ENVIRONMENTAL EDUCATION

UNIT I - ENVIRONMENTAL EDUCATION

Concept and Meaning of Environment – Components of Environment – Types of Environment – Environmental Awareness- Environmental Attitude – Ecological Sensitivity – Environmental Education: Focal aspects of Environmental Education – Goals of Environmental Education – Objectives of Environmental Education – Need and Importance of Environmental Education – Scope of Environmental Education.

CONCEPT AND MEANING OF ENVIRONMENT

- The word Environment derives from the French word environner, which means to surround or encircle.
- Our environment consists of all the living and nonliving things in our immediate vicinity. Examples include Water, Animal, and Human
- Environment is a collection of physical, chemical, biological, and social components that have direct or indirect negative effects on living organisms and human activities over the short or long term.
- Environment can also refer to the sum of all external factors that impact human life. The environment encompasses the human, social, political, economic, and physical environments.

Webster's ninth new college dictionary defines environment as the "circumstances, objects or conditions by which one is surrounded".

The Encyclopedia Britannica defines environment as the entire range of external influence acting on an organism both physical and biological".

TYPES OF ENVIRONMENT AND ITS COMPONENTS

Two kinds of Environment

(i) Natural Environment

Consists of air, water, land, forests, mountains, radiations, living organisms

(ii) Man-made Environment

Artificial environment created by man.

Natural environment further classified into

(i) Biotic or living component
(ii) Abiotic or physical component

COMPONENTS OF BIOTIC ENVIRONMENT

(i) Flora - consists of general species of vegetation like plants, grass, bushes, forests etc.
(ii) Fauna – Consists of mammals and other species like birds, reptiles, fishes, sharks, whales etc.,

COMPONENTS OF ABIOTIC ENVIRONMENT

Atmosphere

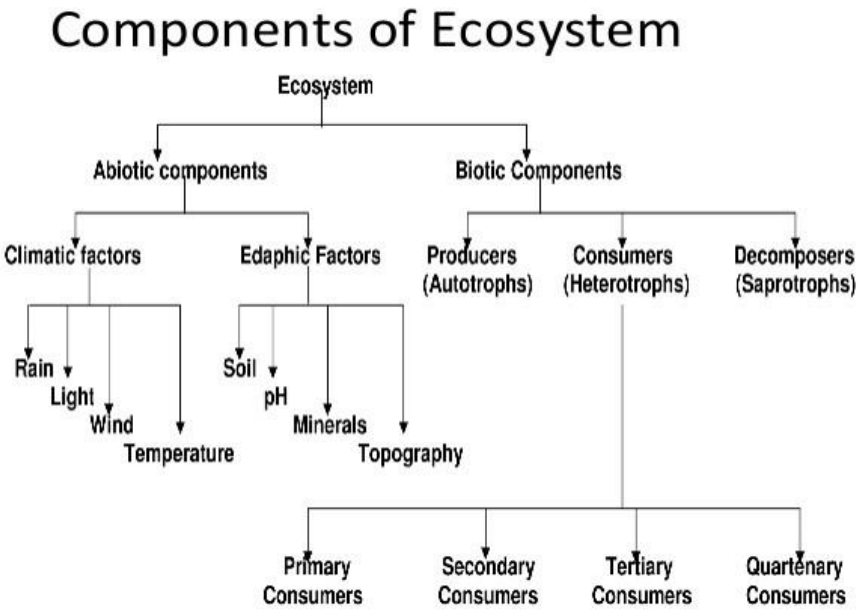
- The thick gaseous layer surrounding the earth.
- It spreads up to 300 km. above the earth's surface.
- Apart from gases there are water vapor, industrial gases, dust and smoke particles in suspended state, microorganism etc.

Lithosphere

- The word lithosphere originated from a Greek word mean "rocky" + "sphere"
- solid outmost shield of the rocky planet.
- The Core which is around 7000 kilometers in diameter and is situated at the Earth's center.
- The Mantle which environs the core and has a thickness of 2900 kilometers.
- The Crust floats on top of the mantle and is composed of basalt rich oceanic crust and granitic rich continental crust.

Hydrosphere

- The hydrosphere includes all water on or near earth surface and includes oceans, lakes, rivers, wetlands, icecaps, clouds, soils, rock layers beneath surface etc.
- water exist in all three states: solid (ice), liquid (water), and gas (water vapor)
- 71%of planet surface is covered with water



ENVIRONMENTAL AWARENESS

- Comprises of a human's perception and cognitive reaction to a condition or an event.
- Defined as to help the individuals and social groups to acquire a basic understanding of and sensitivity towards environment and its associated problems.
- Provides understanding and competence to recognize resources and interdependence between physical and biological components of environment for growth and development.

According to the Belgrade International Workshop (1975), environmental awareness may provide power and understanding to:

- Recognize the interdependence among materials into physical environment, plant and animal life for survival, growth and development,
- Take decisions individually and collectively and initiate actions for social, cultural and economic survival, growth and development and for conservation of nature and natural resources,
- Identify human, material, space and time resources in the environment,
- Recognize ways of making effective use of environmental resources for social, economic and cultural survival, growth and development, and
- Take decisions for the effective use of resources, recognize special significance

of conservation of natural resources and initiate or support community efforts for the purpose.

