

UNIT-1

The Environment

Introduction

The science of 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. It is the science of physical phenomena in the environment. It studies of the sources, reactions, transport, effect and fate of physical and biological species in the air, water and soil.

The Environment:

Environment is constituted by the interacting systems of physical, biological and cultural elements inter-related in various ways, individually as well as collectively. These elements may be explained as under:

(1) Physical elements: Physical elements are as space, landforms, water bodies, climate soils, rocks and minerals. They determine the variable character of the human habitat, its opportunities as well as limitations.

(2) Biological elements :Biological elements such as plants, animals, microorganisms and men constitute the biosphere.

(3) Cultural elements:Cultural elements such as economic, social and political elements are essentially manmade features, which make cultural milieu.

The environment consists of four segments as under:

1. The Atmosphere: The atmosphere implies the protective blanket of gases, surrounding the earth:

(a) It sustains life on the earth.

(b) It saves it from the hostile environment of outer space.

(c) It absorbs most of the cosmic rays from outer space and a major portion of the electromagnetic radiation from the sun.

(d) It transmits only here ultraviolet, visible, near infrared radiation (300 to 2500 nm) and radio waves. (0.14 to 40 m) while filtering out tissue-damaging ultraviolet waves below about 300 nm.

The atmosphere is composed of nitrogen and oxygen. Besides, argon, carbon dioxide, and trace gases.

2. Hydrosphere: The Hydrosphere comprises all types of water resources oceans, seas, lakes, rivers, streams, reservoir, polar icecaps, glaciers, and ground water.

(i) Nature 97% of the earth's water supply is in the oceans,

(ii) About 2% of the water resources is locked in the polar icecaps and glaciers.

(iii) Only about 1% is available as fresh surface water-rivers, lakes streams, and ground water fit to be used for human consumption and other uses.

3. Lithosphere: Lithosphere is the outer mantle of the solid earth. It consists of minerals occurring in the earth's crusts and the soil e.g. minerals, organic matter, air and water.

4. Biosphere: Biosphere indicates the realm of living organisms and their interactions with environment, viz atmosphere, hydrosphere and lithosphere.

Ecology:

- (1) Ernst Haeckel (1866) defined ecology "as the body of knowledge concerning the economy of nature-the investigation of the total relations of animal to its inorganic and organic environment.
- (2) Frederick Clements (1916) considered ecology to be "the science of community.
- (3) British ecologist Charles Elton (1927) defined ecology as "the scientific natural history concerned with the sociology and economics of animals."
- (4) Taylor (1936) defines ecology as "the science of the relations of all organisms to all their environments."
- (5) Taylor (1936) defined ecology as "the science of the relations of all organisms to all their environments."
- (6) Allee (1949), considered ecology as "the science of inter-relations between living organisms and their environment, including both the physical and biotic environments, and emphasizing inter-species as well as intra-species relations.
- (7) G.L. Clarke (1954) defined ecology as "the study of inter-relations of plants and animals with their environment which may include the influences of other plants and animals present as well as those of the physical features."
- (8) Woodbury (1955) regarded ecology as "the science which investigates organisms in relation to their environment: a philosophy in which the world of life is interpreted in terms of natural processes.
- (9) A. Macfadyen (1957) defined ecology as "a science, which concerns itself with the inter-relationships of living organisms, plants and animals, and their environments."
- (10) S.C. Kendeigh (1961, 1974) defined ecology as "the study of animals and plants in their relation to each other and to their environment." Certain modern ecologists have provided somewhat broader definitions of ecology.
- (11) M.E. Clark (1973) considers ecology as "a study of ecosystems of the totality of the reciprocal interactions between living organisms and their physical surroundings.
- (12) Pinaka (1973) defined ecology as "the scientific study of the relationships of living organisms with each other and with their environments." He adds that "it is the science of biological interactions among individuals, populations, and communities; and it is also the science of ecosystems-the inter-relations of biotic communities with their non-living environments.
- (13) R.L. Smith (1977), considers ecology as "a multidisciplinary science which deals with the organism and its place to live and which focuses on the ecosystems."

ECO-SYSTEM

- Ecosystem considers the living organisms and their non-living environment are inseparably interrelated and interact with each other. A.G. Tansley (in 1935) defined the Eco-system as 'the system resulting from the integrations of all the living and non-living factors of the environment'. Thus he regarded the Eco-systems as including not only the organism complex but also the whole complex of physical factors forming the environment.

- The eco-system can be defined as any spatial or organizational unit including living organisms and non-living substances interacting to produce an exchange of materials between the living and non-living parts. The eco-system can be studied from either structural or functional aspects.

1. Structural Aspect

The structural aspects of ecosystem include a description of the arrangement, types and numbers of species and their life histories, along with a description of the physical features of the environment.

2. Functional Aspect

The functional aspects of the ecosystem include the flow of energy and the cycling of nutrients.

- The non-living part of the eco-system includes different kinds of habitats such as air, water and land, and a variety of abiotic factors. Habitat can be defined as the natural abode or locality of an animal, plant or person. It includes all features of the environment in a given locality. For example, water is used as habitat by aquatic organisms and it comprises three major categories-marine, brackish and freshwater habitats. Each of these categories may be subdivided into smaller unit, such as a freshwater habitat may exist as a large lake, a pond, a puddle, a river or a stream.
- The land is used as a habitat for numerous terrestrial organisms. It includes many major categories of landmasses, which are called biomes. Biomes are distinct large areas of earth inclusive of flora and fauna, e.g. deserts, prairie, tropical forests, etc. Soil is also used
- As a habitat by a variety of microbes, plants and animals.

Division of Ecosystem

The ecosystem can be divided, from the energetic view point into three types of organisms: producers, consumers, and reducers. These can be explained as under:

(1) Producer: Photosynthetic algae, plants and bacteria are the producers of the ecosystem; all other organisms depend upon them directly or indirectly for food.

(2) Consumers: Consumers are herbivorous, carnivorous, and omnivorous animals; they eat the organic matter produced by other organisms.

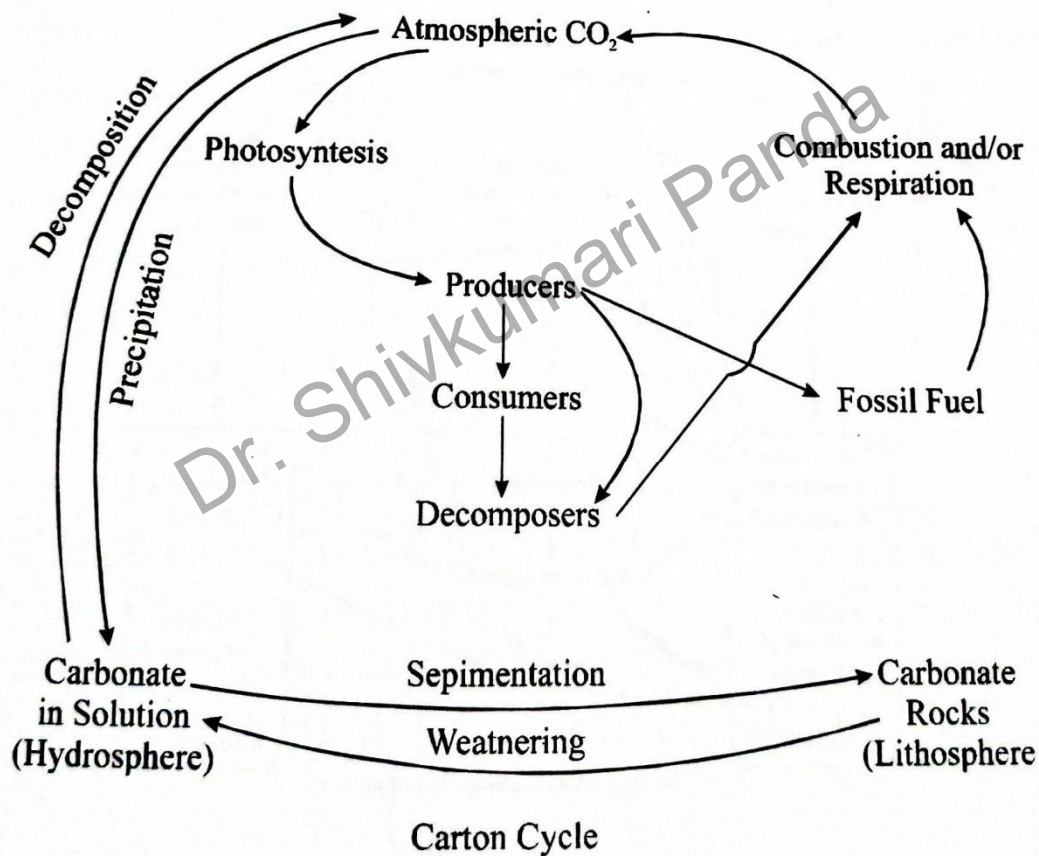
(3) Reducers: Reducers are heterotrophic organisms like animals; they are fungi and bacteria that decompose dead organic matter.

