called detritivores.

Examples: beetles, termites, ants, crabs, earthworm etc.

C. Decomposers (or) Saptrotrophs: (Saptro = Rotten, trophos=feeder)

- Decomposers attack the dead bodies of producers and consumers and decompose them into simple compounds. During the decomposition inorganic nutrients are released.
- The organisms which break down the complex compounds into simple products are called decomposers (or) reducers.
- The non-living component of an ecosystem is called "A biotic component"
- These non-living components enter the body of living organism, take part in metabolic activities and then return to the environment. The A biotic component of the ecosystems divided into three portions.
- Climate factors: Solar radiation, temperature, wind, water current, rain fall etc.
- Physical factors: light, fire, soil, air etc.
- Chemical factors: Organic and Inorganic substances.



FUNCTION OF AN ECOSYSTEM:

- The function of an ecosystem is related to the cycling of materials (matter) and flow of energy.

Types of functions:

- Functions of an ecosystem are of three types:

1. Primary Function: The producers (plants) can make their food themselves through photosynthesis. This process is called primary function of ecosystem.

Examples: All green plants and trees.

2. Secondary Function: The consumers (animals and humans) cannot make their own food. They are always depending upon the producers for their energy. This is called secondary function of ecosystem.

3. **Tertiary Function:** Decomposers attack the dead bodies of consumers and producers and decompose the min to simpler compounds. During the decomposition inorganic nutrients are released.

Examples: Micro organisms like bacteria and fungi, etc.

Food chains, food webs and ecological pyramids.

The functioning of an ecosystem may be understood by studying the following terms:

A. Food chains
B. Food webs
C. Food pyramids (or) Energy pyramids
D. Energy and material flow.

A. Food Chain:

- Anything which we eat to live is called food.
- Food contains energy.
- Food can be transferred from one organism to the other.
- The process of transfer of food (energy) from one organism to a series of organisms is called as **"Food Chain".**
- A food chain always starts with a plant life and end with animal life. Thus a food chain is a picture (or) model that shows the flow of energy from Autotrophs (producers) to series of organisms in an environment, as shown in the following figure.

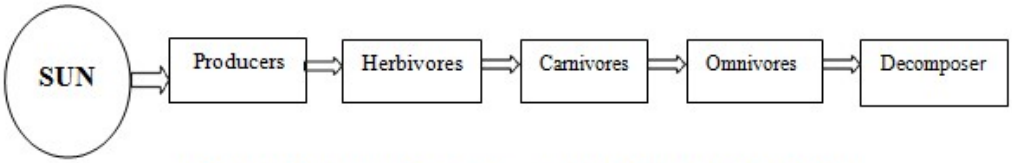


Figure: Schematic representation of food chain.

- In fact all the food chains start with the sun. The sun provides energy for plants.
- The producers (plants) can make their food themselves with the help of the sunlight, chlorophyll, water and air. The consumers, including animals and humans, cannot make their own food. They are always depending upon the producers for their energy.
- Decomposers are the micro-organisms that break down the dead animals and plants and release nutrients that become part of the soil, which are re-used by new plants, back to the starting point of the food chain.

Types of food chain:

Three basic types of food **chains** are found in a typical eco system. They are:

1. Grazing food chains. 2. Detritus food chains. 3. Parasitic food chains.

1. Grazing food chains:

- Grazing food chain starts with green plants (producers) and goes to decomposer food chain (or) detritus food chain through herbivores and carnivores.
- It has two types:

a. Terrestrial food chain and b. Aquatic food chain

Terrestrial food chain: Food chain on land is called terrestrial food chain.

Example: Grassland food chain, Forest land food chain & Desert land food chain.

Grass land food chain

Grasses → Grasshoppers → Frog → Snake → Eagles

Forest food chain

Green plants → Deer → Tiger (or) lion

Aquatic food chain: This food chain is slightly different from terrestrial food chain. It is seen in aquatic (water) eco system. Food chain in water is called "Aquatic food chain".

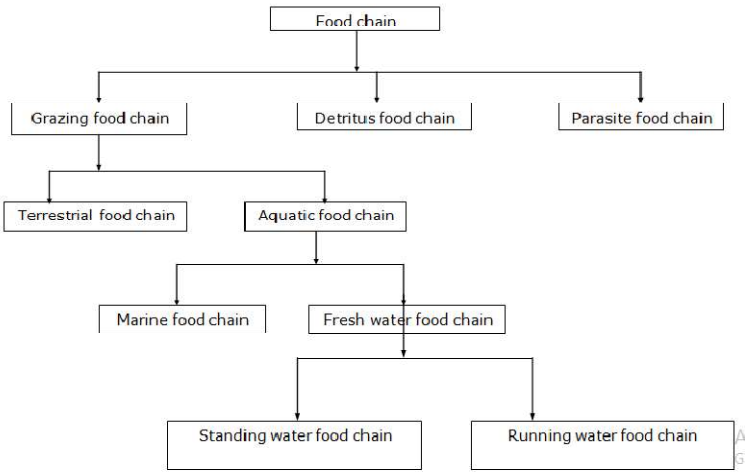
Example: Marine food chain, Ocean, Fresh water food chain, Pond, lake, streams etc.

Food chain in a pond

Phytoplankton → Zoo Plankton → Small fish → Large fish → Man

Marine Food chain:

Sea Weeds → Small fish → Large fish → Sharks and other animals



Detritus' food chain: Detritus food chain starts with dead organic matter (plants and animals) and goes to decomposer through consumers. Detritus food chains, independent of solar energy, but they depend on influx of dead organic matter.

Example: Dead Plants →Soil mitts Algae→ Crabs Small fish→ large fish

Parasitic food chain: Parasitic food chain operates in many ecosystems. In this food chain either consumer (or) producer is parasitized and the food passes to smaller organisms. A parasitic food chain involves host parasite hyper parasites' links.

Example: Trees→ Fruit eating birds→ Lice &Bugs→ Bacteria→ Fungi

Food Web:

- Web means "network" such as spider's web, World Wide Web (WWW) etc.
- So, food web is a network of food chains.
- In a food web many food chains are inter connected, where different types of organisms are connected at different tropic levels, so that there are a number of options of eating and being eaten at each tropic level. Thus, there is a inter connecting of various food chains are called food webs and as shown in following figure.

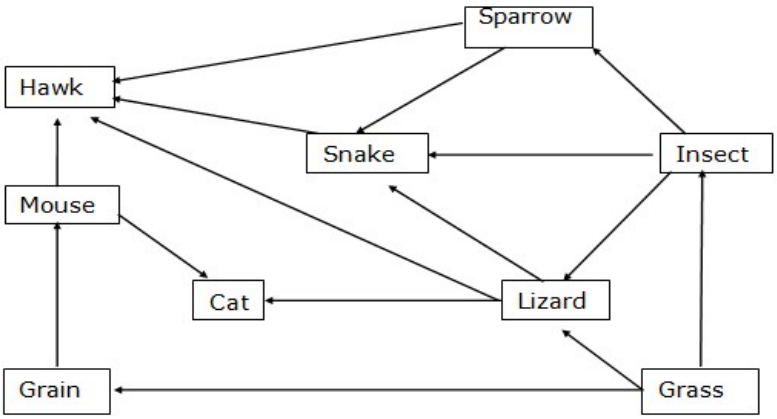


Fig. Food Web

This food web shows many linear food chains <as shown in figure>. These linear food chains are inter connected with other food chains operating in the eco system to forma food web. The grazing food chains are as follows:

- Grains → Mouse → Cat
- Grains → Mouse → Hawk
- Grains → Mouse → Snake → Hawk
- Grains → Insect → Sparrow → Hawk
- Grass → Insect → Lizard → Snake → Hawk
- Grass → Insect → Sparrow → Snake → Hawk

The above food web is a simple one. Much more complex food webs do exist in nature.

Ecological Pyramids:

- The concept of ecological pyramids was first developed by British ecologist Charles Elton in1927.
- Ecological pyramids are the diagrammatic representation of tropic structures in which the tropic levels (i.e., tiers) are depicted in successive stages.
- An ecological pyramid is shown in the following figure.
- In ecological pyramids, tropic levels are shown in the following manner:
  i. The producers represent first tropic level in the ecological pyramid.
  ii. The herbivores (or) primary consumers represent second tropic level in the ecological pyramid.

iii. The carnivores (or) secondary consumers represent third tropic level in the Ecological pyramid.
iv. The omnivores (or) tertiary consumers represent fourth tropic level in the ecological pyramid.

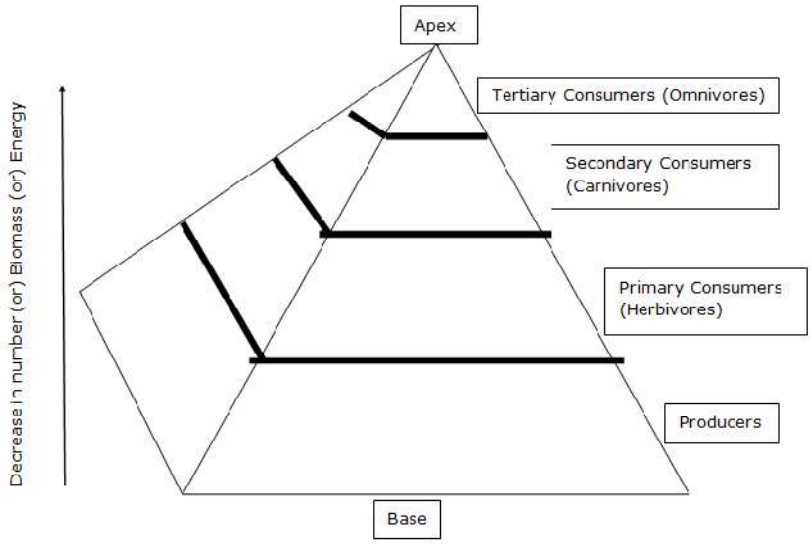


Figure: Formation of an Ecological Pyramid

• On the basis of the number of organisms, the biomass of organisms and energy flow in organist population. Three types of ecological pyramids are:

1. Pyramid of numbers.
2. Pyramid of biomass
3. Pyramid of energy.

Pyramid of numbers:

- It shows the number of individual organisms present in each tropic level.
- It is expressed in numbers per unit area.
- Depending upon the type of ecosystem, we have three types of pyramid of numbers.
  a) Upright pyramid of numbers.
  b) Partly upright pyramid of numbers.
  c) Inverted pyramid of numbers.