- **According to the United Nations Conference of Human Environment at Stockholm (1971),** environmental awareness may be developed by:
- Identifying, analyzing and understanding the needs and problems of personal life including health, vocation, etc.,
- Social life at different levels, namely, family, caste, community, religion, town or village life, state and country, and
- National life including civic, economic, etc.

Environmental awareness may be affected by

(i) Intelligence,
(ii) Maturity,
(iii) Sincerity,
(iv) Attitude,
(v) Values,
(vi) Participation in co-curricular activities,
(vii) Media of mass communication,
(viii) Literacy, and
(ix) Distance education

The United National Conference of Human Environment (Stockholm, June 1971) was a major event for those concerned with the quality of the world's environment.

Environmental Awareness may be developed by:

- Identifying; analyzing and understanding the needs and problems of personal life including health, vocation, etc.
- Social life at different levels viz., family, caste, community, religion, town or village life, state and country.

(iii) National life including civic, economic, etc.

Role of Education in Developing Environmental Awareness

- Organizing numerous national and international seminars and conferences on the topic of "environment."

- Recognizing the critical need for an introduction to "environmental education,"
- Involvement and identification with a field study based on affective development, such as emotions, attitudes, and values.
- In addition to dispensing information and knowledge, teachers are expected to manage teaching-learning situations.
- Additionally, classroom organisation has been drastically altered.
- Teachers should utilise group activities and tolerate a certain amount of active participation and talking in class.
- Change must also be made to the notion of classroom discipline.
- In addition, classroom activities must be geared toward the environmental approach to teaching learning strategies.
- Educators should prioritize the children's positive growth over their acquisition of bookish knowledge.
- Periodically, the teacher should show them documentary films at school.
- Plan an excursion to observe and appreciate nature and natural resources.
- The instructor should recommend that students view. To watch television, to read newspapers, and to listen to the radio news regarding the environment.
- Should display environmental teaching aids such as graphs and models of the environment that will be severely polluted and degraded.

ENVIRONMENTAL ATTITUDE

- There is a well-defined object of reference for an attitude. For instance, a person's views on a profession, a sport, or music are attitudes.
- A person's degree or intensity of attitude can range from extremely positive through a gradient to extremely negative (Freeman, 1968).
- Attitude comes from judgements.
- It develops according to the ABC model, i.e., emotion, behavioural modification, and cognition.

Procedures in development of environmental attitude

- Personality of the teacher
- Effective teaching methods,

- Students' curiosity is satisfied through the use of appropriate techniques.
- Utilization of literature on the environment,
- Environmental consciousness among young students, and
- Facilitation of environmental education through nature walks, poster displays, festival planning, etc.

Environmental attitude may be affected by the following factors

(i) Mass communication,

(ii) Personal contacts,

(iii) Schooling,

(iv) Personal experience,

(v) Culture, and

(vi) Personality and attitude change

ECOLOGICAL INTELLIGENCE

- Ecological intelligence is distinct from eco-literacy and biomimicry.
- Ecological Intelligence is the expression of nature's relational creativity in human thought and action.
- Ecological Intelligence transcends ethnicity and gender and resides in all.
- Ecology is the study of natural relationships. Therefore, Ecological Intelligence is synonymous with the inventiveness of natural relationships.
- Ecological Intelligence examines the profound environmental, social, and health repercussions of everyday consumer decisions.

Daniel Goleman defines "ecological intelligence" as individuals' ability to apply what they learn about their impact on the environment to make changes in their behavior and live more sustainably.

ECOLOGICAL SENSITIVITY

- Ecological Sensitive Areas or Ecologically Sensitive Zones are areas around Wildlife Sanctuaries, National Parks, and Protected Areas that the Ministry of Environment, Forests, and Climate Change has identified as requiring additional protection due to their sensitivity.
- Ecological sensitivity is crucial because it is a fundamental characteristic of many

organisms.

- It allows an organism to adapt to varying environmental conditions.
- Environmental Sensitivity levels frequently vary considerably from person to person, with some being more and others being less sensitive to the same conditions.
- It is caused by exposure to chemicals like solvents and pesticides, as well as biological contaminants like mould.
- Low-level, chronic exposure to hazardous substances. Low-level chronic exposure, both at work and at home.

ENVIRONMENTAL EDUCATION

- Environmental Education is the process of fostering environmental awareness, concern, and knowledge in individuals.
- Learn how to sustainably preserve, conserve, and utilise the environment for the benefit of present and future generations.
- Environmental education focuses on topics such as how the natural environment functions and how humans should manage the ecosystem to sustain the environment.
- It provides the skills and knowledge necessary to manage the associated challenges.
- The primary objective of environmental education is to impart knowledge, raise awareness, instil a caring attitude, and impart the skills required to manage the environment and environmental challenges.
- In 1972, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) hosted the Stockholm Conference on the Human Environment, which elevated the importance of environmental education on a global scale. UNESCO launched the International Environmental Education Programme shortly after the conference (IEEP)
- It is a process that aims to develop responsible actions necessary for the preservation, conservation, and improvement of the environment and its components by increasing environmental awareness and comprehension.

FOCAL ASPECTS OF ENVIRONMENTAL EDUCATION

- Environmental education is a process that enables individuals to investigate

environmental issues, apply problem-solving energy, and take action to better the environment.

- Individuals acquire a deeper comprehension of environmental issues and the ability to make informed and accountable decisions.
- Exposing students to the real world, nature, and social environment in which they live demonstrates concern for reality.
- Permit students to analyse, evaluate, and draw inferences regarding environmental problems and issues.
- Enable students understand environment issues and take positive environmental action.
- Develop the environmental action skills of students in order to facilitate humanity's journey towards sustainability.