2.3 : Function of an ecosystem

Structure and function of ecosystem studied together for complete understanding of nature. However, function of an ecosystem operates under natural conditions considered separately. From the operational point of view the living and non-living components of an ecosystem so deeply interrelated that their separation is impracticable. The mode of movement of materials and energy in an ecosystem, the producer, consumer, decomposer's relative dependence study is known as **function of ecosystem**. So, it involves food chain, food web, energy flow and different **biogeochemical cycles**.

2.3.1 : Carbon cycle

Carbon is present in the atmosphere, mainly in the form of carbon dioxide. It is a minor constituent of the atmosphere (0.036%). However, without carbon dioxide life could not exist, as it is vital to the production of carbohydrate through photosynthesis by plants. Carbon is returned to the atmosphere about as fast as it is removed. The figure illustrates the global carbon cycle.



Carbon cycle

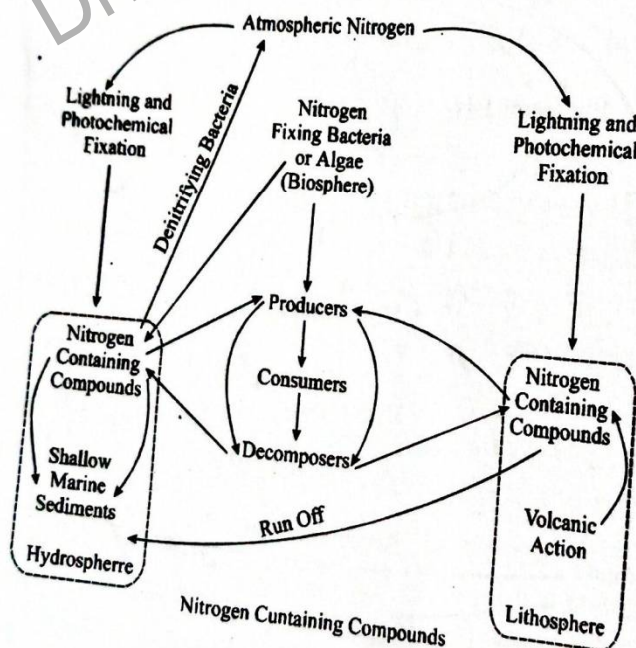
Carbon from atmosphere moves to green plants and then to animals. Finally from them to bacteria, fungi and other micro-organisms that return it to the atmosphere through decomposition of dead organic matter. Some dead plants and animal materials are buried in sediments before they can be broken down completely by decomposers. This process has been going on, to a greater or lesser extent for hundreds of millions of years. It was important during carboniferous period and much of plant and animal remains have been transformed into coal, oil and natural gas. When these fossil fuels are burned, the stored carbon enters the atmosphere as carbon dioxide. The carbon cycle is quite complicated. There are limited number of avenues by which carbon utilized and a much larger number is restored to the atmosphere. Collectively these various pathways constitute self regulating feedback mechanisms resulting in a relatively homeostatic system. Some of the carbon is also returned to the atmosphere through respiration of various trophic levels in the food chain.

Carbon dioxide is not a pollutant in the strict sense of the word. Before the onset of industrial revolution, flow of carbon among atmosphere, continent and ocean was balanced, but with the advent of industrialization and urban development this equilibrium has disturbed. The richest source of carbon is ocean, where it occurs in the form of carbonates and bicarbonates. The ocean contain about 50 times, more carbon dioxide than atmosphere. Ocean regulates atmosphere CO_2 level despite photosynthetic uptake. Thus there is a continuous exchange of CO_2 between atmosphere and organisms on one hand, and between the atmosphere and the sea on the other. However, a major portion of the dissolved CO_2 in the ocean is below thermocline, in the layer where temperature drops abruptly. Carbon dioxide is a pollutant because it's concentrations in the atmosphere are increasing.

Nitrogen cycle

2.3.2 : Nitrogen cycle

Nitrogen is an element essential for protein synthesis in all living organisms. It constitutes nearly 16% by weight of all proteins. There is an inexhaustible supply of nitrogen in the atmosphere but the elemental form cannot be used directly by most of the living organisms. Nitrogen needs to be fixed, that is converted to ammonia, nitrates or nitrites before it can be taken up by plants.



Nitrogen cycle

Nitrogen fixation takes place in three different ways.

- (i) by certain free living and symbiotic bacteria and blue green algae.
- (ii) by industrial process, fertilizer factory.
- (iii) to a limited extent by atmospheric phenomena, lightning.

At present the amount fixed by industrially, far exceeds the amount by bacteria and atmospheric actions.

The periodic thunderstorms convert the gaseous nitrogen in the atmosphere to nitrates which eventually reach the earth's surface through precipitation and then into the soil to be utilized by plants. More importantly certain microorganism capable of fixing atmospheric nitrogen. These include free living Azotobacter, symbiotic Rhizobium, blue green algae. Ammonium ion can be directly taken up as source of nitrogen by some plants or oxidised to nitrite and nitrate by specialised bacteria called nitrosamines and nitrobacter, respectively. The symbiotic bacteria capable of fixing atmospheric nitrogen give in the root nodules of leguminous plants like, peas, beans, alfalfa, clover etc. The nitrates synthesized by bacteria in the soil are taken up by plants and go through higher trophic levels of the ecosystem. By excretion or death of all organisms nitrogen is returned to the soil in the form of ammonia. In the soil as well as oceans there are special denitrifying bacteria which convert the nitrates and nitrites to elemental nitrogen and this escapes into the atmosphere.

Dr. Shivkumari Panda

Environment pollution

INTRODUCTION

Pollution is an undesirable change in the physical, chemical or biological character of air, water and land that may be dangerous 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 human activity. The important pollutants are summarised 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.
- **Photochemical 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

- On the basis of natural disposal, pollutants are of two types:
 - (i) Non-degradable pollutants: These are the pollutants, which degrade at a very slow rate by the natural biological processes. These are inorganic compounds such as salts (chlorides), metallic oxides waste producing materials and materials like, aluminium cans, mercuric salts and even DDT. These continue to accumulate in the environment.
 - (ii) 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 rate of deposition exceeds the rate of decay of disposal.
- On the basis of the form in which they persist after their release into the environment, pollutants can be categorized under two types:
 - (i) **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 and NH₃.

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

(e) *Particles of different size and substances*: These are found suspended in air.

(ii) Secondary pollutants - The secondary pollutants are produced by the combination of primary emitted pollutants in the atmosphere. It is the result of chemical reaction between two or more air components. Primary pollutant SO₂ reacts with oxygen in atmosphere to form sulphur trioxide. This SO₃ can react with water vapour in air to form sulphuric acid which is a secondary pollutant.

(iii) Smog- The fog deposited with smoke and chemical fumes forms a dark and thick covering called as the smog. Smog is very common in almost all the industrial areas as the smog is trapped for many days by the inactive air. It is harmful both for animals and plants.

AIR POLLUTION

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.

SOURCES OF AIR POLLUTION

Different sources of air pollution are fossil fuels, industries, agricultural activities, wars, natural causes and emissions from vehicles.

(i) Burning Fossil Fuels : Burning of wood, charcoal and other fossil fuels causes air pollution by the release of carbon dioxide (CO₂), carbon sulphur dioxide etc. Petroleum consists mainly of hydrocarbons, sulphur and nitrogen.

(ii) Emissions from Automobiles: Vehicles are mainly responsible for more than 80% of total air pollution. The major pollutants released from automobiles, locomotives, aircraft etc., include CO, unburnt hydrocarbons and nitrogen oxide.

(iii) Industries: Paper and pulp factories, petroleum refineries, fertilizer plants, and steel industries, thermal power plants are the main sources of air pollution. They add various harmful gases like CO, SO₃, NO, Hydrocarbons etc., to the atmosphere. Textile factories release cotton dust into the air. Cities experiencing this type of pollution are Kanpur, Surat and Ahmedabad. The pesticide and insecticide industries are posing serious threat to the environment. Food processing industries and tanneries emit offensive odors. Release of poisonous gases from accidents also poses serious threats. e.g. Bhopal Gas Tragedy in which methyl isocyanate (MIC) gas leakage killed several people. In Tokyo, about 34 tons of carbon particles mixed with other suspended particles settle per square kilometre every day.

(iv) Farming Activities: Spraying of insecticides also causes air pollution. These, when inhaled generate harsh trouble to both animals and man.

(vi) Natural Causes: Gas emissions from active volcanoes, marsh gas, spores of fungi and pollens are the natural causes of air pollution.

COMMON AIR POLLUTANTS

Air pollutants are of two main types ~gaseous and particulate. Oxides of carbon, Nitrogen and sulphur are gaseous pollutants. Particulate pollutants may be solid or liquid particles, larger particles settle down quickly viz., sand and water droplets whereas small dust particles remain suspended in air for a long time. These are added into the atmosphere by the processes of blasting, drilling, crushing, grinding and mixing.

(i) Carbon Dioxide

CO₂ content of air has increased by 20% during the last century. CO₂ causes nausea and headache. Its increase in the air may cause green house effect, rise in the atmospheric temperature. This may melt the polar ice resulting in rise in level of oceans and flooding of coastal regions.