Upright Pyramid of numbers:

- The number of individual organisms gradually decreases from lower tropic level to higher tropic level is called ***"upright pyramid of numbers".***
  Example: A grassland ecosystem and a pond ecosystem show an upright pyramid of numbers.
- The producers in the grass lands are grasses, which are small in size and large in numbers. So, producers occupy lower tropic level (1st tropic level).
- The primary consumers (herbivores) are rats, which occupy the II tropic level. Since the numbers of rats are lower when compared to the grasses, the size of which is lower.
- The secondary consumers (carnivores) are snakes, which occupy the III tropic level. Since the numbers of snakes are lower when compared to the rats, the size of which is lower.

- The tertiary consumers (omnivores) are eagles, which occupy the IV tropic level. The number and size of the last tropic level is lowest <as shown in figure>.
- Similarly, in the case of pond ecosystem, producers, herbivores and carnivores are decreases from lower tropic level to the higher tropic level. Thus, these pyramids are upright.
- Therefore, the numbers of individual organisms permit area, decreases from lower tropic level to higher tropic level as shown in figure.

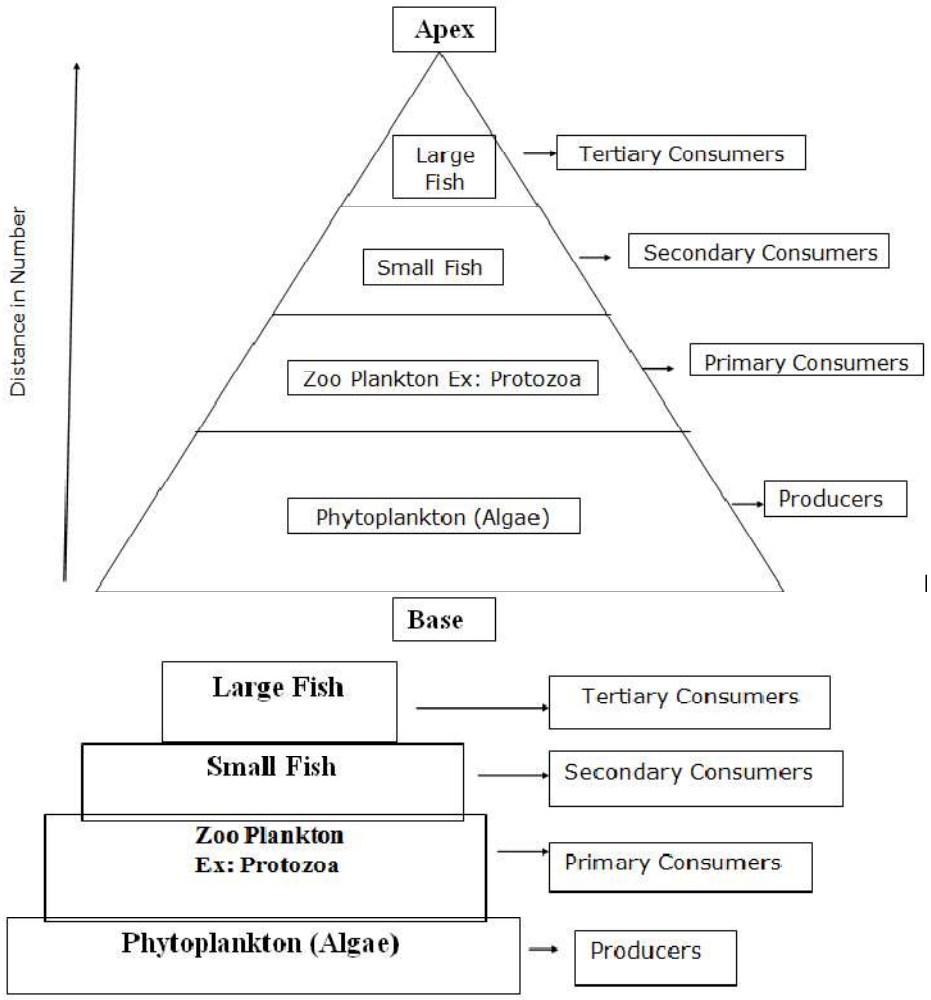


Figure: Pyramid of numbers in an aquatic (pond) ecosystem

Partially Upright Pyramid of Numbers:

- A forest eco system is an example of partially upright pyramid.
- In a forest eco system, big trees are the producers, which are less number. So, these producers occupy the lower tropic level which is narrow base.
- The primary consumers (herbivores) are birds, insects, which occupy the II tropic level. Since the number of birds, insects and other species are higher when compared to the trees, the size of which is broader.
- The secondary consumers (Carnivores) are fox, snakes, lizards, which occupy the third tropic level. Since

the number of fox, snakes are lower when compared to the birds, insects the size of which is lower.

- The tertiary consumers (omnivores) are lion, tiger, which occupy the IV tropic level. Since the number of lion, tiger are lower when compared to the fox and snakes the size of which is very (or) narrow lower. So the pyramid is narrow on both sides and broader in the middle and hence it is called partially upright of number as shown in figure.

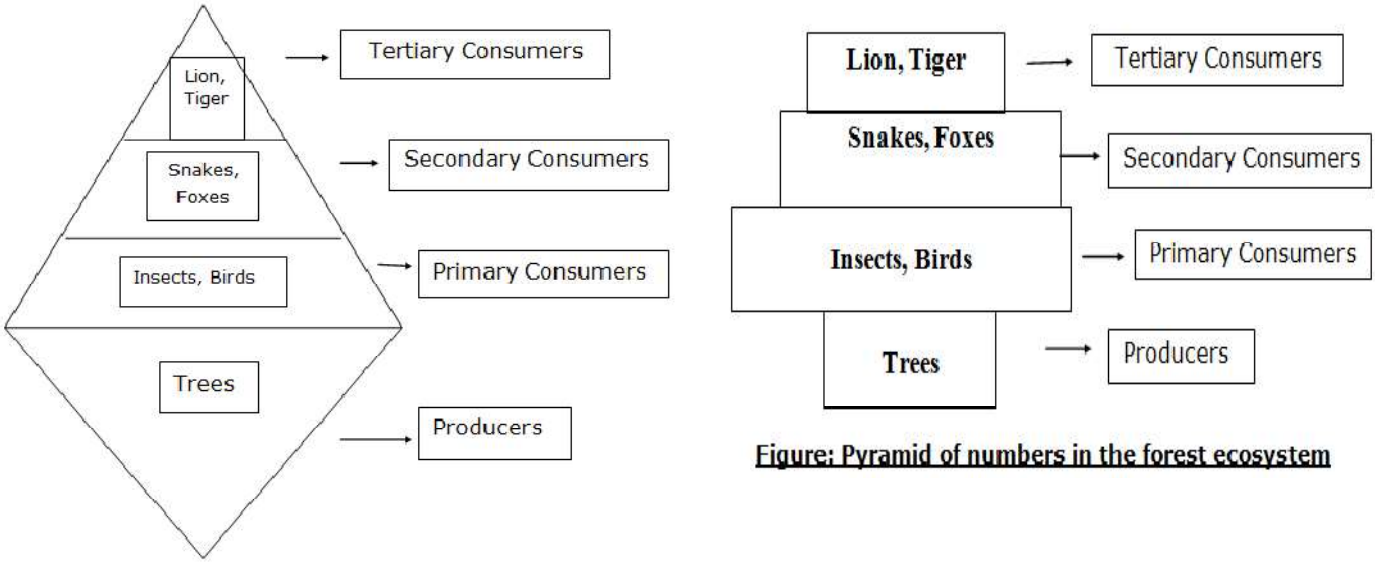
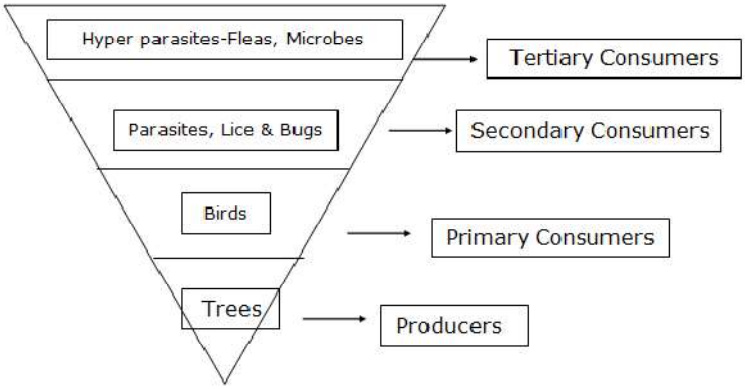


Figure: Pyramid of numbers in the forest ecosystem

Inverted Pyramid of Numbers:

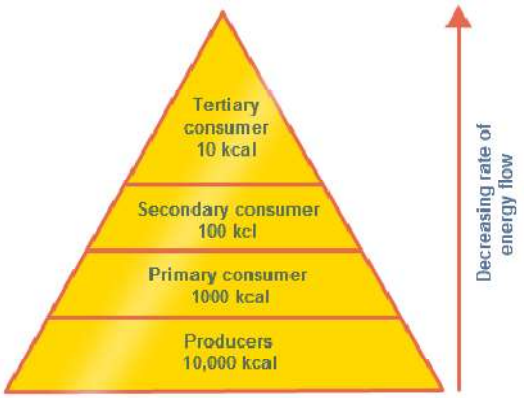
The number of individual organisms gradually increases from lower tropic level to higher tropic level, is known as "**inverted pyramid of numbers".**

Example: Parasitic food chain shows as inverted pyramid of number as shown in the following figure.



The pyramid of energy or the energy pyramid describes the overall nature of the ecosystem. During the flow of energy from organism to other, there is considerable loss of energy in the form of heat. The primary producers

like the Autotrophs there is more amount of energy available. The least energy is available in the tertiary consumers. Thus, shorter food chain has more amount of energy available even at the highest trophic level.



Pyramid of Energy

Forest ecosystems:

Forest ecosystems are areas of the landscape that are dominated by trees and consist of biologically integrated communities of plants, animals and microbes, together with the local soils (substrates) and atmospheres (climates) with which they interact.

Structure of Forest Ecosystems:

Different organisms exist within the forest layers. These organisms interact with each other and their surroundings. Each organism has a role or niche in sustaining the ecosystem.