GOALS OF ENVIRONMENTAL EDUCATION

The main goal of environmental education is to

- develop a global concern and awareness for the global environment and its associated problems.
- require a commitment to work individually and collectively towards the resolution of existing issues and the implementation of preventative measures.

The specific goals of environmental education are

- To improve environmental quality
- To increase public understanding of environmental issues and conservation
- To foster an environment in which individuals participate in decision-making and acquire the skills necessary to evaluate developmental programmes.

OBJECTIVES OF ENVIRONMENTAL EDUCATION

- Awareness: to assist social groups and individuals in developing an awareness and sensitivity towards the global environment and its associated issues.
- Knowledge: "to assist social groups and individuals in gaining diverse experiences and a fundamental understanding of the environment and its associated issues."
- Attitudes: to assist social groups and individuals in acquiring a set of values and a concern for the environment, as well as the motivation to participate actively in environmental improvement and protection.

- To assist social groups and individuals in acquiring the skills necessary to identify and resolve environmental issues.
- Participation: Provide opportunities for social groups and individuals to be actively involved at all levels in the resolution of environmental problems.

Objectives of Environmental Education at Primary Level

- To be aware of and comprehend true environmental aspects in general.
- To know and comprehend the interaction between mammals, between humans and their environment, and between various environmental elements and components.
- Develop an appreciation, awareness, and sensitivity for the causes and efforts of the class that occur continuously in society and the world around us.
- To cultivate and develop skills in thinking, reasoning, inquiring, evaluating, and making decisions regarding humans and the surrounding world.
- Instill the mindset of using one's knowledge and abilities to solve problems and issues pertaining to individuals, society, and the environment.
- To develop values and attitudes regarding the need and necessity of living in harmony within the context of a diverse society.

Focus

- Humans, animals, and plants all experience a variety of life processes.
- Humans, animals, and plants are constantly adapting to their environment.
- Humans alter and modify the environment with great care in order to satisfy their numerous needs for survival.
- Identification between the human and natural worlds, as well as between environmental elements that give rise to various phenomena affecting humans.
- Through careful planning and processing, society would take measures to preserve the environment and natural balance.

Objectives of Environmental Education at Secondary Level

- Environmental education should be taught as an integrated science that incorporates environmental education concepts.

Objectives

- To emphasise the practical application of science.
- To develop a scientific attitude in student.

- To foster an environment that encourages greater reliance on scientific principles and practices.
- To introduce students to a variety of natural phenomena.
- To develop a perspective that emphasizes the methodology employed in various scientific disciplines.

Aspects of Environmental Education Emphasized at Higher Secondary Level

- Population - growth, problems arising from unplanned population growth.
- Land use, land reclamation, and conservation of land and soil.
- Resources - resource uses, resource conservation, and resource recycling.
- Food and Nutrition - Food production, food adulteration, food preservation, etc.
- Causes of wildlife, plant, soil, and water conservation, as well as the preservation of other nonrenewable natural beauty.
- Pollution - Water, air, and soil pollution, noise pollution, insecticide and other chemical pollution, and waste disposal.
- Individual, family, national, and social health and hygiene, as well as health hazards, etc.
- Humans and Nature - Additional elements of atmosphere, environmental quality, and the future of the planet.

Constraints to Implementing Environmental Education

- Rigid Specialization.
- Environmental education's inter-disciplinary value is intricate.
- High student-to-teacher ratios are required to organise student participation programmes.
- Insufficiency of certified environmental educators.
- Inadequate availability of equipment, supplementary materials, and reference materials.
- A disposition to resist change.

Aims of Environmental Education

EE has two main aims

- Provide diverse professional groups with the knowledge necessary to develop a sense of environmental responsibility and rational resource utilisation. International

Journal of Current Research and Modern Education (IJCRME) The second objective is to use these knowledge and skills to sustainably preserve, conserve, and utilise the environment for the benefit of current and future generations.

NEED AND IMPORTANCE OF ENVIRONMENTAL EDUCATION

- The necessity to protect the environment, and thus the justifications for environmental education, result from the following:
- Environment is the foundation of all life, and as such, it merits proper care and management.
- Numerous problems that could pose a threat to human existence could develop if the environment is continuously threatened.
- The environment is a part of our cultural heritage that should be preserved for future generations.
- Some environmental resources are irreplaceable and should be managed sustainably in order to prevent the extinction of certain environmental components, such as plants and animals.
- In order to promote healthy living, it is necessary to improve the sanity and beauty of our environment.
- The environment is an integral component of nature and must be preserved for its own sake.

IMPORTANCE OF ENVIRONMENTAL EDUCATION

Environmental study is founded on a holistic perspective of diverse environmental systems. It aims to equip citizens with the knowledge and skills necessary to conduct scientific research and identify practical solutions to pressing environmental issues. The citizens gain the ability to analyse environmental parameters such as aquatic, terrestrial, and atmospheric systems, as well as their interactions with the biosphere and astrosphere.

Importance

- The global population is growing at an alarming rate, particularly in developing nations.
- The earth's natural resource endowment is limited.
- Advanced methods and techniques are used to exploit natural resources.