(ii) Carbon Monoxide

It is a very poisonous gas and is produced by incomplete combustion of fuel. If inhaled, it combines with hemoglobin and reduces its oxygen-carrying capacity. This leads to laziness, reduced vision and death.

(iii) Oxides of Nitrogen

These include NO and NO₂, 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.

(iv) Oxides of Sulphur

SO₂ and SO₃ are produced by burning of coal and petroleum and are harmful to buildings, clothing, plants and animals. High concentration of SO₂ causes chlorosis (yellowing of leaves), plasmolysis, damage to mucous membrane and metabolic inhibition. SO₂ and SO₃ react with water to form Sulphuric and sulphurous acids. These may precipitate as rain or snow producing acid rain or acid precipitation.

(v) 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 unburnt hydrocarbons to form peroxyacyl nitrate (PAN), Ozone, aldehydes and some other complex organic compounds in the air.

(vi) Hydrocarbons

These are unburnt discharges from incomplete combustion of fuel in automobiles. These form PAN with nitrogen oxides, which is highly toxic.

(vii) 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.

(viii) Aerosols

Aerosols are chemicals released in the air in vapour form. These include fluorocarbon (carbon compound having fluorine) present in emissions from the Jet aeroplanes. 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.

(ix) Radioactive Substances

These are released by nuclear explosions and explosives. These are extremely harmful for health.

(x) 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.

Effects of Air Pollution

Effect on Plants

- (i) SO_2 causes chlorosis and also results in the death of cells and tissues.
- (ii) Fluorides and PAN damage leafy vegetables such as lettuce and spinach.
- (iii) Oxides of nitrogen and fluorides reduce crop yield.
- (iv) Smog bleaches and blazes foliage of important leafy plants.
- (v) Hydrocarbons cause premature yellowing, fall of leaves and flower buds, discoloration and curling of sepals and petals.
- (vi) Smoke and dust cover the leaf surface and reduce photosynthetic capacity of plants.
- (vii) Ozone damages cereals, fruits, and cotton crop.

Effect on Man

The effect of pollutants on animals and man are as follows-

- (i) Ozone causes dryness of mucous membranes, changes eye vision, causes headache, pulmonary congestion and oedema.
- (ii) Ozone has been reported to produce chromosomal aberrations.
- (iii) SO_2 causes drying of mouth, scratchy throat, smarting eyes and disorders of respiratory tract.
- (iv) SO_3 , CO and NO_2 diffuse into blood stream and reduce oxygen transport. CO damages cardiovascular system. Hydrocarbons and other pollutants act, as carcinogens and lead to different cancers.
- (v) Cotton dust leads to respiratory disorders e.g. bronchitis and asthma.
- (vi) Smoking of tobacco causes cancerous growth in lungs.

Control of Air Pollution

Following measures have been suggested to control air pollution-

- (i) Some gases, which are more soluble in a particular liquid than air, for example, ammonia in water, can be separated by dissolving in it
- (ii) Particles larger than 50 μ m are separated in gravity settling tanks. Using cyclone collectors or electrostatic precipitators separates fine particles.
- (iii) The height of chimneys should be increased to the highest possible level to reduce pollution at the ground level.
- (iv) SO_2 pollution can be controlled by extracting sulphur from the fuel before use.
- (v) Pollution control laws should be enforced strictly.
- (vi) Trees should be planted on the roadside, riverbanks, parks and open places as they keep the environment fresh.
- (vii) Population growth, which is the main cause of pollution should be checked.
- (viii) Nuclear explosions should be restricted.

WATER POLLUTION

Water is extremely essential for life, this common fact is known to all. It is required to meet our basic needs in day to day life viz., cooking, drinking, bathing, disposal of sewage, irrigation, generating electricity in power plants, cooling and manufacturing different products in industries and the disposal of industrial wastes. During all these processes the undesirable substances are added to the water resources to a great extent. This alters the basic chemistry of water in rivers and streams.

Sources of Water Pollution

(i) Domestic sewage

This includes household's wastes like food wastes, synthetic detergents used for washing clothes and cleaning bathrooms and latrines and water based paints.

(ii) Industrial effluents

The industrial wastes are discharged in the adjoining rivers and streams through flush lines of factories. The textiles, sugar and fertilizers factories, oil refineries, drugs manufacture, rubber, and rayon fibers, the paper industries and the chemical factories all produce Chemical pollution.

(iii) Agricultural source

Increased use of fertilizers has become essential for high yielding crop plants. Excess of nitrates used as fertilizers seep into ground water is carried into lakes and pond. On entering the drinking water supply system these create several health problems.

(iv) Pesticides

These include insecticides, fungicides, nematocides, rodenticides, herbicides and soil fumigants. These contain chlorinated hydrocarbons, organophosphates, metallic salts, carbonates, acetic acid derivatives etc. many pesticides are non-degradable. They pass through the food chains and accumulate in fatty tissues thus causing several health hazards.

(v) Thermal pollution

Power plants and nuclear power stations are the main sources of thermal pollution of water where water is used for cooling and becomes hot. The hot water on entering the main water body raises its temperature, which kills fishes and other aquatic animals and increases the rate of respiration in aquatic plants.

(vi) Pathogenic organisms

Sewage and domestic waste from houses introduces pathogenic organisms viz., protozoa, worms-eggs and bacteria into water. This contaminated water if consumed causes jaundice, typhoid, dysentery, cholera, tuberculosis etc.

(vii) Mineral oils

Oil from oil spills and washings of automobiles finds way into river water through sewers.

(viii) Underground water pollution

Underground water particularly in cities and industrial areas is no more pure and safe. The sources of underground water pollution are sewage, seepage, pits, industrial effluents, septic tanks, fertilizers and pesticides, garbage etc.

(ix) Marine water pollution

River and stream network sources of water ultimately end up ocean and seas. Thus, these acts as the sink of all natural and man-made water based pollutants. The main sources of oceanic pollution are discharges of oil, greases, petroleum products, detergents, sewage and garbage including radioactive wastes.

Effect of Water Pollutants

The main effects of water pollutants are:

1. Compounds of mercury, arsenic and lead are poisonous and chemically harmful as they even affect water treatment plants e.g. organic sulphur compounds interfere with nitrification.

2. Mercury when dissolved in water is absorbed by aquatic plants and enters the food chain. Lead impairs metabolism and brings about congenital deformities, anaemia etc.
3. Cadmium damages kidneys and liver.
4. Inorganic nitrates and phosphates promote growth of oxygen-consuming algae, which result in the death of fishes and other aquatic animals.
5. Presence of dyes and compounds in the discharged water changes the colour of water.
6. Soap, detergents and, alkalis result in foam formation.
7. Industrial effluents containing iron, free chlorine, phenol, manganese, oils, hydrocarbons, ammonia, algae and microorganisms impair the taste and odours of water.
8. The nitrates and phosphates dissolved in water accelerate the growth of microorganisms, which consume much of the dissolved oxygen depriving fish and other aquatic life (Eutrophication).
9. Biomagnifications is the increase of toxic materials at each tropic level of a food chain.

For example, DDT after reaching a water system is absorbed by the microorganisms on which smaller fishes feed. From them, DDT reaches the carnivorous animals. Since bigger fishes consume more food, large amounts of DDT accumulates in their body.

CONTROL OF WATER POLLUTION

- (i) Separate ponds and tanks to be used for cattle and animals.
- (ii) Use of pesticides, insecticides and fertilizers should be done judiciously. Rapid biodegradable substitutes for pesticides should be employed.
- (iii) In towns where sewage facilities are not available, septic tanks should be made in the houses.
- (iv) Rivers and lakes should not be used for bathing or washing as it contaminates water.
- (v) Domestic sewage and industrial wastes should be treated before discharging them into drains.

SOIL POLLUTION

Like water and air, soil is also equally important for living organisms. It supports plants on which all other living organisms depend. The process of soil formation is so slow that the soil may be regarded as a non-renewable source. Therefore, the study and control of soil pollution is important. Any substance that reduces soil productivity is called **soil pollutant**.

Sources of Soil Pollution

There are several materials, which adversely affect physical, chemical and biological properties of the soil and thus reduce its productivity. These are

1. Chemicals present in industrial waste.
2. Pesticides and insecticides that are sprayed on crops.
3. Fertilizers and manures that are added to the soil to increase the crop yield.

Effect of Soil Pollutants

Chemicals and pesticides affect the structure and fertility of soil by killing the soil microorganisms. Pesticides are absorbed by the plants and then transferred to other organism. Hence, they affected food chains and food webs. Excretory products of livestock and human beings used as manure pollute the soil besides giving high yield. The faulty sanitation and unhygienic practices of the people add to the soil pollution. Pathogens present in the wastes and excreta contaminate the soil and vegetable crops causing diseases in man and domesticated animals.

Types of Soil Pollution

It is of the following types-

(i) Positive soil pollution

Reduction in the productivity of soil due to the addition of undesirable substances like pesticides, herbicides, fertilisers, etc. is called positive pollution. These pollutants have cumulative effect and kill the soil organisms.