Some provide food for other organisms; others provide shelter or control populations through predation:

Producers:

- In a forest ecosystem, trees and other plants get their energy from sunlight. Plants produce their own food, in the form of carbohydrates.
- Plants are, therefore, called the primary producers, since they produce the basic foodstuffs for other organisms within food chains and food webs.
- Photosynthesis is the chemical reaction that allows plants to produce their own food.

Consumers:

- Animals cannot produce their own food. They must consume food sources for energy they need to survive.
- All animals, including mammals, insects, and birds, are called consumers.
- Consumers rely on plants and other animals as a food source.
- **Primary consumers** only eat plants and are referred to as herbivores.
- **Secondary consumers** are referred to as carnivores and feed on herbivores.
- **Tertiary consumers** are carnivores that feed on other carnivores.
- **Omnivores** eat both plant and animal matter.

Decomposers:

- Leaves, needles, old branches, dead plants and animals are decomposed by worms, microbes, fungi, ants, and other bugs.
- Decomposers break these items down into their smallest primary elements to be used again. Decomposers

are important in that they sustain the nutrient cycle of ecosystems.

- Humans are part of Forest Ecosystem:
- Humans are consumers. We get food and materials from forests. Because of this, we are a part of the forest ecosystem. Human consumption alters forest ecosystems. Human intervention may be necessary to sustain forest communities under the increased pressure of human use.

GRASSLAND ECOSYSTEM:

Dominated by grass – few shrubs and trees are also found – rainfall average but erratic – overgrazing leads to desertification.

Three types – depending on the climate

- **Tropical grass lands –** found near the boarders of tropical rain forests. Eg. Savannas in Africa. Animals – Zebra, giraffes etc. – fires are common in dry seasons – termite mounds produce methane – leads to fire – high in photosynthesis – deliberate burning leads to release of high CO2 – global warming.
- **Temperate grasslands –** flat and gentle slopes of hills. Very cold winter and very hot summer - dry summer fires do not allow shrubs and trees to grow – soil is quite fertile – cleaned for agriculture.
- **Polar grasslands –** found in arctic polar region – organism – arctic wolf, fox, etc. – A thick layer of ice remains frozen under the soil surface throughout the year – known as permafrost – summer insects and birds appear.

Components:

Structural Components:

Abiotic: soil pH, nutrients, soil moisture, temp, climatic conditions, etc. Biotic: grass, caterpillar, butterfly, worms, insects, birds, etc.

❖ AQUATICECOSYSTEM

Definition: Deals with water bodies and biotic communities present in them-Classified as fresh water and marine ecosystems. Fresh water systems are classified as lentic and lotic ecosystems.

Types:

a) Pond ecosystem: Small fresh water ecosystem – seasonal in nature– organisms: algae, aquatic plants, insects, fishes etc. Ponds are very often exposed to anthropogenic pressure like cloth washing, bathing, cattle bathing, swimming etc.

b) **Lake Ecosystem:** Big fresh water ecosystem – Zonation or stratification, especially during summer is a common one.

Top layer – shallow, warm, prone to anthropogenic activities – Littoral zone

Second layer – enough sunlight, high primary productivity – Limnetic zone

Third layer – very poor or no sunlight – Profundal zone

Eg. Dal Lake in Srinagar, Naini Lake in Nainital

Organisms:

- Planktons – phytoplankton eg. Algae – zooplankton eg.Rotifers
- Nektons – that swims in water eg.Fishes
- Neustons– that float on the surface of water Benthos – that attached to sediments eg. Snails

Types of lakes: Many types

- Oligotrophic lakes – with less nutrient content

- Eutrophic lakes– with very high nutrient content due to fertilizer contamination
- Desert salt lakes – that contains high saline water due to over evaporation
- Volcanic lakes – formed by water emitted from magma due to volcanic eruptions
- Dystrophic lakes – that contains highly acidic water (lowpH)
- Endemic lakes – lakes that contain many endemic species etc.

Streams: fresh water ecosystem where water current plays a major role. Oxygen and nutrient content are uniform. Stream organisms have to face extreme difference in climatic conditions but they do not suffer from oxygen deficiency as pond and lake organisms. This is because large surface area of running water provides more oxygen supply. The animals have very narrow range of tolerance towards oxygen deficiency. Thus stream are worst victims of industrial pollution.

River ecosystem: large streams flowing from mountain highlands are rivers.

❖ Three phases:

a) Mountain highlands – rushing down water fall of water – large quantity of dissolved oxygen – plants attached to rocks and fishes that require more oxygen are found.

b) Second phase – gentle slopes of hills – warmer – supports the growth of plants and fishes that require less oxygen are seen.

c) Third phase: river shapes the land – lots of silts, nutrients are brought – deposited in plains and delta – very rich in biodiversity.

Oceans: Gigantic reservoirs of water covering >70% of earth surface – 2,50,000 species – huge variety of sea products, drugs etc. – provide Fe, Mg, oils, natural gas, sand etc. – major sinks of carbon dioxide – regulate biochemical cycles.

❖ **Two zones:**

a) Coastal zone – warm, nutrient rich, shallow – high sunlight – high primary productivity.

b) Open sea – away from continental shelf – vertically divided in to 3zones.

- Euphotic zone – abundant sunlight
- Bathyal zone – dim sunlight
- Abyssal zone – dark zone – world's largest ecological unit.

❖ **Estuary:** coastal area where river meet ocean – strongly affected by tidal actions – very rich in nutrients – very rich in biodiversity also – organisms are highly tolerant – many species are endemic – high food productivity – however to be protected from pollution.

Characteristics:

Structural Components:

Abiotic: pH, nutrients, D.O, temp, climatic conditions, etc.

Biotic: Phytoplankton, fishes, snails insects, birds, etc.

Expected Questions

1. Short Answer Type Question:

a) What do you mean by ecosystem? Classify the ecosystems.
b) What is ecological succession? Discuss the types of succession.
c) Give the relation between food chain and food web.
d) Discuss different types of consumers.
e) What are dreetrivos? Classify them and give examples.
f) Distinguish between pond ecosystem and Lake Ecosystem.
g) Name different types of ecosystem with examples.
h) What are the characteristic features of desert ecosystem?
i) Define ecology.
j) What is ecological pyramid?

2. Long Answer type Question:

a) Illustrate the energy flow diagram.
b) Discuss the major ecological organization levels.
c) Explain the dimensions of environment.
d) Explain structure of the environment.
e) Earth is an ecosystem. Explain.
f) What is ecological succession? Discuss its types and various phases.
g) Write short notes on
    i. Food chain and food web.
    ii. Desert ecosystem.
    iii. Pond ecosystem.
    iv. Estuaries ecosystem.
h) Describe forest ecosystem with its structure and function.
i) Enumerate the grassland ecosystem and its structure and function.
j) Explain ecological pyramid with suitable diagram.
k) Discuss general characteristics of ecosystem.
l) Differentiate between primary succession and secondary succession.

UNIT 4

Biodiversity and its Conservation

Introduction-Definition: genetics, species and ecosystem diversity.

- Biodiversity is the abbreviated word for ―biological diversity (bio -life or living organisms, diversity-variety). Thus biodiversity is the total variety of life on our planet, the total number of races, varieties and species. The sum of total of various types of microbes, plants and animals (producers, consumers and decomposers) in a system.
- Biomes can be considered life zones, environment with similar climatic, topographic and soil conditions and roughly comparable biological communities (Eg. Grassland, forest). The biomes shelter an astounding variety of living organisms (from driest desert to dripping rain forest, from highest mountain to deepest ocean trenches, life occurs in a marvelous spectrum of size, shape, colour and inter relationship). The variety of living organisms, the biodiversity, makes the world beautiful.
- There are 1.4 million species known presently. But based on new discoveries, by research expeditions, mainly in tropics, taxonomists estimate there are between 3-50 million different species may be alive today. Insects makeup more than one half of all known species and may comprise more than 90% of all species on earth.

LEVELS OFBIODIVERSITY

❖ The concept of biodiversity may be analyzed in 3 different levels. They are

1. Ecosystem Diversity
2. Species Diversity
3. Genetic Diversity

1. Community or Ecosystem Diversity -:

- A set of biotic components (plants, animals and microorganisms) and abiotic components (soil, air, water, etc.) interacting with each other is known as an ecosystem.
- Ecosystem or ecological diversity means the richness and complexity of a biological community, including tropic levels, ecological processes (which capture energy), food webs and material recycling.
- The diversity at an ecological level or habitat level is known as ecosystem diversity.

Ex: River ecosystem- Rivers include fish, aquatic insects, mussels and a variety of plants that have adapted.

- Ecosystem diversity is the aggregate of different environmental types in a region.
- It explains the interaction between living organisms and physical environment in an ecosystem.

2. Species diversity–:

- A discrete group of organisms of the same kind is known as species.
- Species diversity is the diversity between different species.
- The sum of varieties of all living organisms at the species level is known as species diversity.
- Species diversity describes the number of kinds of organisms within individual communities or ecosystems.
- The biotic component is composed of a large number of species of plants, animals and microorganisms

which interact with each other and with the abiotic component of the environment.

Ex: The total number of species living on earth is approximately more than 2 million. However, only around 1.5 million are found and assigned scientific names.

Plant species: Apple, Mango, Wheat, Grapes, Rice etc.

Animal species: Lion, Tiger, Elephant, Deer etc.

3. Genetic Diversity–:

- A species with different genetic characteristics is known as a sub-species or "genera".
- Genetic diversity is a measure of the variety of versions of same gene within individual species.
- With in individual species, there are varieties that are slightly different from one other. These differences are due to differences in the combination of genes.
- Genes are the basic units of hereditary information transmitted from one generation to the other.

Ex: (i) Rice varieties - All rice varieties belong to the species ***"oryzasativa"***.

However there are thousands of rice varieties that show variation at the genetic level in the form of different size, shape, colour and nutrient content.

(ii) Teak wood varieties: The various teak wood varieties available are Indian teak, Burma teak, Malaysian teak etc.

FUNCTIONS OF BIODIVERSITY:-

Two main functions of biodiversity are

1. It is the source on which the entire human species depends on for food, fibre, shelter, fuel and medicine.
2. It depends on biosphere which in turn leads to stability in climate, water, soil, air and overall health of biosphere.

Biogeographically classification of India:-

• India has different climate and topography in different parts and hence is termed as a mega diversity country.

• India occupies **10th place among plant rich countries of the world.**

• It is essential to acquire knowledge about the distribution and environmental interaction of flora and fauna of India.