- The resources are overexploited, and no consideration is given to leaving them for future generations.
- Unplanned exploitation of natural resources causes all types and levels of pollution.
- Pollution and environmental degradation have a negative impact on the health of all living things on earth, including humans.
- People should take collective responsibility for the deteriorating environment and initiate the necessary steps to save the planet.
- Education and training are required to prevent biodiversity loss and extinction of species.
- Combined with industries, urban areas are major sources of pollution.
- Increase the number and size of protected areas so that the wild life is protected at least in these locations.
- The study enables people to comprehend the complexities of the environment and the need for people to adapt appropriate activities and pursue environmentally sustainable development.
- The study encourages students to participate in community service and diverse environment and management projects.
- It is time to reorient educational systems and curricula to meet these requirements.
- Environmental education examines human interactions with the natural environment through a multidisciplinary lens.
- Environmental study is a crucial tool for bringing about the changes in knowledge, values, behaviours, and lifestyles necessary for achieving sustainability and stability within and between nations.
- Environmental education addresses all issues affecting organisms. Fundamentally, it is a multidisciplinary approach that fosters an appreciation for the natural world and the human impact on its integrity. It is an applied science because it seeks practical solutions for sustaining human civilization with the finite resources of the planet.

SCOPE OF ENVIRONMENTAL EDUCATION

Environmental education has a broad scope and comprehensive subject matter because

it is directly related to all human activities. The scope of population education varies based on the country's circumstances and requirements. Its subject matter varies based on the country's social, economic, and political conditions. Environmental education encompasses biological, physical, and social components.

1. Biological Aspect: Biology is one of the most essential components of environmental education. People, animals, birds, insects, microorganisms, and plants are examples of biological aspects.

2. Physical aspect: Physical aspects can also be subdivided into natural and man-made components. Air, water, land, climate, and other natural physical aspects are included. Similarly, human-made physical aspects encompass all human-made objects, including roads, buildings, bridges, and so on.

3. Socio- cultural aspect: Sociocultural factors consist of human-made social practises, rules and laws, and other religious sites, etc. They were created by humans through their efforts.

UNIT II – NATURAL RESOURCES, PROBLEMS AND SOLUTIONS

Land resources and Prevention of soil erosion – Forest resources and prevention of deforestation – Water resource and prevention of water scarcity – Mineral resources and prevention and Exploitation of Minerals – Food Resources, Food Crisis, and increasing Food Production – Energy Resources – Alternative Energy Resources

LAND RESOURCES AND PREVENTION OF SOIL EROSION

Definition of Natural Resources

A natural resource is any material provided by nature that is capable of being transformed into something more valuable and useful.

LAND RESOURCES

Multiple components make up the land's resources. It supports all plant and animal life, including aquatic plants that float freely. Land is connected to the atmosphere, from which it receives various gases; it has numerous water bodies as a result of precipitation and enough underground water to support plant life. The land is exposed to solar radiation, which is essential for photosynthesis. A region with numerous animal species

and functional ecosystem types. The nation's most valuable asset. A dynamic natural substance atop the Earth's crust in which plants grow and take root. Mineral, organic, and living substances comprise the land's natural resources.

PREVENTION OF SOIL EROSION

Forest Management should be given top priority in order to prevent illegal tree felling.

Efforts should be made to prevent forest soil erosion.

Before implementing various developmental activities such as urbanization, mining, the construction of dams, canals, roads, railways, airports, and industries, etc., numerous studies must be conducted.

FOREST RESOURCES

Forests and wildlife are essential to a region's ecological equilibrium. They constitute an essential renewable natural resource. Forest ecosystems are dominated by trees, whose species diversity varies across the globe. It contributes to the economic growth of the nation by providing goods and services to individuals and businesses. It improves environmental quality by influencing the life-supporting system. The presence of forests reduces air pollution and soil erosion.

DEFORESTATION

Deforestation is the process of turning forest land into non-forest land for pastures for animals, logging, companies, industrial gain, urban use, or just to make a wasteland.

PREVENTION OF DEFORESTATION

a) Use recycled items

b) Tree Care

c) Farming Practices

d) Cut back on palm oil

e) Coals

f) Reforestation.

g) Become an advocate of reforestation.

h) Arbor day foundation’s Rain forest

i) Support Conservation Organizations

WATER RESOURCES

Water is supposedly a valuable resource. Large quantities of water are also required for industrial and residential consumption in our country. The history of human civilization demonstrates that water resources are nearly synonymous with civilization. Due to water shortages caused by climatic changes, a number of cities and civilizations have vanished. Every year, waterborne diseases claim the lives of millions of people throughout the world, particularly in developing nations.

PREVENTION OF WATER SCARCITY

Improve the utilization of created irrigation potential. Optimize the agricultural output and output of irrigated lands in a sustainable manner. Integrate all functions associated with irrigated agriculture through a multidisciplinary team operating under the supervision of an area development authority. Major and moderate Irrigation Projects are initiated. Groundwater development, which accounts for the majority of minor irrigation, The primary objectives of the National Commission for Integrated Water Resources Development Plan are the development of water resources for drinking, irrigation, industry, flood control, and the transfer of excess water to deficit areas, among others. The work of the Central Water Commission (CWC) is divided into four functional wings: water planning, design, and research; river management and planning and progress; and river planning and design. We should not waste water. Leaking faucets must be fixed.