(ii) Negative soil pollution

It is caused by the removal of useful components from soil by erosion, deforestation and improper methods of agriculture.

Control of Soil Pollution

Various measure to control soil pollution are-

1. Transfer stations for bulk shifting of refuse should be constructed in cities and big towns.
2. Pneumatic pipes should be laid for collecting and disposing wastes.
3. Materials like paper, glass and plastics can be recycled.
4. Metals should be recovered from scrap and disposed materials.
5. Use of chemical fertilizers should be reduced by the use of bio fertilizers and manures.
6. Use of pesticides can be reduced by adopting biological control of pests.
7. Use of cattle dung and agricultural wastes in biogas plants should be encouraged.
8. Deforestation can check soil erosion to a great extent.

RADIATION POLLUTION

The radiations from the atomic blasts cause several health hazards. The radiations carry high energy and remove electrons from atoms and attach them to other atoms producing positive and negative ion pairs. Hence, they are known as ionizing radiations. The ionization property of these radiations proves to be highly injurious to the protoplasm. The ionizing radiations of ecological concern are classified as follows:

Corpuscular Radiations

These consist of streams of atomic or subatomic particles, which transfer their energy to the matter they strike.

(i) Alpha particles

These particles are large and travel few centimeters in the air. These cause large amount of local ionization.

(ii) Beta particles

These are small particles characterized by having high velocities. They can travel a few meters in space. These are capable of entering into the tissues for few centimeters.

Since alpha and beta particles have low penetration power they can produce harmful effects only when absorbed, ingested or deposited in or near living tissues.

(iii) Electromagnetic radiations

Electromagnetic radiations include waves of shorter wavelengths. These are capable of traveling long distances and can readily penetrate the living tissue. These include gamma rays. These can penetrate and produce effect even without being taken inside.

Other Types of Radiations

Besides radioactive radiations, some other radiations are also present in the atmosphere.

(i) Neutrons

These are large uncharged particles, which do not cause radiation by themselves, but they produce radioactivity in non-radioactive materials through which they pass.

(ii) X-rays

These are electromagnetic waves very similar to gamma rays, but originate from the outer electron shell of radioactive substances, which are not dispersed in nature.

(iii) Cosmic rays

These are radiations from the outer space, which contain alpha and beta particles together with gamma rays.

Sources of Radiations

The radiations are produced from the radioactive elements, which are known as radionuclides or radioactive isotopes, e.g. Uranium, Radium, Thorium, and Carbon-14. These contribute to background radiation. But isotopes of certain metabolically important elements like Carbon-14, Cobalt-60, Calcium 45, Iodine-131, Phosphorus-32, etc. are not ecologically harmful but are used as tracers. The third category of radionuclides comprises of fission products of uranium and certain other elements. These are cesium, strontium, and plutonium etc.

Biological Effects of Radiation

The effects of radiation have revealed that acute doses are found to be deleterious and may kill the organisms, whereas the increase in radiation in biological environment leads to different kinds of mutations. The effects of Cobalt-60 or Cesium-137 gamma radiations have now been studied on communities and on ecosystems at different places. The research concludes that Irradiations eliminate varieties in species. The sensitivity of cells, tissues and organisms to radiation varies. The cells with larger chromosomes are more sensitive. Herbaceous communities and early stages of succession are resistant than the mature forest.

Nuclear Fall Outs or Radioactive Fall Outs

The atomic blasts not only produce the local ionizing radiations at that time but the radioisotopes produced as a result of explosion enter the atmosphere and continue to fallout gradually over broad geographic areas for a very long time. These are known as nuclear fallout or radioactive fallout. These are dangerous for life as they also produce ionizing radiations.

Biological Effects of Fall outs

The fallout of radionuclides combines with various metals and dust and from colloidal suspension combines with organic compounds to form complexes. The smaller particles of radionuclides adhere tightly to the leaves of plants and produce radiation damage to leaf tissue besides entering the tissues also. Through grazing animals these enter the food chain directly at the primary consumers level. Radionuclides, which combine with organic substances, enter the food chain through producer-trophic level. Therefore, the radionuclides fall out manages to enter the body of all living organisms. Radioactive Strontium-90 poses a health hazard in human beings and other higher vertebrates. It continues to deposit in the bones and causes bone cancer and leukemia. Radioactive Cesium-137 is known to cause irreversible genetic changes in different organisms. The fallout radiations do cause changes in the genetic constitution of organisms, resulting in gene mutations and chromosomal aberrations. Their considerable, doses may kill, cripple and alter the animals and plants in the areas.

Control of Radiation Pollution

Following measures can help in controlling the radioactive pollution:

- (i) Workers in nuclear plants should be provided with nuclear gadgets and safety measures against accidents.
- (ii) Leakage of radioactive elements from nuclear reactors, laboratories, transport, careless handling and use of radioactive fuels should be checked.
- (iii) Level of radiation pollution should be monitored regularly in risk areas.
- (iv) Disposal of radioactive wastes deserves special attention.

NOISE POLLUTION

- Noise pollution can be defined as any disturbing or unwanted noise that interferes or harms humans or wildlife. Although noise constantly surrounds us, noise pollution generally receives less attention than water quality and air quality issues because it cannot be seen, tasted, or smelled.
- Actually, the concept of pollution is limited to nature and resources. However, the noise that tends to disrupt the natural rhythm of life makes for one of the biggest pollutants.
- Noise pollution is unwanted sound, it needs to be controlled to make the workplace comfortable.

Types of Noise:-

External Noise:-

- Atmospheric noise.
- Extraterrestrial noise.
- Industrial noise.
- Man made noise.

Internal Noise:-

- Thermal noise.
- Shot noise.
- Transit time noise.
- Miscellaneous noise.

Sources of noise pollution:

- Noise generated by mining operations is often of higher intensity than natural noise, and mining operations can occur throughout the night. Common mining and mineral processing activities that contribute to noise pollution include overburden removal, drilling and blasting, excavating, crushing, loading and unloading, vehicular traffic, and the use of generators.

Sources of Noise Pollution:-

THESE ARE THE MAIN SOURCES OF NOISE POLLUTION :-

Household sources.

Social Events.

Commercial & Industrial Activities.

Transportation.

Household Sources:-

Gadgets like food mixer, grinder, vacuum cleaner, washing machine and dryer, cooler, air conditioners, can be very noisy and injurious to health.

Others include loud speakers of sound systems and TVs, ipods and ear phones.

Another example may be your neighbour's dog barking all night everyday at every shadow it sees, disturbing everyone else in the apartment.

Social Events:-

Places of worship, discos and gigs, parties and other social events also create a lot of noise for the people living in that area.

In many market areas, people sell with loud speakers, others shout out offers and try to get customers to buy their goods.

It is important to note that whey these events are not often, they can be called "Nuisance" rather than noise pollution.

Commercial & Industrial Activities:-

Printing presses, manufacturing industries, construction sites contribute the noise pollutions in large cities.

In many industries it is a requirement that people always wear earplugs to minimize their exposure to heavy noise.

People who work with noisy equipments are required to wear noise-proof gadgets.

Transportation:-

Aeroplanes flying over houses close to busy airports.

Over ground and Under ground trains, vehicles on roads, these are constantly making a lot of noise.

Biological effect:

- Noise pollution has a negative impact on wildlife species by reducing habitat quality, increasing stress levels, and masking other sounds.
- Chronic noise exposure is especially disruptive for species that rely on sound for communication or hunting
- Additionally, bird species have been shown to avoid areas with noise pollution.
- Reductions in bird populations can in turn negatively impact seed dispersion, affecting ecosystem services and diversity.
- Because much of the noise pollution in natural habitats is caused by vehicle traffic, generators, and development in general, noise pollution often aggravate the problems associated with habitat destruction and fragmentation.

Noise pollution is the reason for cause of nervous disorder, headache, high blood pressure and short memory.

Depression and fatigue, which considerably reduces the efficiency of a person.

Frustration and difficulty in concentration, disturbance of rest, physical and mental fatigue.

Chronic exposure to noise may cause noise-induced hearing loss.

THERMAL POLLUTION

Increase in the normal temperatures of natural waters caused by intervention of human activities.

Major Causes :

- Nuclear power plants
- Hydro-electric power
- Coal fired power plants
- Industrial waste
- Deforestation
- Soil erosion
- Burning of fossil fuels

Nuclear Power Plants:

Nuclear power plants use water as a cooling agent. After the water is used, it is put back into a water supply at 9-20°C warmer.

Hydro electric power plants:

It generates less heat compared to nuclear power plants. But they actively participate in thermal pollution.

Coal Fired power plants : Coal used as fuel. Condenser coils cooled with water from nearby lake/ river. Heated effluents decrease DO of water & damages marine organisms.

Industrial Waste: Discharged water from steam electric power industry using turbo generators. Temperature of receiving water increases by 6-9°C

Soil erosion: Erosion makes the water muddy, which increases the light absorbed.

Possible Solutions:

- Desalination plants
- Less nuclear power
- Prevent soil erosion

Cooling towers: A tower like device in which atmospheric air circulates and cools warm water, generally by direct contact (evaporation).