• Bio-geographers have classified India into ten bio-geographic zones with each zone having characteristic climate, soil and biodiversity.

• These zones are described below:

Trans-Himalayas: The trans-Himalayas are an extension to the Tibetan plateau. This region harbors the high-altitude cold desert in ladakh (Jammu and Kashmir) and Lahaul Spiti (Himachal Pradesh). It accounts for 5.7% of the country's landmass.

Himalayas: The Himalayas are the northern boundaries of India. The entire mountain chain is running from Kashmir in the North-west to Assam in the north-east. The Himalayas comprise of a diverse range of biotic provinces and biomes. The Himalaya as cover 7.2% of the country's landmass

Desert: The extremely dry area west of the Aravalli hill range comprises both the salty desert of Gujarat and the sandy desert of Rajasthan. Deserts occupy around 6.9% of the country's land mass.

The kinds of deserts found in India are:

1. The desert of western Rajasthan
2. The desert of Gujarat
3. The high-altitude cold desert of Jammu &Kashmir and Himachal Pradesh.
4. The Indian deserts have more diversified fauna.

Lakshadweep islands are included in this but the area of these islands is negligible.

Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and optional values.

VALUE OF BIODIVERSITY:-

Definition and estimation of the value of biodiversity is not easy. The value of biodiversity is classified into:

1. Direct Value and
2. Indirect Value

1. Direct value of biodiversity: It is of two types

a. Consumptive use value and b. Productive use value

a. Consumptive use value:

- The consumptive use value is the value placed on nature's products that are consumed directly, without passing through a market. Some of them are firewood, food, and game meat.
- When direct consumption requires recreation, as in sport fishing and game viewing, the consumptive value is the whole recreational experience. Consumptive value seldom appears in national income accounts, but could be easily included in measures such as GDP. It is valued from the cost if resource was sold at market value, rather than being consumed.
- High consumptive use values on resources may lead to the following problems:

- Over-exploitation of wildlife in developing countries
- Loss of traditional control son hunting and
- Loss of wildlife populations at productive levels.
- Consumptive use value benefits the communities closest to the resource if harvested sustainably and manage deficiently.

b. Productive use value:

- Productive use value refers to products that are commercially harvested (sold in a market).
- Its value is estimated at the production end rather than retail end by adding an inflated cost to the finished product.
- Productive use value is often the only value of biological resource reflected in national income accounts and may have a major impact on the national economy.
- Timber, fish, honey, construction materials, mushrooms, fruits, medicinal plants and game meat sold in a market have productive use value.

2. Indirect Value Of biodiversity:

- Indirect values provide economic benefits without being harvested and do not appear in GDP. However, they are crucial to other natural products which influence the GDP.
- These values involve functions performed by biodiversity which are not of any use. Ex: Ecological Processes etc.
- Direct values are often derived from indirect values because plants and animals are supported by the services provided by their environments.
- Many classes of plant and animal species are consumed by tribal and non-tribal communities.

Ex:

1. Ecological functions
2. Flood and storm protection
5. Nutrient cycles
6. Photosynthesis

3. Waste as simulation
4. Microclimatic functions
7. Carbon stores
8. Soil protection etc.

Indirect value of biodiversity is of the following types:

1) Non-consumptive use value
2) Optional value
3) Existence or ethical value and
4) Information value

1) Non-consumptive use value:

- This indirect value deals with nature's functions and services.
- It includes photosynthesis of plants which provides support system for other species by maintaining water cycle, regulating climate, production and protection of the soil, absorption and breakdown of pollutants, recreational, aesthetic, socio-cultural, scientific, educational, spiritual and historic values of natural environments.
- Recreational value is important with regard to tourism and helps the national GDP.

2) Optional value:

- This refers to the potential of biodiversity that is currently known and needs to be explored.
- This refers to the idea that there may be several existing species that may prove to be important in future and their usefulness needs to be studied with reference to a specific problem currently plaguing the society.
- **Ex:** The growing biotechnology field is searching for a cure for diseases like cancer and AIDS.
- Medicinal plants and herbs play a very important role in the economic growth of our country.

3) Existence value:

- This is the value gained from continuous knowledge of existence. Also, this is the value that people are willing to pay to keep a species/ community /ecosystem from going extinct.

Examples of this are high amounts being spent for animals like pandas, whales, lions etc.

- Our rich heritage teaches us to worship plants, animals, rivers and mountains.

Examples being the Ganga River, trees like Banyan and Peepal and plants like the Vambu, Tulsi and Vengai are worshipped.

4) Information value: This relates to the educational, scientific and aesthetic and tourism values of biodiversity in an ecosystem

Aesthetic Values: Beautiful plants and animals inspire us to protect biodiversity. The most important aesthetic value of biodiversity is eco-tourism.

Ex: 1. People from distant places spend time and money to visit areas where they can enjoy aesthetic value of biodiversity. This is called eco-tourism.

2. The pleasant music of wild birds, beautifully coloured butterflies, colour of peacocks and colour of flowers are very important for their aesthetic value.

Threats to biodiversity: Habitats loss, poaching of wild life, man wild life conflicts.

THREATS TO BIODIVERSITY

- Any disturbance in a natural ecosystem tends to reduce its biodiversity.
- Waste generated due to increase in human population and industrialization spoils the environment and leads to decreased diversity in biological species.
- Any change in the system leads to a major imbalance and threatens the normal ecological cycle.

❖ **Causes for loss of biodiversity are:**

1. Habitat loss
2. Poaching of wild life and
3. Man-wild life conflicts

1. Habitat loss: The loss of populations of interbreeding organisms is caused by habitat loss. Factors influencing habitat loss are:

a. **Deforestation:** Loss of habitat is mainly caused by deforestation activities. Forests and grasslands are cleared for conversion into agriculture lands or settlement areas or developmental projects. Forests and grasslands are natural home to thousands of species which disintegrate due to loss of their natural habitat.

b. **Destruction of wetlands:** Wetlands, estuaries and mangroves are destroyed due to farming, filling and pollution that cause loss of biodiversity

c. **Habitat fragmentation:** When the habitat is divided into small and scattered patches the phenomenon is called habitat fragmentation. This leads to the disappearance of most wildlife.

d. **Raw material:** To produce hybrid seeds, wild plants are used as raw materials leading to extinction of many wild plant species.

e. **Production of drugs:** Pharmaceutical companies collect wild plants for the production of drugs leading to extinction of several medicinal plant species.

f. **Illegal trade:** Illegal trade of wildlife reduces biodiversity leading to habitat loss

g. **Developmental activities:** Construction of dams in forest areas coupled with the discharge of industrial effluents kills birds and other aquatic life.

2. Poaching of wildlife: Poaching refers to killing animals or commercial hunting. It contributes to loss of biodiversity. Poaching can be of two types listed below:

1. **Subsistence poaching:** This refers to killing animals for survival.

2. **Commercial poaching:** This refers to hunting animals in order to sell their products.

Factors influencing poaching:

1. Human population: Increased human population in India has led to pressure on forest resources, leading to degradation of wild life habitats

2. Commercial activities: Although a ban has been imposed internationally on the trade of products of endangered species, there is a continued smuggling of wildlife products. Since trading of such products is highly profitable, poachers continue to hunt endangered animals and smuggle their fur, skin and tusks to other countries. Wildlife products include furs, horns, tusks, live specimens and herbal products. Richest source of biodiversity lies in developing nations in Asia, Africa and Latin America. Advanced countries like Europe, North America, Japan, Taiwan, and Honkong are the major importers of wildlife products.

3. Man-Wildlife Conflicts: Man-wildlife conflicts arise, when wildlife starts causing immense damage and danger to man. Under such conditions it is very difficult for the forest department officials to convince the affected villagers to gain the villagers support for wild life conservation.

Ex: 1. In Sambalpur, Orissa, several people were killed by elephants. In retaliation, the villagers killed and injured several elephants.

2. In Mysore, elephants were killed by farmers in retaliation to the damaged one by elephants to their cotton and sugarcane fields.

3. Villagers sometimes hide explosives in their fields to ward-off animals which explode when the elephants enter the fields

4. Several people were killed when leopards attacked them in Sanjay Gandhi National Park, Mumbai

Factors influencing man-animal conflicts:-

- Shrinking forest cover compels wildlife to move outside the forest
- Human encroachment into forest area induces a man-wildlife conflict

- Injured animals have a tendency to attack man
- Wild animals venture out of the forest area in search of food
- Villager's set-up electric wiring around their fields. This injures animals (Elephants) who suffer pain and get violent.
- Cash compensation paid by the government is not enough.
- Garbage near human settlements or food crops attracts wild animals.

CONSERVATION OF BIODIVERSITY

The following measures should be taken to conserve biodiversity

- Illegal hunting and trade of animals and animal products should be stopped immediately
- People-at-large should boycott purchasing coats, purse or bags made of animal skin
- Bio-diversity laws should be strengthened.
- Adequate crop and cattle compensation schemes must be started
- Solar powered fencing must be provided with electric current proof trenches to prevent animals from entering fields.
- Cropping pattern should be changed near the forest borders
- Adequate food and water should be made available for wild animals within forest zones.
- Development and construction work in and around forest region must be stopped.
- Biodiversity is one of the important tools for sustainable development. The commercial, medical, genetic, aesthetic, and ecological importance of biodiversity emphasizes the need for its conservation.

Factors affecting biodiversity:

- Biodiversity is disturbed by human activity
- Poaching of animals, over-exploitation of natural sources and degradation of habitats affect biodiversity.
- Marine ecosystems are disturbed due to oil spills and discharge of effluents
- Climatic factors like global warming, ozone depletion and acid rain also affect biodiversity

Need for biodiversity

- It provides recreation and tourism
- Drugs, herbs, food and other important raw materials are derived from plants and animals
- It preserves the genetic diversity of plants and animals
- It ensures sustainable utilization of life supporting systems on earth.
- It needs to conservation of essential ecological diversity and life supporting systems
- Loss of biodiversity leads to ecological and environmental deterioration

Types of conservation

There are two types of biodiversity conservation:

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

1. IN-SITU CONSERVATION

In-situ conservation involves protection of flora and fauna within its natural habitat. The natural habitats or ecosystems under in-situ conservation are called "protected areas".

a. Biosphere reserves b. National parks
c. Wild life sanctuaries d. Gene sanctuaries

a. Biosphere reserves: They cover large areas (>5000 sq.km.) They are normally used to protect species for a long time. The roles of biosphere reserves are listed below:

- Long-term survival of evolving ecosystem

- Protect endangered species
- Protect maximum number of species and communities
- Serve as site of recreation and tourism
- May also be used for educational and research purposes
- Biosphere reserves function as an open system and changes in land use are not allowed. No tourism and explosive activities are allowed in biosphere reserves.

b. A national park: It is an area dedicated for the conservation of wildlife along with its environment. It covers an area ranging from 100 to 500 sq.km. One or more national parks may exist within a biosphere reserve. A national park issued for enjoyment through tourism, without affecting the environment. It is used to protect, propagate and develop wildlife. Grazing domestic animals inside national parks is prohibited All private rights and forestry activities are prohibited inside a national park.

c. Wildlife sanctuary is an area that is reserved for the conservation of animals only.