MINERAL RESOURCES

A mineral is an inorganic, naturally occurring substance. More than 2,000 minerals have been identified, the majority of which are inorganic and formed by various elemental combinations. A small portion of the earth's crust consists of organic materials composed of individual elements such as gold, silver, diamond, and sulphur. Mineral Resource refers to a concentration or occurrence of material with inherent economic value in or on the earth's crust in such form, quality, and quantity that there are reasonable prospects for eventual economic extraction.

CATEGORIES OF MINERAL RESOURCES

Mineral resources can be divided into two major categories.

- Metallic Mineral Resources
- Non-metallic Mineral Resources

Metallic Minerals are metals that are hard substance and conduct heat and electricity with characteristics of luster or shine. For example Gold, Silver, Tin, Copper, Lead, Zinc, Iron, Nickel, Chromium, and Aluminium.

Characteristics of Metallic Minerals

- Metallic Minerals have a brilliant appearance.
- Metals are present in their chemical makeup.
- Sources of the metal that can be extracted through mining.
- Metallic minerals contain metal in its elemental state.

Metallic minerals are further classified into Ferrous and Non-ferrous metallic minerals. Ferrous Minerals include iron-containing minerals such as iron ore, manganese, and chromite. Non-Ferrous Minerals include gold, silver, copper, and lead, among others, because they do not contain iron. Nonmetallic minerals are a distinct class of chemical elements that cannot produce a new substance when melted. Instances include sand, gravel, gypsum, halite, Uranium, and dimension stone.

Characteristics of Non-metallic Mineral Resources

Non-metallic minerals are minerals that exhibit a non-metallic sheen or lustre. In their chemical composition, these minerals do not contain extractable metals.

Use of Minerals

The utilisation of minerals depends on their deposits. Some nations have abundant mineral deposits, while others have none. The primary application of minerals depends on their properties. Aluminum, for instance, is utilised in the aircraft, shipping, and automobile industries because it is naturally lightweight, strong, and durable. Minerals are used in nearly every industry. Platinum, gold, and silver are utilised in the jewellery industry. Copper is used in the production of coins and pipes and wires. In the computer industry, silicon derived from quartz is utilised.

Conservation of Mineral Resources

Consumable mineral resources account for only 1 percent of all minerals present in the earth's crust. However, the consumption rate is so high that these nonrenewable

mineral resources will be depleted very quickly. Listed below are a number of measures to conserve minerals:

- Utilization of minerals in a methodical and sustainable manner.
- The reuse of metals
- Utilization of renewable substitutes.
- The technology should be improved so that low-grade ores can be utilised profitably.

PREVENTION OF EXPLOITATION OF MINERALS

A national mineral policy has been adopted, which incorporates the various policy guidelines that have been periodically issued. The policy also emphasizes the following new aspects and components:

- Proper inventory development.
- Proper linkage between the exploitation of minerals and the development of the mineral industry.
- Give preference to members of the listed Tribes for the exploration and development of small deposits in listed areas.
- As a result of the negative effects of mining, the forest, environment, and ecology suffer.
- Implementation of the mining plan for the adaptation of appropriate mining techniques.
- optimal utilisation of minerals, export of minerals in a value-added form, and recycling of metal scrap and mineral waste.

Mineral rights and mining law administration are delegated to the states under the Constitution. The MMRD Act of 1957 and the rules and regulations promulgated under it, however, govern the development of minerals by the Central Government. The statute authorises the Central Government to establish regulations for the following:

- Issuing prospecting licences and mining leases.
- The conservation and utilisation of natural resources.
- Modifications made to existing leases.

The MMRD Act, enacted in 1957, was amended in 1972, and in February 1987, significant amendments were made. Additionally, the Mineral concession Rules, 1960, were amended in February 1987 and 1988. In 1988, more comprehensive regulations replaced the Mineral Conservation and Development Rules of 1958. The guidelines outline the environmental factors that must be considered when selecting a site. The following is suggested in the guidelines for cost benefit analysis. The cost of environmental protection and mitigating measures should also be included in the estimations. In addition, the following should be included:

- Reforestation as compensation.
- The restoration of land in extraction zones.
- Control of the extracted plant.
- Noise, air, and soil pollution control resulting from the extraction and mining processes.
- The rehabilitation of project dropouts.

GSI (Geological Survey of India)

- The Geological Survey of India (GSI) is the primary national organisation for locating mineral resources other than petroleum, natural gas, and atomic minerals.
- GSI is responsible for the preparation of systematic geological mapping of hard rock areas as well as quaternary geological formations.
- Its functions extend to marine geosciences, water resources development projects, foundation engineering, land use, and environmental projects.
- GSI conducts both basic and applied research in a variety of disciplines, including geochronology, stratigraphy, palaeontology, petrology, remote sensing, and geophysics.

Indian Bureau of Mines (IBM)

- Indian Bureau of Mines (IBM) is a multidisciplinary department of science and technology.
- In addition to coal, petroleum, natural gas, atomic minerals, and minor minerals, it is primarily responsible for the conservation and scientific development of all other mineral resources.

- Before granting approval, it examines mining laws, inspects and studies mines, and conducts research on beneficiation of low-grade ores and minerals and special mining issues.
- It provides technical consulting services to the mining industry for the survey and geological evaluation of mineral resources, as well as the preparation of feasibility reports for mining projects, including the design of beneficiation plants.
- It advises the federal and state governments on all mineral industry, trade, and legislative matters.
- IBM serves as a "data bank" for mines and minerals and publishes statistical data on a periodic basis.