- **Cooling ponds:** The pond receives thermal energy in the water from the plant's condensers and the energy is dissipated mainly through evaporation. Once the water has cooled in the pond, it is reused by the plant. New water is added to the system ("make-up" water) to replace the water lost through evaporation.

Dr. Shivkumari Panda

UNIT-3

ENVIRONMENTAL MOVEMENTS IN INDIA

ENVIRONMENTAL MOVEMENTS IN INDIA

- The green politics or green movement or environmental movement can be defined as a social movement for the conservation of the environment or for the improvement of the state policy especially inclined towards the environment.
- An environmental movement can be defined as a common or political association, for the safety of the atmosphere or for the enhancement of the state of the environment. The terms like 'green movement' or 'conservation movement' are alternatively used to denote the same.
- The environmental movements favour the **sustainable management** of natural resources. The movements often stress the protection of the environment via **changes in public policy**. Many movements are centred on **ecology, health and human rights**.
- Environmental movements range from the highly organized and formally institutionalized ones to the radically informal activities.
- The spatial scope of various environmental movements ranges from being local to almost global.

GRASSROOT ENVIRONMENTAL MOVEMENT IN INDIA:

- India has a strong tradition of living in harmony with nature since the Vedic times beginning 1700 BC. The 1970's and 80's saw the emergence of major successful grassroots resistance movements such as Chipko, Silent Valley, and Save Narmada movements.
- More such spontaneous movements are failing now in the absence of political support. There is no 'green' party in India which can highlight the issues facing the poor and vulnerable people. Even the mainstream media controlled by the corporate sector does not reach the darkness in which the poor people live.
- Environmental movement is a type of "social movement that involves an array of individuals and groups that perceive a common interest in environmental protection and act to bring about changes in environmental policies and practices"
- The major environmental movements in India can be discussed as follows:

(a) Bishnoi Movement:

This movement was led by Amrita Devi in which around 363 people sacrificed their lives for the protection of their forests. This movement was the first of its kind to have developed the strategy of hugging or embracing the trees for their protection spontaneously. The Bishnoi tree martyrs were influenced by the teachings of Guru Maharaj Jambaji, who founded the Bishnoi faith in 1485 and set forth principles forbidding harm to trees and animals. The king who came to know about these events rushed to the village and apologized, ordering the soldiers to cease logging operations. Soon afterwards, the maharajah designated the Bishnoi state as a protected area, forbidding harm to trees and animals. This legislation still exists today in the region.

(b) The Chipko Movement:

The Chipko is one of the world known environmental movements in India. The Chipko movement focused world attention on the environmental problems of the Alaknanda catchment area in the mid Western Himalayas.

- Here the leaders are Sundarlal Bahuguna, Gaura Devi, Sudesha Devi, Bachni Devi, Chandi Prasad Bhatt, Govind Singh Rawat, Dhoom Singh Negi, Shamsheer Singh Bisht and Ghanasyam Raturi.
- Mr. Bahuguna enlightened the villagers by conveying the importance of trees in the environment which checks the erosion of soil, cause rains and provides pure air. The women of the village of Tehri-Garhwal tied the sacred thread around trunks of trees and they hugged the trees, hence it was called the 'Chipko Movement' or 'hug the tree movement'.
- The main demand of the people in these protests was that the benefits of the forests (especially the right to fodder) should go to local people. The Chipko movement gathered momentum in 1978 when the women faced police firings and other tortures.
- The then state Chief Minister, Hemwati Nandan Bahuguna set up a committee to look into the matter, which eventually ruled in favour of the villagers. This

became a turning point in the history of eco-development struggles in the region and around the world.

(c) Narmada Bachao Andolan:

- The most popular movement in the environmental history of India is the movement against the Narmada River Valley Project by Medha Patkar, Baba Amte, Adivasis, farmers, environmentalists and human rights activists.
- The Narmada is the largest west-flowing river on the Indian peninsula. The Narmada winds its 1,312 km long course to the Arabian Sea through lovely forested hills, rich agricultural plains and narrow rocky gorges in a series of falls. More than twenty one million people live in the valley, mostly in villages.
- Many tribal groups, such as the Bhils and the Gonds, occupy the forested uplands. The Narmada valley is the site of one of the world's largest multipurpose water projects.
- The movement first started as a protest for not providing proper rehabilitation and resettlement for the people who have been displaced by the construction of the **Sardar Sarovar Dam**. Later on, the movement turned its focus on the preservation of the environment and the eco-systems of the valley. Activists also demanded the height of the dam to be reduced to 88 m from the proposed height of 130m. World Bank withdrew from the project.
- The environmental issue was taken into court. In October 2000, the Supreme Court gave a judgment approving the construction of the Sardar Sarovar Dam with a condition that the height of the dam could be raised to 90 m. This height is much higher than the 88 m which anti-dam activists demanded, but it is definitely lower than the proposed height of 130 m. The project is now largely financed by the state governments and market borrowings. The project is expected to be fully completed by 2025.
- Although not successful, as the dam could not be prevented, the NBA has created an anti-big dam opinion in India and outside. It questioned the paradigm of development. As a democratic movement, it followed the Gandhian way 100 per cent.

(d) Silent Valley Movement:

- Silent Valley is one of the important biodiversity hotspot in Southern end of Western Ghats in Kerala in 1976. This silent valley movement was against the decision of the government to construct a dam for hydroelectric power project in silent valley forest led by Sugatha Kumari. In account of several protests and the active role played by women, the forest was declared as a National Park.
- The proposed project was not ecologically viable, as it would drown a chunk of the valuable rainforest of the valley and threaten the life of a host of endangered species of both flora and fauna.
- The Kerala State Electricity Board (KSEB) proposed a hydroelectric dam across the Kunthipuzha River that runs through Silent Valley. In February 1973, the Planning Commission approved the project at a cost of about Rs 25 crores. Many feared that the project would submerge 8.3 sq km of untouched moist evergreen forest. Several NGOs strongly opposed the project and urged the government to abandon it.
- In January 1981, bowing to unrelenting public pressure, Indira Gandhi declared that Silent Valley will be protected. In June 1983 the Center re-examined the issue through a commission chaired by Prof. M.G.K. Menon. In November 1983 the Silent Valley Hydroelectric Project was called off. In 1985, Prime Minister Rajiv Gandhi formally inaugurated the Silent Valley National Park.
- The Kerala Sastra Sahitya Parishad (KSSP) an NGO, was working for three decades among masses of Kerala for growing environmental awareness. The campaign to save Silent Valley turned out to be a public education programme in many respects. The movement in many ways saves the ecosystem of Silent Valley area.

(e) Appiko Movement:

- Appiko Movement is one of the forest-based environmental movements in India. The movement took place in the Uttara Kanada district of Karnataka in the Western Ghats.
- The Appiko movement succeeded in its three-fold objectives include
- **1]** protecting the existing forest cover,
- **2]** regeneration of trees in denuded land, and
- **3]** utilizing forest wealth with proper consideration to conservation to conservation of natural resources.

- The Appiko movement saved the basic life sources for the people- trees like bamboo useful for making handcrafted items which they could sell for earning a few rupees. It also saved medicinal trees for their use by the local people”
- It can be said that the Appiko movement is the southern version of the Chipko movement. The Appiko Movement was locally known as “Appiko Chaluvali”. The locals embraced the trees which were to be cut by contractors of the forest department. The Appiko movement used various techniques to raise awareness such as foot marches in the interior forest, slide shows, folk dances, street plays etc.
- The second area of the movement’s work was to promote afforestation on bare lands. The movement later focused on the rational use of the ecosphere by introducing alternative energy resource to reduce pressure on the forest. The movement became a success. The current status of the project is – stopped.
- The movement created awareness among the villagers throughout the Western Ghats about the ecological danger posed by the commercial and industrial interests to their forest which was the main source of nourishment.

(f) Tehri Dam Conflict:

- One of the most protracted environmental movements in the recent years is the movement against the Tehri Dam.
- Tehri dam gain national attention in the 1980s and the 1990s. The major objections include seismic sensitivity of the region, submergence of forest areas along with Tehri town etc. Despite the support from other prominent leaders like Sunderlal Bahuguna, the movement has failed to gather enough popular support at the national as well as international levels.
- According to the latest reports, the construction of the dam is being carried out with police protection as Sunderlal Bahuguna is sitting on fast unto death. After prime minister’s assurance to review the project, Bahuguna ended his fast but construction goes on, though at a slower pace.

(g) Jungle Bachao Andholan:

- The tribals of the Singhbhum district of Bihar started the protest when the government decided to replace the natural sal forests with the highly-priced teak. This move was

called by many “Greed Game Political Populism”. Later this movement spread to Jharkhand and Orissa.