- It protects animals only
- It allows operations such as harvesting of timber, collection of forest products, private ownership rights and forestry operations, provided it does not affect animals adversely

d. Gene sanctuary is an area where plants are conserved. Other projects for of the conservation animals are Project Tiger, Girl Lion Project, Crocodile breeding project, project elephant etc.

Advantages of in-situ conservation

- It is cheap and convenient
- Species get adjusted to natural disasters like drought, floods, forest fires etc.

Disadvantages of in-situ conservation

- A large surface area of earth is required to preserve biodiversity
- Maintenance is not proper due to shortage of staff and pollution

2. EX-SITU CONSERVATION

- Ex-situ conservation involves protection of flora and fauna outside their natural habitats.
- This type of conservation is mainly done for conservation of crop varieties and wild relatives of crops.
- Ex-situ conservation involves maintenance and breeding of endangered plant and animal species under controlled conditions
- It identifies those species that are at a high risk of extinction
- It prefers species that are important for man in the near future among the endangered species.

Important centers of ex-situ conservation:

1. Botanical gardens
2. Seed banks
3. Microbial culture collections
4. Tissue and cell cultures
5. Museums
6. Zoological gardens

Methods of ex-situ conservation

National Bureau of Plant Genetic Resources (NPBGR):- It is located in New Delhi and uses the Cryopreservation Technique to preserve agricultural and horticultural crops. Cryopreservation technique involves using liquid nitrogen at -196 C. Varieties of rice, turnip, radish, tomato, onion, carrot, chili, tobacco have been successfully preserved for years using this technique.

National Bureau of Animal Genetic Resources (NPAGR):- It is located in Karnal, Haryana and preserves the semen of domesticated bovine animals.

National Facility for Plant Tissue Culture Repository (NFPTCR): -In this facility, conservation of varieties of crop plants or trees is done using tissue culture. This facility has been created within the NPBGR.

Advantages of Ex-situ conservation

1. Survival of endangered species is increasing due to special care and attention.
2. In captive breeding the animals are assured of food, water, shelter and security thereby have a longer lifespan.
3. It is carried-out in cases of endangered species that do not have any chance of survival in the wild.

Disadvantages of Ex-situ conservation

1. It is an expensive method.
2. Freedom of wildlife is lost.
3. Animals cannot survive in the natural environment.

Expected Questions

1. Short Answer Type Question:

a) What is biodiversity?
b) What are different forms of biodiversity?
c) What are the threats to biodiversity?
d) Define in-situ and ex-situ conservation of biodiversity.
e) Discuss the values of biodiversity at the local and the global levels.
f) Define Hotspots.
g) Which is the largest national park in India?
h) How many biodiversity hot spots are in India?

2. Long Answer type Question:

a) What is meant by biodiversity? Explain the hierarchical levels of biodiversity.
b) What do you mean by value of biodiversity? Explain the consumptive use and productivity use of biodiversity.
c) Describe the uses and importance of biodiversity.
d) What are hotspots of biodiversity? Discuss their significance. Explain the hotspots that extend into India.
e) Discuss the causes that have posed threats to biodiversity.
f) Write short notes on
i. In-situ conservation. ii. Ex-situ conservation. iii. Sustainable conservation.
g) What are endangered and endemic species of India?
h) Explain biodiversity at global, national and local levels.

ENVIRONMENTAL POLLUTION

UNIT- 5

INTRODUCTION

POLLUTION may be defined as an undesirable change in the physical, chemical or biological characteristics of air, water and land that may be harmful to human life and other animals, living conditions, industrial processes and cultural assets. Pollution can be natural or manmade.

- The agents that pollute are called pollutants.

POLLUTANTS : Pollutants are by-products of man's action. The important pollutants are summarized below:

• **Deposited matter—** Soot, smoke, tar or dust and domestic wastes.

• **Gases—**CO, nitrogen oxides, sulphur oxides, halogens (chlorine, bromine and iodine).

• **Metals—**Lead, zinc, iron and chromium.

• **Industrial pollutants—**Benzene, ether, acetic acid etc., and cyanide compounds.

• **Agriculture pollutants—**Pesticides, herbicides, fungicides and fertilizers.

• **Photo chemical pollutants—**Ozone, oxides of nitrogen, aldehydes, ethylene, photochemical smog and proxy acetyl nitrate.

• **Radiation pollutants—**Radioactive substances and radioactive fall-outs of the nuclear test.

Classification of Pollutants

Nature of disposal: On the basis of natural disposal, pollutants are of two types:

1. Non-degradable pollutants: These are the pollutants, which degrade at a very slow pace by the natural biological processes. These are inorganic compounds such as salts (chlorides), metallic oxides waste producing materials and materials like, aluminum cans, mercuric salts and even DDT. These continue to accumulate in the environment.

2. Biodegradable pollutants: These include domestic sewage that easily decomposes under natural processes and can be rapidly decomposed by natural/ artificial methods. These cause serious problems when accumulated in large amounts as the pace of deposition exceeds the pace of decomposition of disposal.

Nature of form: On the basis of the form in which they persist after their release into the environment, pollutants can be categorized under two types:

Primary pollutants: These include those substances, which are emitted directly from some identifiable sources. This include-

a. Sulphur compounds: SO2, SO3, H2S produced by the oxidation of fuel.

b. Carbon compounds: Oxides of carbon (CO+CO2) and hydrocarbons.

c. Nitrogen compounds: NO2 andNH3.

d. Halogen compounds: Hydrogen fluoride (HF) and hydrochloric acid (HCL).

e. Particles of different size and substances: These are found suspended in air. The fine particles below the diameter of 100u are more abundant and include particles of metals, carbon, tar, pollen, fungi, bacteria, silicates and others.

Secondary pollutants: The secondary pollutants are produced by the combination of primary emitted pollutants in the atmosphere.

Ex: In bright sunlight, a photochemical reaction occurs between nitrogen oxides; oxygen and waste hydrocarbons from gasoline that forms peroxy-acetyle nitrate (PAN) and ozone (O3), both of them are toxic components of smog and cause smarting eyes and lung damage.

DEFINITION CAUSES, EFFECTS AND CONTROL MEASURES OF POLLUTION

AIRPOLLUTION

Introduction: Air pollution is one such form that refers to the contamination of the air, irrespective of indoors or outside. A physical, biological or chemical alteration to the air in the atmosphere can be termed as pollution. It occurs when any harmful gases, dust, smoke enters into the atmosphere and makes it difficult for plants, animals and humans to survive as the air becomes dirty.

The WHO defines **air pollution** as the presence of materials in the air in such concentration which are harmful to man and his environment. A number of ingredients find their way in the air and these are mostly gases, which rapidly spread over wide areas.

The composition of Air is given below:

- Nitrogen 78%
- Oxygen 21%
- Argon Less than 1%
- Carbon dioxide 0.037%
- Water vapour remaining
- Ozone, Helium and ammonia Trace amount

Causes of Air pollution:

- **Burning of Fossil Fuels:** Sulfur dioxide emitted from the combustion of fossil fuels like coal, petroleum and other factory combustibles is one of the major causes of air pollution. Pollutants emitting from vehicles cause immense amount of pollution. Carbon Monoxide produced by improper or incomplete combustion emitted from vehicles is another major pollutant along with Nitrogen Oxides that is produced from both natural and manmade processes.
- **Agricultural activities:** Ammonia is a very common by product from agriculture related activities and is one of the most hazardous gases in the atmosphere. Use of insecticides, pesticides and fertilizers in agricultural activities emit harmful chemicals into the air and cause water pollution.
- **Exhaust from factories and industries:** Manufacturing industries release large amount of carbon monoxide, hydrocarbons, organic compounds, and chemicals into the air thereby depleting the quality of air. Petroleum refineries also release hydrocarbons and various other chemicals that pollute the air and also cause land pollution.
- **Mining operations:** Mining is a process wherein minerals below the earth are extracted using large equipment. During the process dust and chemicals are released in the air causing massive air pollution.
- **Indoor air pollution:** Household cleaning products, painting supplies emit toxic Chemicals in the air and cause air pollution.
- **Suspended Particulate matter:** Suspended particulate matter popular by its acronym SPM, is another cause of pollution.

Types of Pollutants Air

- **Primarily air pollutants** can be caused by primary sources or secondary sources. The pollutants that are a direct result of the process can be called primary pollutants. A classic example of a primary pollutant would

be the sulfur-dioxide emitted from factories

- **Secondary pollutants** are the ones that are caused by the inter mingling and reactions of primary pollutants. Smog created by the interactions of several primary pollutants is known to be as secondary pollutant.