FOOD RESOURCES

- Food is one of the basic needs of humans; it is the most important substance for the proper functioning and well-being of the body at all ages.
- The human diet is not limited to a specific food group.
- Man consumes a variety of plant- and animal-based foods because no single food source provides us with all the necessary nutrients.
- The majority of food comes from plants.
- Some foods are derived directly from plants, while even animals that produce food are fed plant-based food.

PLANTS

- Numerous plants and plant parts are consumed as food, and approximately 2,000 plant species are cultivated for human consumption. Numerous of these plant species have multiple cultivars.
- Plant seeds are an excellent source of nutrition for animals, including humans, because they contain essential nutrients.
- Cereals and nuts are both edible seeds.
- Oils are frequently extracted by pressing oil-rich oilseeds.
- Typically, seeds are rich in unsaturated fats.
- Fruits are the matured ovaries of plants, which contain seeds.
- Vegetables are a second type of commonly consumed plant material.

ANIMALS

- They use animals as food either directly or indirectly in the production of their goods.
- Meat is an example of an animal product derived directly from the muscle systems or organs.
- Many cultures consume or transform milk produced by mammary glands into dairy products (cheese, butter, etc.).

FOOD CRISIS AND INCREASING FOOD PRODUCTION

- A food crisis occurs when rates of hunger and malnutrition rise sharply at local, national, or global levels.
- This definition distinguishes a food crisis from chronic hunger, although food crises are far more likely among populations already suffering from prolonged hunger and malnutrition.
- The food crisis seen in 2007 and 2008, with a sharp increase in basic food prices highlights the extreme vulnerability of the current agricultural and food model.

INCREASING FOOD PRODUCTION

- Training farmers for new techniques of agriculture, Cultivation and crop rotation.
- Construction of water storage reservoirs.
- Improvement in the irrigation system and Canal networking.
- Adopting water conservation and water harvesting techniques.
- Adapting Soil reclamation processes.
- Available land acreage should be properly and judiciously utilized.
- Soil fertility should be increased through wise use of fertilizers and organic manures.
- Mixed cropping should be practiced wherever possible.
- Soil erosion and loss of nutrients should be prevented by maintaining vegetation cover throughout the year.
- High yield and disease resistant plant varieties should be introduce.
- Integrated and balance use of available water source (surface and groundwater) should be made.

- Weeds and pest should be controlled; integrated pest control practices should be prepared over total Reliance on chemical pesticides.
- Combining use of traditional methods/ equipment with modern methods/ equipment of agriculture.
- Crop rotation should be done. Energy Resources Energy is an important input for development. It aims at human welfare covering household, agriculture, transport and industrial complexes.

ENERGY RESOURCES

Kinds of energy resources

1. Renewable Energy Resources:

- These resources are mostly biomass based and available in unlimited amount in nature
- can be renewed over relatively short period.
- These include firewood (or fuel wood) obtained from forests, petro plants, plant biomass (agricultural wastes such as biogases), animal dung, solar energy, wind energy, water energy (hydroelectric and tidal energy), geothermal and dendro thermal energy.
- These are called renewable energy because they can reproduce themselves in nature and
- can be harvested continuously through a sustained proper planning and management.

2. Non –Renewable Energy Resources:

- These energy resources are available in limited quantities and develop gradually over time.
- They are likely to be exhausted one day due to their unlimited use.
- Coal, crude oil, natural gas, and nuclear power are examples of energy resources.
- The common energy sources of coal, petroleum, and natural gas have an organic (biotic) origin.
- Additionally known as fossil fuels.

ALTERNATIVE ENERGY RESOURCES

- Energy resources are widely known
- To meet the increasing demand for energy in our urban and rural areas, it is necessary to develop and employ both conventional and renewable energy sources.
- Domestic, commercial, and industrial sectors have successfully demonstrated the technological and economic viability of a variety of systems and devices based on renewable energy sources.

REASONS FOR USE OF ALTERNATIVE RESOURCES

- Coal, mineral oil, natural gas, and nuclear minerals are nonrenewable and will be depleted tomorrow.
- Utilizing conventional resources invariably causes environmental pollution issues.
- The widespread utilisation of wood may result in deforestation.
- A conventional source of energy that utilises a centralised system necessitates significant expenditures for infrastructure and management.
- The energy crisis of the 1970s compelled scientists to develop renewable and pollution-free alternative sources of energy.
- Due to the rapid depletion of conventional energy sources, nations throughout the world are compelled to focus on tapping the vast potential of non-conventional energy sources. These include dendrothermal, solar, wind, ocean (tidal) geothermal heat, biomass, farm and animal waste, and human waste.

UNIT III – ENVIRONMENTAL POLLUTION, HAZARDS AND DISASTER MANAGEMENT

Environmental Degradation – Types of Environmental Degradation – Environmental Pollution – Environmental Pollutants – Types of Pollution: Soil/Land Pollution, Water Pollution, Air Pollution, Radiation / Nuclear Pollution, Light Pollution, Solid Waste Pollution – Prevention and Management of Pollution – Hazards and Disaster Management – Earthquake, Landslides, Volcanic eruption, Forest fire, Tsunami, Flood – Nuclear and Industrial Accidents – Oil Spills