ROLE OF WOMEN :

- Women Symbolize 'Prakriti' means 'Nature' in Indian Philosophy. She creates and nurtures the creation to bloom. She signifies 'shakti' - the power that drives the system. True, that the status of Indian women has eroded significantly since the Vedic times. Nevertheless, with the spread of education and social reforms 20th century experienced reawakening and a gradual uprise.
- Both women and nature have been considered as subordinates entities by men throughout history, which conveys a close relationship between them. People's approaches to environmental issues may depend on their relationship with nature.
- Women in India are playing a crucial role in protection and conservation of environment. Women in our country have brought a different perspective to the environment debate, because of their different experience base. Poor women's lives are not compartmentalized and they see the issues in a broad and holistic perspective. They understand clearly that economics and environment are compatible. Their experience reveals to them that soil, water and vegetation, necessary for their day-to-day living, requires care and good management. Environmental degradation is related not only to the biosphere alone, but to the social sphere as well.
- The interdependence of women with nature can be evolved from the following observations-
 1. Women are having base and skills for natural resource management.
 2. Women are better managers for natural resources
 3. Women have sensitiveness towards environment.
 4. Women have high ecological consciousness.
- Women are regarded as the best caretakers of environment since ancient days. Women play the most important role in managing environment.

ENVIRONMENTAL MOVEMENTS INITIATED BY WOMEN:

- People in Western countries think they originated the environmental movements without knowing that the villagers in mostly poor and developing countries initiated these movements.

- The direct concern of Indian women with environment protection can be traced long back to 1731 A D , when Amrita Bai of Khejaralli village of Jodhpur District of Rajasthan sacrificed her life for saving the trees of her village She is the founder of the modern “Chipko Movement”. In order to save the trees, she embraced the trees and was cut as per the orders of the then Maharaja. Her three daughters and later her husband came forward and one by one 363 people were killed and the trees remained untouched because of villagers strong resistance. This movement started by Amrita Bai in 1731 A D was revived by Bachni Devi and Gaura Devi of Uttar Pradesh in 1972. They snatched the axe from the wood cutters and warned contractors not to cut the trees. They gave a slogan which means forests bear soil, water and air and the three substances are basic requirements of our life.
- Chipko movement, an environmentalist movement initiated by these Indian women (which also is where the term tree-huggers originated) .This conflict started because men wanted to cut the trees to use them for industrial purposes while women wanted to keep them since it was their food resource and deforestation was a survival matter for local people.The Chipko movement adopted the slogan “ecology is permanent economy”.
- Some commentators have described chipko movement as Women’s movement. It is important to recall the names of Indian women who have fought legal battles in the court of law for environment protection, as Mrs. Sarla Tripathi of Indore, Kinkari Devi of Sirmour District, Krishna Devi of Rajasthan etc .
- Today the torchbearers are Maneka Gandhi, an environmentalist & politician, Medha Patekar, a social worker & environmentalist who are carrying on the crusade of environment protection. But the problem of present day environment protection cannot be solved with the involvement of a few selected groups of women. It requires a global involvement of the entire community of womenfolk. Today, there is need of participation of every woman of every class / every locality, and any woman should not underestimate her role.

ENVIRONMENTAL MOVEMENT IN ODISHA:

- Odisha is one of the poorest states in India. The People’s movement against the establishment of mining industry in Odisha revolves around Jal, Jamin and Jangal

(water land, and forests). These natural resources are the only source of the livelihood of the common people of the region.

- Mines and other large industrial projects in Odisha have meant the large-scale displacement of people, and destruction of the environment. These have led to widespread grass-roots resistance.
- Against this unfair and the development oriented model, strong non-violent environmental movements have come up. These include **Chilika Bachao Andolon, the Baliapal movement in Balasore District and the movements for protecting Gandhamardan Hill in Sambalpur district.**
- Following are some environmental movement in odisha:

(A) **KASHIPUR PEOPLE'S MOVEMENT:**

- Kashipur Block of Rayagada district, a Tribal Scheduled area, has a population of 121,044 ; 61 per cent of them belong to scheduled tribes and 20 per cent to scheduled castes. The area is rich in bauxite. The UAIL plant is proposed to be set up at Doraguda village, about 12 km away from Tikri police station. The plant will directly affect 10,000 people of 24 villages, but the company claims that only 183 families of three villages will be affected.
- The movement was began by Pakrutika Sampada Surakshya Parishad. Every family has composed songs highlighting its involvement in the protest movement. The movement was highlighted by songs, dances and poems sung by women as they work and protect the gate during the years of struggle.

(B) **THE KALINGA NAGAR MOVEMENT AGAINST TATA:**

- The Government of Odisha started the idea of developing a major industrial complex in the mineral rich region of Dangadi, Duburi and Sukinda located in the district of Jajpur. The complex includes about thirteen mineral-based industries such as iron and steel, stainless steel, sponge iron and ferrochrome etc. Iron ore and chromites are the main raw materials for these industries.
- Some companies such as the Tatas, Visa, Jindal, and Mesco have started their projects; a few others are nearing completion.
- The first-time unity among the tribes of the state and the neighbouring states has emerged as a strong political force. The Tata Steel Company has announced a

package according to which, every displaced family would be considered as a family of the Tata Steel and the Company would look into their all-round development.

(C) **THE ANTI-POSCO MOVEMENT:**

- The Pohang Steel Company (POSCO) of South Korean and the Government of Odisha signed an MoU for establishment of a steel plant and construction of captive port for the company near Paradeep of Jagatsinghpur district on 22nd November 2005. The total land requirements for the plant are 4004 Acres. The land issue has given rise to a dispute between local villagers and governments, both central and state. The land concerned is very fertile and double-cropped. Apart from rice and vegetables, the villagers cultivate betel (Paan) leaves on it. The betel cultivation, which is very profitable, is also land-specific: it requires specific soil, climatic conditions and expertise labour. The fishing community of the area is another group that will be affected. The Bay of Bengal is hardly 2 km from the villages. This fishermen community wants to be resettled in a place where they can maintain their traditional craft. The Mining activity for about 600 million tons of iron ore over 1,200 hectares in the Khandahdar forests of Sundergarh will also destroy the forest-based livelihoods of several villages of the Tribal Group.
- The villagers have blocked all the entry roads to their villages, thus foiling any police action. Check gates have been erected, and there is round-the-clock patrolling.

(d) **MOVEMENT AGAINST VEDANTA:**

- Niyamgiri or Niyam Dongar is a hill range, about 250 sq. km. in area. Socio-cultural, anthropological and geographical it is a single hilly; but administratively, it currently comes under three districts of Kalahandi, Rayagada and Koraput. Members of Dongaria kandha tribe (Dongaria means hill people) depends on Niyamgiri for sustenance. A Dongaria Kandha, must reside in Niyamgiri and possess land there. Dongaria kandha have a distinctive heritage, with their dress style, mode of living, indigenous skills, cultural pattern and social relation with nature and forest.
- Niyamgiri hills receive heavy rainfall every year and drought is unheard of in this area.

STATE POLLUTION CONTROL BOARD:

- It functions under the Water Act, 1974 and Air Act, 1981, **to advise the State Government on any matter concerning the prevention or manage of water and air pollution.** To collect and disseminate information relating to water and air pollution and the prevention, control or abatement thereof.
- The board conducts environmental assessments and research of the state. It works on the basis of the following points:
 - Pollution assessment (survey and monitoring).
 - R&D and laboratory management.
 - Development of standards and guidelines for industry specific emissions and effluents standards
 - Training
 - Information database management and library
 - Pollution control technology
 - Pollution control enforcement
 - Mass awareness and publications
 - Hazard waste management

CENTRAL POLLUTION CONTROL BOARD:

- The **Central Pollution Control Board (CPCB)** of India is a constitutional establishment under the Ministry of Environment, Forest and Climate Change having head office in New Delhi. It was established in 1974 under the Water (Prevention and Control of pollution) Act, 1974. The CPCB is also entrusted with the powers and functions under the Air (Prevention and Control of Pollution) Act, 1981.
- It serves as a field formation and also provides technical services to the Ministry of Environment and Forests under the provisions of the Environment (Protection) Act, 1986. It Co-ordinates the activities of the State Pollution Control Boards by providing technical assistance and guidance and also resolves disputes among them
- The current acting chairman is Shri Naresh pal Gangwar (June 2021) and the Member Secretary is Dr. Prashant Gargava.
- It has seven zonal offices and 5 laboratories. The board conducts environmental assessments and research. It is responsible for maintaining national standards under a

variety of environmental laws. It has responsibilities to conduct monitoring of water and air quality and maintains monitoring data. The agency also works with industries and all levels of government in a wide variety of voluntary pollution prevention programs and energy conservation efforts. It advises the central government to prevent and control water and air pollution. It also advises the Governments of Union Territories on industrial and other sources of water and air pollution.

- **Central Pollution Control Board (CPCB)** along with its counterparts with the State Pollution Control Boards (SPCBs) are responsible for implementation of legislation relating to prevention and control of environmental pollution.