Common air pollutants

- **Carbon Dioxide:** CO_2 content of air has increased by 20% during the last century. CO_2 causes nausea and headache. Its increase in the air may cause greenhouse effect, rise in the atmospheric temperature. This may melt the polar ice resulting in rise in level of oceans and flooding of coastal regions.
- **Carbon Monoxide:** It is a very poisonous gas and is produced by incomplete combustion of fuel. If inhaled. It combines with hemoglobin and reduce sits oxygen-carrying capacity. This leads to laziness, reduced vision and death.
- **Oxides of Nitrogen:** These include NO and NO_2,which are released by automobiles and chemical industries as waste gases and also by burning of materials. These are harmful and lower the oxygen carrying capacity of blood.
- **Oxides of Sulphur:** SO_2 and SO_3 are produced by burning of coal and petroleum and are harmful to buildings, clothing, plants and animals. High concentration of SO_2 causes chlorosis (yellowing of leaves), plasmolysis, damage to mucous membrane and metabolic inhibition. SO_2 and SO_3 react with water to form Sulphuric and sulphurous acids. These may precipitate as rain or snow producing acid rain or acid precipitation.
- **Photochemical Oxidants:** Formed by the photochemical reactions between primary pollutants, viz. oxides of nitrogen and hydrocarbons. Nitrogen oxides in the presence of sunlight react with un-burnt hydrocarbons to form peroxy acetyl nitrate (PAN), Ozone, aldehydes and some other complex organic compounds in the air.
- **Hydrocarbons:** These are un-burnt discharges from incomplete combustion of fuel in automobiles. These forms PAN with nitrogen oxides, which is highly toxic.
- **Particulate Matter:** Industries and automobiles release fine solid and liquid particles into the air. Fly ash and soot from burning of coal, metal dust containing lead, chromium, nickel, cadmium, zinc and mercury from metallurgical processes; cotton dust from textile mills; and pesticides sprayed on crops are examples of particulate pollutants in the air. These are injurious to respiratory tract.
- **Aerosols:** Aerosols are chemicals released in the air in vapor form. These include fluorocarbon (carbon compound having fluorine) present in emissions from the Jet aero planes. Aerosols deplete the ozone layer. Thinning of ozone layer results in more harmful ultraviolet rays reaching the earth, which are harmful to skin, and can lead to skin cancer also.
- **Radioactive Substances:** These are released by nuclear explosions and explosives. These are extremely harmful for health.
- **Fluorides:** Rocks, soils and. Minerals containing fluorides release an extremely toxic gas called hydrogen fluoride on heating. This gas is highly injurious to livestock and cattle.

Control Measures

The atmosphere has several built-in self-cleaning processes such as dispersion, gravitational settling, flocculation, absorption, rain-washout, etc. to cleanse the atmosphere. However, control of contaminants at their source level is a desirable and effective method through preventive or control technologies.

A. Source control: Some measures that can be adopted in this direction are

1. Using unleaded petrol
2. Using fuels with low sulphur and ash content
3. Encouraging people to use public transport walk or use a cycle as opposed to private vehicles
4. Ensure that houses, schools, restaurants and playgrounds are not located on busy streets
5. Plant trees along busy streets as they remove particulates, carbon dioxide and absorb noise
6. Industries and waste disposal sites should be situated outside the city preferably on the downwind of the city.
7. Catalytic converters should be used to help control emissions of carbon monoxide and hydro carbons

B. Control measures in industrial centers:

1. Emission rates should be restricted to permissible levels by each and every industry
2. Incorporation of air pollution control equipment in design of plant layout must be made mandatory.
3. Continuous monitoring of the atmosphere for pollutants should be carried out to know the emission levels.

Equipment used to control air pollution

Air pollution can be reduced by adopting the following approaches.

1. Ensuring sufficient supply of oxygen to the combustion chamber and adequate temperature so that the combustion is complete thereby eliminating much of the smoke consisting of partly burnt ashes and dust.
2. To use mechanical devices such as scrubbers, cyclones, bag houses and electro- static precipitators in manufacturing processes. The equipment used to remove particulates from the exhaust gases of electric power and industrial plants are shown below. All methods retain hazardous materials that must be disposed safely. Wet scrubber can additionally reduce sulphur dioxide emissions.
3. The air pollutants collected must be carefully disposed. The factory fumes are dealt with chemical treatment.

WATER POLLUTION

Water pollution may be defined as "the alteration in physical, chemical and biological characteristics of water which may cause harmful effects on humans and aquatic life." Pollutants include:

- Sewage
- Industrial effluents and chemicals
- Oil and other wastes
- Chemicals in air dissolve in rain water, fertilizers, pesticides and herbicides leached from land pollute water.

TYPES, EFFECTS AND SOURCES OF WATER POLLUTION

Water pollution is any chemical, biological or physical change in water quality that has a harmful effect on living organisms or makes water unsuitable for desired uses.

Infectious agents

Ex: Bacteria, Viruses, Protozoa, and parasitic worms.

- Human sources Human and animal wastes

Effects: Variety of diseases.

- **Oxygen demanding wastes (Dissolved oxygen):** This degradation consumes dissolved oxygen in water.

Human sources: Sewage, Animal feedlots, paper mills and food processing facilities.

Effects: Large populations of bacteria decomposing these wastes can degrade water quality by depleting water of dissolved oxygen.

- Inorganic chemicals

Ex: Water soluble inorganic chemicals: Acids Compounds of toxic metals such as lead (Pb), arsenic (As) and selenium (Se) Salts such as NaCl in oceans and fluoride (F-) found in some soils.

Human sources: Surface runoff, industrial effluents and household cleansers Effects: Inorganic chemicals can: Make freshwater unusable for drinking and irrigation Cause skin cancer and neck damage nervous system, liver and kidneys Harm fish and other aquatic life Lower crop yields .Accelerate corrosion of metals exposed to such water.

- **Organic chemicals Ex:** Oil, Gasoline, Plastics, Pesticides, Cleaning solvents and Detergents. Human Sources: Industrial effluents, household cleansers and surface runoff from farms.

Effects: Can threaten human health by causing nervous system damage and some cancers. Harm fish and wildlife.

Plant nutrients Ex: Water soluble compounds containing nitrate, Phosphate and Ammonium ions.

Effects: Drinking water with excessive levels of nitrates lower the oxygen carrying capacity of the blood and can kill urban children and infants.

- **Sediment Ex:** Soil, silt, etc. Human Sources: Land erosion

Effects: Causes cloudy water thereby reducing photosynthetic activity Disruption of aquatic food chain Carries pesticides, bacteria and other harmful substances Settles and destroys feeding and spawning grounds of fish Clogs and fills lakes, artificial reservoirs, stream channels and harbours.

- **Radioactive materials:** Iodine Radon Uranium Cesium and Thorium

Human sources: Nuclear power plants, mining and processing of uranium and other ores, nuclear weapon production and natural sources.

Effects: Genetic mutations, birth defects and certain cancers.

- **Heat (Thermal pollution) Ex**: Excessive heat

Human sources: Water cooling of electric power plants and some types of industrial plants.

Effects: Low dissolved oxygen levels thereby making aquatic organisms more vulnerable to disease, parasites and toxic chemicals.

Point and non-point sources of water pollution:

- **Point sources:** These are pollutants that are discharged at specific locations through pipes, ditches or sewers into bodies of surface waters.

Ex: Factories, sewage treatment plants, abandoned underground mines and oil tankers.

- **Non point sources** These pollutants cannot be traced to a single point of discharge. They are large land areas or air-sheds that pollute water by runoff, subsurface flow or deposition from the atmosphere.

Ex: Acid deposition, runoff of chemicals into surface water from croplands, livestock feedlots, logged forests, urban streets, lawns, golf courses and parking lots.

Control measures of water pollution

- Administration of water pollution control should be in the hands of state or central government
- Scientific techniques should be adopted for environmental control of catchment areas of rivers, ponds or

streams

- Industrial plants should be based on recycling operations as it helps prevent disposal of wastes into natural waters but also extraction of products from waste.
- Plants, trees and forests control pollution as they act as natural air conditioners.
- Trees are capable of reducing sulphur dioxide and nitric oxide pollutants and hence more trees should be planted.
- No type of waste (treated, partially treated or untreated) should be discharged into any natural water body. Industries should develop closed loop water supply schemes and domestic sewage must be used for irrigation.
- Qualified and experienced people must be consulted from time to time for effective control of water pollution.
- Public awareness must be initiated regarding adverse effects of water pollution using the media.
- Laws, standards and practices should be established to prevent water pollution and these laws should be modified from time to time based on current requirements and technological advancements.
- Basic and applied research in public health engineering should be encouraged.

SOIL POLLUTION

Soil pollution is defined as, "contamination of soil by human and natural activities which may cause harmful effect on living organisms". Composition of soil is listed below:

COMPONENT %

Organic mineral matter 45%, Organic matter 05%, Soil water 25%, Soil air 25%

TYPES, EFFECTS AND SOURCES OF SOIL POLLUTION

Soil pollution mainly occurs due to the following:

- Industrial wastes
- Urban wastes
- Agricultural practices
- Radioactive pollutants
- Biological agents

Industrial Wastes – Disposal of Industrial wastes is the major problem for soil pollution

Sources: Industrial pollutants are mainly discharged from various origins such as pulp and paper mills, chemical fertilizers, oil refineries, sugar factories, tanneries, textiles, steel, distilleries, fertilizers, pesticides, coal and mineral mining industries, drugs, glass, cement, petroleum and engineering industries etc.

Effect: These pollutants affect and alter the chemical and biological properties of soil. As a result, hazardous chemicals can enter into human food chain from the soil or water, disturb the biochemical process and finally lead to serious effects on living organisms.

Urban Wastes – Urban wastes comprise of both commercial and domestic wastes consisting of dried sludge and sewage. All the urban solid wastes are commonly referred to as refuse.

Constituents of urban refuse: This refuse consists of garbage and rubbish materials like plastics, glasses, metallic cans, fibers, paper, rubbers, street sweepings, fuel residues, leaves, containers, abandoned vehicles and other discarded manufactured products. Urban domestic wastes though disposed of separately from industrial wastes, can still be dangerous. This happens because they are not easily degraded.

Agricultural Practices – Modern agricultural practices pollute the soil to a large extent. With the advancing agro-technology, huge quantities of fertilizers, pesticides, herbicides and weedicides are added to increase the crop

yield. Apart from these farm wastes, manure, slurry, debris, soil erosion containing mostly inorganic chemicals are reported to cause soil pollution

Radioactive pollutants - **Radioactive substances** resulting from explosions of nuclear testing laboratories and industries giving rise to nuclear dust radioactive wastes penetrate the soil and accumulate giving rise to land/soil pollution.

Ex: Radio nuclides of Radium, Thorium, Uranium, isotopes of Potassium (K-40) and Carbon (C-14) are commonly found in soil, rock, water and air.

Explosion of hydrogen weapons and cosmic radiations include neutron, proton reactions by which Nitrogen (N-15) produces C-14. This C-14 participates in Carbon metabolism of plants which is then into animals and human beings.

Biological agents – Soil gets a large amount of human, animal and bird excreta which constitute a major source of land pollution by biological agents.

Ex: 1. Heavy application of manures and digested sludge can cause serious damage to plants within a few years

Control measures of soil pollution:

Soil erosion can be controlled by a variety of forestry and farm practices.