ENVIRONMENTAL DEGRADATION

- Environmental degradation is the process of reducing biological diversity and the overall health of the environment, thereby compromising the natural environment.
- This process can be entirely natural, or it can be accelerated or caused by human activity.
- Numerous international organisations recognise environmental degradation as one of the most significant threats to our planet, and if the environment is irreparably damaged, it could spell the end of human existence on our planet.
- Degradation of the Environment is one of the greatest challenges facing humanity in the modern world.
- The Degradation of the Environment has resulted in a vast array of problems for humanity.
- Environmental Degradation is causing an increase in both the number and severity of problems.
- Occurring natural forces, such as forest fires, volcanic eruptions, earthquakes, tsunamis, floods, and cloud bursts, etc., cause severe damage to the environment.
- In addition to contributing to Environmental Degradation, human activities such as deforestation can have a significant negative impact on earth's systems.
- With the increase in population and the diversification of economic activities that accompanied it, problems began to multiply.
- These issues have become increasingly severe as a result of the industrial revolution. Industrialization, widespread deforestation, and population growth

have been identified as significant causes of the Degradation of the Environment.

MEANING OF DEGRADATION OF ENVIRONMENT

- Environmental Degradation is the deterioration of the environment as a result of depletion of resources such as air, water, and soil, destruction of ecosystems, and extinction of wildlife.
- It is any change or disturbance to the environment that is deemed undesirable.
- Caused by a combination of an already very large and growing human population, accelerating economic growth, and the application of resource-depleting and polluting technology.

The **United Nations International Strategy for Disaster Reduction** defines Environmental Degradation as ―The reduction of the capacity of the environment to meet social and ecological objectives and needs‖. According to **Business Dictionary**, Environmental Degradation refers to ―Erosion of the quality of the natural environment caused directly or indirectly by human activities‖.

Degradation can be mainly grouped into

(a) ecosystem imbalance

(b) deforestation

(c) freshwater degradation

(d) soil degradation

(e) marine degradation

(f) air pollution

(g) ozone depletion

(h) global warming

(i) solid and hazardous wastes.

TYPES OF ENVIRONMENTAL DEGRADATION

Divided into two categories

1. Slow degradation

2. Extreme adverse changes in environmental quality

ENVIRONMENTAL POLLUTION

- Environmental Degradation is the deterioration of the environment due to the depletion of resources like air, water, and soil, the destruction of ecosystems, and the extinction of wildlife.
- Considered undesirable is any change or disruption to the environment.
- Caused by a combination of a large and growing human population, accelerating economic growth, and the use of resource-depleting and polluting technology.

There are many sources of pollution. Based on sources of pollution, pollution can be of two types namely natural and manmade.

Natural sources of pollution include volcanic eruption (smoke, ash, gases, and dust), forest fires, floods, cyclones, etc.

Man-made sources of pollution

- Man-made sources of pollution include industries, agriculture, domestic sewage, automobiles, nuclear explosions, etc. The majority of pollution comes from industries.
- Industries release a variety of contaminants, including gaseous matter, solid matter, and wastewater containing numerous chemical components.
- Included among the sources of urban pollution are sewage water, solid waste, gaseous exhaust, and liquid effluents.
- The use of chemical fertilisers, pesticides, and insecticides contributes to soil contamination.

MEANING OF ENVIRONMENTAL POLLUTION

Pollution is the result of the urban-industrial and technological revolution, the rapid exploitation of natural resources, the accelerated exchange of matter and energy, and the accumulation of ever-increasing industrial wastes and urban effluents. Environmental Pollution is one of the most serious problems humanity and other life forms face on Earth today. Environmental Pollution is the contamination of physical and geological earth/atmosphere components. Environmental Pollution is a global problem that affects both developed and developing nations.

Holdgate (1979) defined Environmental Pollution as ―the introduction by man, into the environment, of substances or energy liable to cause interference with legitimate uses of the environment‖.

Singh (1991) has defined pollution in a very simple manner, i.e., ―disequilibrium condition from equilibrium condition in any system‖. This definition may be applied to all types of pollution ranging from physical to economic, political, social, and religious.

According to Natural Environmental Research Council (NERC), pollution is viewed as ―the release of substance and energy as waste products by human activities which result in changes, usually harmful, within the natural environment‖.

Pollution is ―any undesirable change in the physical, chemical or biological characteristics of air, water, and soil that may create a hazard or potential hazard to the health, safety or welfare of any living species‖.

ENVIRONMENTAL POLLUTANTS

The substances which cause pollution are known as pollutants.

According to the Indian Environment (Protection) Act, 1986, a **pollutant** has been defined as ―any solid, liquid or gaseous substance present in such concentration as may be or tend to be injurious to the environment‖.

Pollutants can be classified into the following:

- Primary and Secondary pollutants and
- Biodegradable and Non – biodegradable pollutants.

TYPES OF ENVIRONMENTAL POLLUTION

Pollution is the introduction of contaminating substances to the natural environment, which has a negative effect on the environment. Depending on the area of the environment that is being polluted, various forms of pollution may exist. The origin of the word pollution is the Latin word polluere, which means contamination. Pollution is therefore something that contaminates the environment. Pollution is the presence of harmful substances in the air, land, and water that are detrimental to living organisms and the environment. The sustainability of the environment is jeopardised by pollution.

The different types of Environmental Pollution.

SOIL / LAND POLLUTION

- Soil pollution is the contamination of an area's soil.
- The soil is necessary for the development of all plants, including crops.
- The deterioration of soil quality results in decreased crop yields and poor crop health.
- Industrial and agricultural chemicals are the most common soil pollutants.
- Soil contamination has become a significant obstacle that we must overcome to establish a healthy environment.
- The majority of microscopic and macroscopic living organisms call soil home.
- The term soil pollution refers to anything that contaminates soil and diminishes its quality. Soil contamination or soil pollution can result from either human activities or natural processes. However, this is primarily due to human actions.