Dr. Shivkumari Panda

UNIT-4

NATURAL RESOURCES

CONSERVATION OF NATURAL RESOURCES:

- **A careful maintenance and protection of something particularly natural resources** or planned management of a natural resource to prevent exploitation, destruction, or neglect water conservation wildlife conservation is called as conservation.
- There are broadly **two types** of conservation methods namely in-situ and ex-situ conservations.
 - (a) In-situ: Conservation of habitats, species and ecosystems where they naturally occur. The conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings.
Example- National parks, biosphere reserves, parks, sanctuaries.
 - (b) Ex-situ: The conservation of elements of biodiversity out of the context of their natural habitats is referred to as ex-situ conservation. Zoos or zoological gardens or zoological parks in which animals are confined within enclosures or semi-natural and open areas, displayed to the public, and in which they may also breed.
Example- Zoo, aquarium, seed banks, botanical gardens, etc.

MANAGEMENT OR CONSERVATION OF WILD LIFE :

- Wildlife conservation covers all human activities and efforts directed to protect wild animal from extinction or destruction. It involves both protection and scientific management of wild species. Wildlife plays an essential role in the ecological and biological processes that are yet again significant to life.
- Wildlife management is the management process influencing interactions between wildlife, its habitats and people to achieve predefined impacts. It attempts to balance the needs of wildlife with the needs of people using the best available science.
- There are three interrelated parts when we talk about wildlife management. This is the so-called three-legged stool: the animal, the habitat and humans.

- Conservation of wildlife can be done by following manner :
 1. Adopt from wild animals to wild places, there's an option for everyone.
 2. Volunteer. If you don't have money to give, donate your time.
 3. Visit. Zoos, aquariums, national parks and wildlife refuges are all home to wild animals.
 4. Donate.
 5. Speak Up.
 6. Buy Responsibly.

SOIL EROSION AND CONSERVATION:

Soil erosion is the detachment, transport & deposition of soil particle on land surface - termed as loss of soil. Soil erosion and land degradation together, constitute one of the major problems that disturb the ecological balance of the world.

- Soil loss is of interest primarily on-site effect of erosion such as loss of crop productivity. Sediment generated by erosion processes are prime carrier of agricultural chemicals that pollutes stream or lakes.
- Soil erosion deteriorates soil quality & reduces productivity of natural agricultural & forest ecosystem.
- Soil erosion deteriorates quality of water. Increased sedimentation causes reduction of carrying capacity of water bodies.
- Soil erosion is the loosening and displacement of topsoil particles from the land. Soil erosion is a natural process that occurs on all lands. Soil erosion may occur at a slow or fast rate. Soil erosion in nature may be
 - (a) A slow process (or geological erosion)
 - (b) A fast process promoted by deforestation, floods, tornadoes, or other human activities.
- Soil erosion is classified on the basis of the physical agent responsible for erosion. The various types of soil erosion are consequently referred to as:
 - (a) Water erosion
 - (b) Wind erosion

(a) Water erosion

Running water is one of the main agents, which carries away soil particles. Soil erosion by water occurs by means of raindrops, waves, or ice. Soil erosion by water is termed differently according to the intensity and nature of erosion.

(i) Raindrop erosion (ii) Sheet erosion (iii) Rill erosion (iv) Stream bank erosion (v)

Erosion due to landslides

(i) Raindrop erosion

- Raindrops behave like tiny bombs when falling on exposed soil, displace soil particles and destroy soil structure.
- Average size of a raindrop is approximately 5 mm in diameter falling through the air hits the soil at a velocity of 32 km/hr.
- Presence of vegetation on land prevents raindrops from falling directly on the soil thus erosion of soil in areas covered by vegetation is prevented.

(ii) Sheet erosion

- The detachment and transportation of soil particles by flowing rainwater is called sheet or wash off erosion.
- This is a very slow process and often remain unnoticed.

(iii) Rill erosion

- In rill erosion finger like rills appear on the cultivated land after it has undergone sheet erosion.
- These rills are usually smoothened out every year while forming.
- Each year the rills slowly increase in number become wider and deeper.
- When rills increase in size, they are called gullies. Ravines are deep gullies.

(iv) Streambank erosion

- The erosion of soil from the banks (shores) of the streams or rivers due to the flowing water is called bank erosion.

(V) Landslide

- A sudden mass movement of soil is called a landslide. Landslides occur due to instability or loss of balance of land mass with respect to gravity.

Consequences of water erosion

- Erosion removes the most fertile part of the soil. The less fertile subsoil is left.
- The fine particles of the topsoil which contain the bulk of nutrients and organic matter needed by the plants are lost from soil erosion.
- Erosion may result in the removal of seeds or seedlings so that the soil becomes bare. Bare soil is more vulnerable to erosion both by wind and water.
- Removal of seeds and seedlings reduces the ability of soil to store water.
- Sheet, rill, gully, and stream bank erosion also cause siltation of rivers, streams, and fields.
- Deposition of silt results in damage of crops and pastures, and sedimentation of water bodies like streams, dams, reservoirs, etc.
- Sedimentation of water bodies deteriorates water quality and damage aquatic habitats and organisms.
- Coastal erosion causes the adjoining land to become covered by sand.

(b) Wind erosion

Soil erosion by wind is more common in areas where the natural vegetation has been destroyed. Such conditions occur mainly in arid and dry areas along the sandy shores of oceans, lakes, and rivers.

The loose soil particles are blown and transported from wind by following three ways:

- (i) Siltation:** blown by the wind in a series of short bounces.
- (ii) Suspension:** transported over long distances in the form of suspended particles.
- (iii) Surface creep:** transported at ground level by high-velocity winds.

Consequences of wind erosion

- Wind erosion removes the finer soil material including organic matter, clay, and silt, in a suspension (colloidal) form and leaving behind coarser, less fertile material.

- The productive capacity of the soil is lost as most of the plant nutrients which remain attached smaller colloidal soil fraction are lost.
- Wind erosion also damages roads and fertile agricultural fields by depositing large quantities of air blown soil particles.

Conservation of soil :

- The protection and conservation of forest resources are not only desirable but are also necessary for the economic development of a nation and the maintenance of environmental and ecological balance from local through regional to global levels.
- The first and foremost task to conserve forests is to protect the existing forests from the heartless and uncontrolled cutting of trees by greedy economic men. This task may be achieved through government legislation and by arousing public interest in the importance of the forest resources.
- The National Forest Policy of India has also laid down certain basic principles for proper management and conservation of the forest resources of the country such as –
- Classification of forests according to functional aspects into protected forests, reserved forests, village forests, etc.
- Expansion in the forest cover by planting trees in order to ameliorate the physical and climatic conditions for the welfare of the people,
- Provision for ensuring progressive increasing supplies of fodder for animals and timber for agricultural implements and firewood to local inhabitants nearer to the forests,
- Opposition to the careless extension of agricultural land at the cost of forest land,
- Extension of the forested area by the massive plan of tree plantation on a large-scale at war-footing so as to bring 33 percent of the country's geographical area under forest etc.
- An important measure of effective conservation of natural forest is to adapt the scientific and judicious method of cutting of trees by following a selective approach. Only mature and desired trees should be cut and unwanted trees of low economic value should be avoided.

ENVIRONMENTAL LAWS

- There are six laws associated to environmental protection and wildlife. These are: **The Environment (Protection) Act, 1986;**
- [The Forest \(Conservation\) Act, 1980;](#)
- [The Wildlife Protection Act, 1972;](#)
- [Water \(Prevention and Control of Pollution\) Act, 1974;](#)
- [Air \(Prevention and Control of Pollution\) Act, 1981](#)
- [The Indian Forest Act, 1927.](#)

Water (Prevention and Control of Pollution) Act, 1974 :

- The Water (Prevention and Control of Pollution) Act was performed in 1974 to provide for the prevention and **control** of water pollution, and for the maintaining or restoring of wholesomeness of water in the country.
- The WATER (PREVENTION AND CONTROL OF POLLUTION) ACT, 1974 defined terms like pollution, sewage effluent, trade effluent, stream, and boards.
- The salient features of WATER (PREVENTION AND CONTROL OF POLLUTION) ACT, 1974 are as follows:
 - a. The Act provides for maintenance and restoration of quality of all types of surface and groundwater.
 - b. **Controlling bodies:** It provides for the establishment of Central and State Boards for pollution control.
 - c. **Functions:** The Act assigns powers and functions to these Boards to control pollution.
 - d. **Authority to board:** The Central and State Pollution Control Boards are given comprehensive powers to advise, coordinate, and provide technical assistance for the prevention and control of water pollution.
 - e. **Audit:** The Act has provisions for funds, budgets, accounts, and audit of the Central and State Pollution Control Boards.
 - f. **Prohibition:** The Act prohibits disposal of any poisonous, noxious or polluting matter to the flow of water in a stream. However, dumping of any material into a stream for the purpose of reclamation of land is not considered an offense.

- g. **Penalties:** The Act provides for severe and deterrent punishments for violation of the Act which includes fine and imprisonment.