Ex: Planting trees on barren slopes

- Contour cultivation and strip cropping may be practiced instead of shifting cultivation
- Terracing and building diversion channels may be undertaken.
- Reducing deforestation and substituting chemical manures by animal wastes also helps arrest soil erosion in the long term.

- **Proper dumping of unwanted materials:** Excess wastes by man and animals pose a disposal problem. Open dumping is the most commonly practiced technique. Nowadays, controlled tipping is followed for solid waste disposal. The surface so obtained is used for housing or sports field.
- **Production of natural fertilizers:** Bio-pesticides should be used in place of toxic chemical pesticides. Organic fertilizers should be used in place of synthesized chemical fertilizers. Ex: Organic wastes in animal dung may be used to prepare compost manure instead of throwing them wastefully and polluting the soil.
- **Proper hygienic condition:** People should be trained regarding sanitary habits.
  Ex: Lavatories should be equipped with quick and effective disposal methods.
- **Public awareness**: Informal and formal public awareness programs should be imparted to educate people on health hazards by environmental education.
  Ex: Mass media, Educational institutions and voluntary agencies can achieve this.
- **Recycling and Reuse of wastes**: To minimize soil pollution, the wastes such as paper, plastics, metals, glasses, organics, petroleum products and industrial effluents etc should be recycled and reused.

  Ex: Industrial wastes should be properly treated at source. Integrated waste treatment methods should be adopted.
- **Ban on Toxic chemicals:** Ban should be imposed on chemicals and pesticides like DDT, BHC, etc. which are fatal to plants and animals. Nuclear explosions and improper disposal of radioactive wastes should be banned.

NOISE POLLUTION

Noise is defined as, "the unwanted, unpleasant or disagreeable sound that causes discomfort to all living beings". Sound intensity is measured in decibels (dB) that is the tenth part of the longest unit Bel. One dB is the faintest sound that a human ear can hear.

TYPES OF NOISE: Environmental noise has been doubling every ten years. Noise is classified as:

A. Industrial Noise B. Transport Noise and C. Neighborhood noise

A. Industrial Noise: It is sound with a high intensity sound caused by industry machines. Sources of such noise pollution are caused by machines from machines in various factories, industries and mills. Noise from mechanical saws and pneumatic drills is unbearable and a nuisance to the public. The Indian Institute of Oto-Rino Laryngology, Chennai reported that increasing industrial pollution damages the hearing ability by at least 20%.Workers in steel industry, who work close to heavy industrial blowers, are exposed to 112dB for eight hours suffer from occupational pollution.

B. Transport Noise: Transport noise mainly consists of traffic noise from road, rail and aircraft. The number of automobiles on roads like motors, scooters, cars, motor cycles, buses, trucks and diesel engine vehicles has increased enormously in the recent past further aggravating the problem of transport noise.

Noise levels in most residential areas in metropolitan cities are hovering around the border line due to increased vehicular noise pollution. This high level of noise pollution leads to deafening in the elderly.

C. Neighborhood Noise: This type of noise includes disturbance from household gadgets and community. Common sources being musical instruments, TV, VCR, Radios, Transistors, Telephones, and loudspeakers etc. Statistically, ever since the industrial revolution, noise in the environment has been doubling every ten years.

Effects of Noise Pollution

1) Noise pollution affects both human and animal health. It leads to:
2) contraction of blood vessels
3) making skin pale
4) Excessive adrenalin in the blood stream which is responsible for high blood pressure.
5) Blaring sounds are known to cause mental distress
6) Heart attacks, neurological problems, birth defects and abortion
7) Muscle contraction leading to nervous breakdown, tension, etc.
8) The adverse reactions are coupled with a change in hormone content of blood, which in-turn increases heart beat, constriction of blood vessels, digestive spams and dilation of the pupil of the eye.
9) Adverse effects health, work efficiency and behavior. Noise pollution may cause damage to the heart, brain, kidneys, liver and may produce emotional disturbance.
10) The most immediate and acute effect of noise is impairment of hearing that diminishes some part of the auditory system. Prolonged exposure to noise of certain frequency pattern leads to chronic damage to the inner ear.

Control Measures:

- **SOURCE CONTROL**: This includes source modification such as acoustic treatment to machine surface, design changes, limiting operational timings, etc.
- **TRANSMISSION PATH INTERVENTION:** This includes containing the source inside a

sound insulating enclosure, constructing a noise barrier or provision of sound absorbing materials along the path.

- **RECEPTOR CONTROL:** This includes protection of the receiver by altering the work schedule or provision of personal protection devices such as ear plugs for operating noisy machinery. The measure may include dissipation and deflection methods.
- **OILING:** Proper oiling will reduce noise from the machine.

Preventive measures:

- Prescribing noise limits for vehicular traffic
- Ban on honking (usage of horns) in certain areas
- Creation of silence zones near schools and hospitals
- Redesigning buildings to make them noise proof
- Reduction of traffic density in residential areas
- Giving preference to mass public transport system.

THERMAL POLLUTION

Thermal pollution is defined as the addition of excess of undesirable heat to water thereby making it harmful to man, animal or aquatic life. Thermal pollution may also cause neither significant departures from nor activities of aquatic communities.

Sources of Thermal Pollution:

The following sources contribute to thermal pollution.

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

Nuclear power plants: Nuclear power plants including drainage from hospitals, research institutions, nuclear experiments and explosions, discharge a lot of heat that is not utilized along with traces of toxic radio nuclides into nearby water streams. Emissions from nuclear reactors and processing installations are also responsible for increasing the temperatures of water bodies.

Coal-fired power plants: Coal fired power plants constitute a major source of thermal pollution. The condenser coils in such plants are cooled with water from nearby lakes or rivers. The resulting heated water is discharged into streams thereby raising the water temperature by 15C. The sudden fluctuation of temperature also leads to "thermal shock" killing aquatic life that has become acclimatized to living in a steady temperature.

Industrial effluents: Industries like textile, paper, pulp and sugar manufacturing release huge amounts of cooling water along with effluents into nearby natural water bodies. The waters polluted by sudden and heavy organic loads result in severe drop in levels of dissolved oxygen leading to death of several aquatic organisms.

Domestic Sewage: Domestic sewage is discharged into rivers, lakes, canals or streams with minimal treatment or without any treatment. These wastes have a higher organic temperature and organic load. This leads to decrease in dissolved oxygen content in the receiving waters resulting in the set-up of anaerobic conditions causing release of foul and offensive gases in water

Hydro-electric power: Generation of hydroelectric power sometimes leads to negative thermal loading in water systems. Apart from electric power industries, various factories with cooling requirement contribute to thermal loading.

Effects of Thermal pollution

- Reduction in dissolved oxygen: Concentration of Dissolved Oxygen (DO) decreases with increase in temperature.
- Increase in toxicity: The rising temperature increases the toxicity of the poison present in water
- Interference in biological activity: Temperature is considered to be of vital significance to physiology, metabolism and biochemical processes that control respiratory rates, digestion, excretion, and overall development of aquatic organisms. Temperature changes cause total disruption to the entire ecosystem.
- Interference in reproduction: In fishes, several activities like nest building, spawning, hatching, migration and reproduction depend on optimum temperature.
- Direct mortality: Thermal pollution is directly responsible for mortality of aquatic organisms. Increase in temperature of water leads to exhaustion of microorganisms thereby shortening the life span of fish
- Food storage for fish: Abrupt changes in temperature alter the seasonal variation in the type and abundance of lower organisms leading to shortage of right food for fish at the right time.

Control Measures For Thermal Pollution

The following methods can be adapted to control high temperature caused by thermal discharges:

Cooling towers: Use of water from water systems for cooling systems for cooling purposes, with subsequent return to the water way after passage through a condenser, is called cooling process. Cooling towers transfer heat from hot water to the atmosphere by evaporation. Cooling towers are of two types:

Wet cooling tower: Hot water coming out from the condenser (reactor) is allowed to spray over baffles. Cool air, with high velocity, is passed from sides, which takes away the heat and cools the water.

Dry cooling tower: Here, hot water is allowed to flow in long spiral pipes. Cool air with the help of a fan is passed over these hot pipes, which cools down hot water. This cool water can be recycled.

Cooling ponds: Cooling ponds are the best way to cool thermal discharges. Heated effluents on the surface of the water in cooling ponds maximize dissipation of heat to the atmosphere and minimize the water area and volume. The warm water wedge acts like a cooling pond.

Spray ponds: The water coming out from condensers is allowed to pass into the ponds through sprayers. Here water is sprayed through nozzles as fine droplets. Heat from the fine droplets gets dissipated to the atmosphere.

Artificial lakes: Artificial lakes are man-made water bodies that offer once-through cooling. The heated effluents can be discharged into the lake at one end and water for cooling purposes may be withdrawn from the other end. The heat is eventually dissipated through evaporation

Nuclear Hazards

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

NUCLEAR HAZARDS

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

Sources of Nuclear Hazards

Natural Sources – This is in space which emits cosmic rays.

Man-made Sources – (Anthropogenic sources) these are nuclear power plants, X-rays, nuclear accidents, nuclear bombs, diagnostic kits.

Effects of Nuclear Hazards

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

Control measures

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

SOLID WASTE MANAGEMENT: CAUSES, EFFECTS AND CONTROL MEASURES OF URBAN AND INDUSTRIAL WASTES.

SOLID WASTE MANAGEMENT

- Rapid population growth and urbanization in developing countries has led to people generating enormous quantities of solid waste and consequent environmental degradation.
- The waste is normally disposed in open dumps creating nuisance and environmental degradation.

- Solid wastes cause a major risk to public health and the environment. Management of solid

INCINERATION:

In this method municipal solid wastes are burnt in a furnace called incinerator. Combustible substances such as rubbish, garbage, dead organisms and non-combustible matter such as glass, porcelain and metals are separated before feeding to incinerators. The non-combustible materials can be left out for recycling and reuse. The leftover ashes and clinkers may account for about 10 to 20% which need further disposal by sanitary landfill or some other means.

ADVANTAGES

- Residue is only 20-25% of the original and can be used as clinker after treatment
- Requires very little space

- Cost of transportation is not high if the incinerator is located within city limits
- Safest from hygienic point of view
- An incinerator plant of 3000 tons per day capacity can generate 3MW of power.

COMPOSTING

In this method, bulk organic waste is converted into fertilizer by biological action.