Air (Prevention and Control of Pollution) Act, 1981:-

- The Air (Prevention and Control of Pollution) Act, 1981 was an Act of the Parliament of India to control and prevent air pollution in India. It was amended in 1987.
- The Government passed this Act in 1981 to clean up our air by controlling pollution.
- It states that sources of air pollution such as industry, vehicles, power plants, etc., are not permitted to release particulate matter, lead, carbon monoxide, sulfur dioxide, nitrogen oxide, volatile organic compounds (VOCs) or other toxic substances beyond a prescribed level.
- The notable points from this act are as follows:
 - (a) To provide for the prevention, control and abatement of air pollution
 - (b) To provide for the establishment of central and State Boards with a view to implement the Act (Central Pollution Control Board and State Pollution Control Board)
 - (c) To confer on the Boards the powers to implement the provisions of the Act and assign to the Boards functions relating to pollution.

Environmental (Protection) Act of 1986

- Environment Protection Act, 1986 is an Act of the Parliament of India.
- In the wake of the Bhopal Tragedy, the Government of India enacted the Environment Protection Act of 1986 under Article 253 of the Constitution Passed in March 1986, it came into force on 19 November 1986.
- The Act is an “umbrella” for legislations designed to provide a framework for Central Government, coordination of the activities of

various central and state authorities established under previous Acts, such as the Water Act and the Air Act.

- In this Act, the main emphasis is given to “Environment”, defined to include water, air and land and the inter-relationships which exist among water, air and land and human beings and other

The objective of the Act

- The purpose of the Act is to implement the decisions of the United Nations Conference on the Human Environment of 1972, in so far as they relate to the protection and improvement of the human environment and the prevention of hazards to human beings, other living creatures, plants and property.
- It is associated with the planning and execution of a nation-wide programme for the prevention, control and abatement of environmental pollution.
- It makes the inspection of any premises, plant, equipment, machinery, manufacturing or other processes, materials or substances and giving, by order, of such directions to such authorities, officers or persons as it may consider necessary to take steps for the prevention, control and abatement of environmental pollution.
- It observes the establishment or recognition of environmental laboratories and institutes to carry out the functions assigned to such environmental laboratories and institutes under this Act.

NATURAL DISASTERS AND THEIR MANAGERMENTS :

- By definition “disaster” means a tragedy, a mishap, a calamity or grave danger event occurred in an area and affected life and properties. It may be arising from natural or man-made causes, or by accident or due to negligence.
- This sudden event results in the substantial loss of life or creates much suffering to humans and other life. It also includes much damage to, and destruction of, property, or damage to, or degradation of the environment.
- A disaster is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.
- Dozens of types of disasters happen all over the world at one time or the other. It is necessary to have an understanding of the types of disasters, their causes, characteristics and impacts. The purpose of this lesson is to know about the following aspects: **1)** Types and Effects of Disasters **2)** Earthquakes, Tsunamis and Volcanic eruptions **3)** Floods, Cyclones and Hurricanes **4)** Landslides, Bushfires and Droughts **5)** Epidemic, Accidents and Civil unrests. It is important to analyze the effects of disasters in relation to their own local circumstances.
- Different types of disasters are distinguished in terms of their nature and extent of impacts. The following are the major types of disasters that are commonly encountered:
 - Disasters like earthquakes, hailstorms, avalanches, landslides, etc. occur quite suddenly.
 - Similarly, floods and cyclones occur with some element of warning yet their occurrence is confined to a short duration.

- Drought, on the other hand, spans over a much longer time-frame and its adverse impact will be on the economic activities of people and on the life of an area. The effects are more of a long-lasting nature.
- Natural disasters may be broadly grouped into major and minor types depending upon their potential to cause damage to human life and property.
- The disasters like earthquakes, volcanic eruptions, droughts, floods and cyclones could be regarded as major types. The disasters like hailstorms, avalanches, landslides, fire accidents, etc. whose impact is localised and the intensity of the damage is much less than the others may be categorized as minor disasters.
- Minor disasters like hailstorms, avalanches, landslides and forest fires also occur without any appreciable degree of warning. Almost all of them cause damage to properties and lives. However, areas prone to be affected by such disasters could be identified. Certain precautionary measures could also be taken in the context of potential threat requiring general awareness and preparedness for appropriate responses on the part of the local administration.
- In addition to these, wartime civil defense or protection measures are also coming under this concept.

General Effects of Disasters

- The typical effects of disasters may be one or more of the following: Loss of life, Injury, Damage and destruction of property, Damage and destruction of plantations and crops, Disruption of production, Disruption of lifestyle, Disruption of transport, Loss of livelihood and occupation to people, Disruption to essential services like electricity, water supply and gas supply, Damage to national infrastructure, Disruption of communication and other networks, Disruption to government systems

and schemes, Shortage of food resources, Spreading of diseases, National economic loss, and Sociological effects.

- Some of the natural disasters are as follows:
- **Earthquakes,:** Earthquakes are shaking of the earth's crustal blocks due to the movement of plates and their rocks along a fault or plate boundaries. The rocks under stress accumulate strain energy over a period of time. When the stress exceeds the strength of the rocks, then the rock gets broken. The strain energy is released as seismic waves. The longer that energy is stored up and is maintained without release, the more likely that a strong earthquake will occur. For an earthquake to occur, there will be no warning. However, after the occurrence of a major earthquake, secondary shocks may indicate of a further earthquake. The speed of onset of an earthquake may be usually sudden. For this purpose, the earthquake-prone areas are generally well identified and defined/demarcated. Major impacts and effects come mainly from land movement, fracture, or slippage. Due to lack of warning, a severe loss to life occurs during earthquakes.
- **Tsunamis:** Tsunamis are huge seismic sea waves that are generated by the earthquakes originating under the sea. If the earthquake displaces the sea surface, waves are generated that can grow while moving over the sea surface. The main characteristics of tsunamis are: The velocity of the wave depends on the depth of water where the seismic disturbance occurs, the initial wave velocity may be as high as 900 kilometer per hour (kph), slowing to approximately 50 kph as the wave strikes the land, the warning time depends on the distance from the point of wave origin. A tsunami can also cause flooding; saltwater contamination of crops, soil, and water supplies. Destruction and damage to buildings, structures, and all shoreline vegetation.

- **Volcanic Eruptions:** Sudden eruptions of volcanoes can create a lot of damages. Volcanoes which are likely to constitute a disaster threat are internationally well documented and, in many cases, monitored for possible activity. Usually, therefore, major eruptions can be predicted. Volcanic blast can destroy structures and environmental surrounds, and also cause fires, possibly including forest fires. Land surface cracking, resulting from volcanic explosion, may affect buildings and other structures. Lava flow can bury buildings and crops. It may also cause fires and render land unusable.
- **Floods:** Floods have the greatest damage potential when compared to the other natural disasters, over the environment. Floods are also considered to be both social and economic disasters. A flood is a body of water overflowing the river channels. Floods are associated with some extreme natural events that happen over a drainage basin. Floods are defined as relatively high flows which overtake the natural channels provided for the runoff. The level at which water flows along streams is called as the river stage. During flood, the stage of a river is high. The river water during a flood usually overflows its banks.
- **Cyclones:** A Cyclone is defined as any large system of winds that rotates about a centre of low atmospheric pressure with a speed over 100 kmph. This swirling action happens in a counter clockwise direction north of the Equator and in a clockwise direction to the south. The diameter of the ring of swirling winds may range from 500 to 1500 km. It is a highly dynamic movement and the direction of its transgression is not precisely predictable. Anticyclones have a flow opposite to that of cyclones--i.e., an outward-spiraling motion, with the winds rotating clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere. They are usually not as strong as the cyclonic storms and bring no

rainfall. The tropical cyclones are called as hurricanes in the Atlantic and Caribbean.

- **Landslides:** Landslide is a general term used to describe the downslope movement of soil, rock, and organic materials under the effects of gravity and also the landform that results from such movement. Landslides can be classified into different types on the basis of the type of movement and the type of material involved. The material in a landslide may be either a **rock** or **soil** (or both). The latter is described as **earth** if mainly composed of sand-sized or finer particles and **debris** if composed of coarser fragments. The type of movement describes the actual internal mechanics of how the landslide mass is displaced: **fall, topple, slide, spread, or flow.**
- **Droughts:** This is arising due to recurring failure of monsoons. The area affected by drought becomes dry and waterless. Food security will be affected. Water scarcity prevails everywhere. People die due to hunger.

Disaster management

- Disaster management is the only way to reduce the effects of all these hazards. India has efficiently handled the recent cyclones and reduced the effects to bare minimum level.
- It was possible due to advance planning. Advance planning is always needed to keep the items of emergency for any disaster.
- Guidelines are also to be prepared in the form of booklets and circulated to the educated individuals.
- Awareness camps are to be organised for public. Training is yet another initiative. Training involves the
 - duties and responsibilities,
 - efforts to sustain,
 - role of employees/NGOs,

- risks, errors, behavioural patterns,
 - recovery techniques,
 - communication channels,
 - safety rules,
 - Priorities and security measures.
 - Knowledge of water quality,
 - sanitation,
 - first aid,
 - emergency medicines,
 - electricity controls and
 - Gas usage is needed.
 - Evacuation, reporting and alert procedures are the other major initiatives.
 - Proper insurance policies, alterations to existing buildings, changes in business locations and other resources are to be planned, for future disaster mitigation.
-