Separated compostable waste is dumped in underground trenches in layers of 1.5m and finally covered with earth of 20cm and left for decomposition. Sometimes, actinomycetes are introduced for active decomposition.

Advantages

- Manure added to soil increases water retention and ion-exchange capacity of soil.
- This method can be used to treat several industrial solid wastes.
- Manure can be sold thereby reducing cost of disposing wastes
- Recycling can be done
- wastes is important in order to minimize the adverse effects posed by their indiscriminate disposal.

TYPES OF SOLID WASTES:

Depending on the nature of origin, solid wastes are classified into

- Urban or municipal wastes
- Industrial wastes and
- Hazardous wastes
- Sources of urban wastes

Urban wastes include the following wastes:

Domestic wastes containing a variety of materials thrown out from homes

Ex: Food waste, Cloth, Waste paper, Glass bottles, Polythene bags, Waste metals, etc.

Commercial wastes: It includes wastes coming out from shops, markets, hotels, offices, institutions, etc.

Ex: Waste paper, packaging material, cans, bottle, polythene bags, etc.

Construction wastes: It includes wastes of construction materials.

Ex: Wood, Concrete, Debris, etc.

Biomedical wastes: It includes mostly waste organic materials

Ex: Anatomical wastes, Infectious wastes, etc.

Classification of urban wastes

Urban wastes are classified into:

- **Bio-degradable wastes -** Those wastes that can be degraded by micro-organisms are called bio-degradable wastes. Ex: Food, vegetables, tea leaves, dry leaves, etc.
- **Non-biodegradable wastes:** Urban solid waste materials that cannot be degraded by micro- organisms are called non-biodegradable wastes. Ex: Polythene bags, scrap materials, glass bottles, etc.

SOURCES OF INDUSTRIAL WASTES

The main source of industrial wastes is chemical industries, metal and mineral processing industries.

Ex: Nuclear plants: It generated radioactive wastes

Thermal power plants: It produces fly ash in large quantities

Chemical Industries: It produces large quantities of hazardous and toxic materials.

Other industries: Other industries produce packing materials, rubbish, organic wastes, acid, alkali, scrap metals, rubber, plastic, paper, glass, wood, oils, paints, dyes, etc.

EFFECT OF IMPROPER SOLID WASTE MANAGEMENT

- Due to improper disposal of municipal solid waste on the roads and immediate surroundings, biodegradable materials undergo decomposition producing foul smell and become a breeding ground for disease vectors.
- Industrial solid wastes are the source for toxic metals and hazardous wastes that affect soil characteristics and productivity of soils when they are dumped on the soil
- Toxic substances may percolate into the ground and contaminate the groundwater.
- Burning of industrial or domestic wastes (cans, pesticides, plastics, radioactive materials and batteries) produce furans, dioxins and polychlorinated biphenyls that are harmful to human beings.
- Solid waste management involves waste generation, mode of collection, transportation, segregation of wastes and disposal techniques.

STEPS INVOLVED IN SOLID WASTE MANAGEMENT:

Two important steps involved in solid waste management are:

A. Reduce, Reuse and Recycle of Raw Materials B. Discarding wastes

Reduce - If usage of raw materials is reduced, the generation of waste also gets reduced.

Reuse - Refillable containers that are discarded after use can be reused.

Rubber rings can be made from discarded cycle tubes and this reduces waste generation duringmanufacture of rubber bands.

Recycle- Recycling is the reprocessing of discarded materials into new useful products.

Ex: Old aluminum cans and glass bottles are melted and recast into new cans and bottles

Preparation of cellulose insulation from paper.

Preparation of automobile body and construction material from steel cans.

This method (Reduce, Reuse & Recycle), i.e, 3R's help save money, energy, raw materials and reduces pollution.

B. DISCARDING WASTES:

The following methods are adopted for discarding wastes:

A. Landfill
B. Incineration and
C. Composting

A. LAND FILL: Solid wastes are placed in a sanitary landfill in which alternate layers of 80 cm thick refuse is covered with selected earth-fill of 20 cm thickness. After 2-3 years solid waste volume shrinks by 25-30% and land is used for parks, roads and small buildings. This is the most common and cheapest method of waste disposal and is mostly employed in Indian cities.

Advantages:

- It is simple and economical
- Segregation of wastes is not required
- Land filled areas can be reclaimed and used for other purposes
- Converts low-lying, marshy waste-land into useful areas.
- Natural resources are returned to soil and recycled.

ROLE OF AN INDIVIDUAL IN PREVENTION OF POLLUTION

- Individuals should minimize wastage of resources such as electricity. Every unit of electricity saved is equivalent unit of electricity produced as it not only saves the fuel that would be used to produce that

electricity, but also help to prevent pollution that is accompanied by burning of that fuel. Therefore, person should always switch off appliances when not in use.

- Individuals should prefer walking or use cycles instead of using motor vehicles, especially when distances to be travelled are small.
- Individuals can make considerable contribution by using mass transport (buses, trains, etc) instead of using personal vehicles.
- When going to workplace, colleagues from nearby localities should pool vehicles instead of going in individual personal vehicles.
- Taking personal vehicles for periodic pollution checks at centers approved by authorities.
- Individuals should reuse items whenever possible.
- Products that are made of recycled material should be given preference.
- Use gunny bags made of jute instead of plastic bags.
- Take part in environment conservation drives such as tree planting drives.
- Use water resources efficiently.
- Use renewable resources by installing equipment such as solar heaters and using solar cookers.

DISASTER MANAGEMENT: FLOODS, EARTH QUAKE, CYCLONE AND LANDSLIDES.

FLOODS:- Increased rainfall or rapid snow melting causes more flow of water in the streams. This excess water flow in a stream covering the adjacent land is called a flood. Floodplain is defined in terms of a flood frequency. Flood frequency is referred as 10 -year flood, 100- year flood, etc. A 10-year flood at any point in a stream is that discharge of water which may be expected to occur on average once in 10 years. Floodplains are generally fertile, flat and easily formed.

CAUSES OF FLOOD

- Construction of buildings in a floodplain
- Removing vegetation
- Paving roads and parking areas
- Deforestation
- Heavy rainfall
- Urbanization
- Earthquake.

Effects of Flood

- Erosion of top soil and vegetation
- Damage and loss to land, house and property
- Spread of endemic water borne diseases
- Interruption of basic facilities of community such as highways, railways, telephone, electricity and day-to-day essentials
- Silting of reservoirs and dams

FLOOD CONTROL

- Construction of flood control dam
- Deepening, widening and straightening of streams
- Lining of streams
- Banning of construction of buildings in flood plains
- Converting flood-plains into wildlife habitat, parks, and recreation areas.

LANDSLIDES

- Landslides occur when mass of earth material move downward. It is also called mass wasting or mass movement.
- Sudden landslide occurs when unconsolidated sediments of a hillside are saturated by rainfall or water logging.
- Many landslides take place in coincidence with earthquakes. The most common form of landslides is earthquake induced landslides or more specifically rock falls and slides of rock fragments that form on steeps lopes.
- The size of area affected by earthquake induced landslides depends on the magnitude of the earthquake, its focal depth, the topography and geologic conditions near the causative fault, the amplitude, frequency, composition and duration of ground shaking.

Control measures for land slides

- Avoid construction activity in landslide occurring areas.
- Reducing slope of hilly side
- Stabilizing the slope portion
- Increasing plantation of deep rooted vegetation on the slope.

EARTH QUAKES

- An earthquake occurs when rocks break and slip along a fault in the earth. Earthquakes occur due to deformation of crust and upper mantle of the earth.
- Due to heating and cooling of the rock below these plates, movement of adjacently overlying plates and great stresses, deformation occurs.
- Tremendous energy cans build-up between neighboring plates.
- If accumulated stress exceeds the strength of the rocks, the rocks break suddenly releasing the stored energy as an earthquake.
- The earthquake releases energy in the form of waves that radiate from the epicenter in all directions.
- The 'p' wave or primary wave alternately compresses and expands material in the same direction it is travelling.
- This wave can move through solid rocks and fluids.
- These are the fastest waves. The is wave or secondary wave is slower and shake the ground up, down, back and forth perpendicular to the direction in which it is travelling. Surface waves follow both the 'P' and 'S' waves.
- The magnitude of an earthquake is measured in Richter scale. The Richter scale is logarithmic.

Effects of earth quake

- Ground shaking
- Liquefaction of ground
- Ground displacement
- Landslides
- Flood
- Fire

Control of earthquake

- There is virtually no technique to control the occurrence of earthquake. However, certain preventive measures can be taken to minimize the damage.
- Minimizing development activity (especially construction, mining, construction of dams and reservoirs) in areas known to be active seismic zones.
- Continuously monitoring seismic activity using 'seismographs' and alerting people regarding any recorded disturbance in advance.

Expected Questions

1. Short Answer Type Question:

a) What do you mean by environmental pollution?
b) Name different types of environmental pollution.
c) What are pollutants? Mention different types of pollutants.
d) What are air pollutants?
e) What are the causes of air pollution?
f) What is the effect of air pollution on human health?
g) How is air pollution controlled?
h) Mention the causes of thermal pollution.
i) Mention the causes of nuclear pollution.
j) What are the water pollutants and classify them?
k) Discuss different categories of water pollution.
l) What are the causes of water pollution?
m) What is soil pollution? Discuss the types of soil pollution.
n) Discuss the causes of soil pollution.
o) What is meant by noise pollution? Give the source/causes of noise pollution.
p) Discuss the effect of noise pollution.
q) What is noise? What are the acceptable noise levels for various occupations?
r) What is a solid waste? What is meant by solid waste management?
s) What is disaster management? Mention the types of environmental disaster.
t) Give the causes of cyclone. What are the effects of cyclone?

2. Long Answer type Question:

a) What is air pollution? Describe the causes, consequences and control measures.
b) What is noise pollution? Describe its causes, effects, and prevention, and control measures.
c) Describe the effects of soil pollution and its control.
d) What is water pollution? Describe its causes, effects, and prevention, and control measures.
e) Discuss the types of environmental pollution.
f) Discuss the various sources of marine pollution. What are the effects and control measures of marine pollution?
g) Write an essay on floods, their control and management.
h) Give a detailed the four aspects of management of environmental disasters.
i) What are the measures you would take in case of floods and cyclones?
j) Write short notes on nuclear hazards.
k) What are the various methods of solid waste treatment? Describe any one method.