Causes of Soil Pollution

- The disposal of industrial waste such as heavy metals, toxic chemicals, oil, etc. has led to soil acidification and contamination as a result of human activities.
- Lack of crop rotation and intensive farming diminishes the quality of soil over time, resulting in land degradation.
- Due to the presence of hazardous chemicals, the disposal of plastics, cans, and electronic items such as batteries is detrimental to the soil.
- The use of chemical fertilisers, inorganic fertilisers, and pesticides will reduce the fertility of the soil and change its structure.
- The storage of waste products can lead to the contamination of groundwater.
- The careless disposal of trash that cannot be recycled results in the contamination of the land. It can take thousands of years for some of this waste to decompose.
- The acidity of the soil, caused by acid rain, is detrimental to plant growth.
- Also responsible for soil contamination are biological agents such as pathogenic organisms.

Effects of Soil Pollution

- Cancer, skin diseases, and disorders of the central nervous system can be caused by soil pollutants in humans.
- Plants and crops grown in polluted soils may accumulate toxins and become unfit for human consumption.

- By emitting harmful particles and noxious gases, soil pollution contributes to air pollution. If toxic chemicals and materials reach the groundwater, it can also cause water pollution.
- When soil is contaminated with toxic materials and chemicals, it cannot sustain plant life.
- Soil fertility declines when it is contaminated with chemicals and heavy metals or degraded by human activities such as mining.
- The depletion of soil fertility by acidification and the demise of soil organisms can result in alterations to the soil's structure.
- The presence of pesticide residues, such as DDT, in excess of permissible levels in fruits, milk, eggs, and vegetables is responsible for diseases such as cancer, sterility, and death.

Prevention of Soil Pollution

- It should be required that industrial facilities do not dispose of their wastes on land.
- The waste products should be recycled or repurposed to the greatest extent possible.
- Materials such as paper, glass, scrap metal, and certain types of plastics can be recycled.
- Municipal corporations should properly manage both domestic and urban garbage.
- Animal wastes and agricultural wastes can be used as fertilizer and to produce biogas.
- Biological methods of pest control can reduce the use of pesticides, thereby minimizing soil contamination.
- Utilize a garbage can at home and in public places to dispose of trash.
- To prevent soil erosion, plant increasingly more plants.
- The general public should be educated on the harmful effects of soil pollution.

WATER POLLUTION

Water pollution is the contamination of water bodies such as lakes, rivers, and ponds by pollutants. Water pollution is among the most dangerous forms of pollution. It can have catastrophic effects on all organisms that consume contaminated water. The majority of all pollutants produced on land end up in bodies of water. Some of the water pollutants include industrial wastes, pathogens released in sewage, and harmful

chemicals found on agricultural land.The contamination of water can result in epidemics that can wipe out an entire species' population.

Causes of Water Pollution

- Sources of natural water contamination include soil erosion, landslides, volcanic eruptions, and the decomposition of plants and animals. Due to soil erosion, mud has mixed with the water, causing it to appear brown and murky.
- Domestic effluents and sewage water are two urban sources of water contamination. Occasionally, sewage water flows into nearby rivers, reservoirs, or lakes.
- Among the industrial sources of water pollution are effluents from industries such as paper, chemicals and petrochemicals, oil refineries, metal works, distilleries, textiles, and others.
- The excessive use of fertilisers, pesticides, and insecticides in agriculture are major contributors to water pollution.
- When acid rain falls, it contaminates water bodies, including streams, rivers, and lakes.
- Thermal Power Plants discharge large amounts of heated water into nearby rivers, lakes, and ponds, causing thermal pollution of water.
- The oil spill in the ocean causes seawater contamination. If an accident or leak occurs, oil will spread across the surface of the water, posing a significant threat to marine life.

Effects of Water Pollution

- Highly contaminated water can harm the heart and kidneys when consumed.
- Water pollution is largely responsible for cholera, typhoid, diarrhoea, dysentery, and other water-borne diseases.
- The presence of toxins in water can harm aquatic organisms, thereby destroying a link in the food chain.
- The quality of food is affected by the use of polluted water from rivers, lakes, and ponds for irrigation.
- Extremely polluted water reduces soil fertility and kills beneficial microorganisms.

- The process of photosynthesis is hindered by polluted water, which hinders the growth of vegetation.
- Water pollution modifies the physical and chemical properties of water. Birds that ingest oil-tainted water perish due to exposure to cold water.

Prevention of Water Pollution

- Cleanliness of drinking water sources is essential.
- The establishment of a sewage treatment plant must be provided for.
- The discharge of untreated effluents from industries into bodies of water should be prohibited.
- The disposal of dead bodies into bodies of water should be prohibited.
- There should be minimal pesticide use in agriculture.
- There will be a strict ban on the use of plastic bags.
- People must be informed about water pollution. They must be educated regarding water-borne diseases..

AIR POLLUTION:

- Air pollution refers to the emission of contaminants such as toxic gases, biological molecules, and particulate matter.
- Pollutants can originate from a variety of sources, including natural processes and human activities.
- Volcanic eruptions, automobile, and industrial effluents, etc, are some examples of air pollution sources.
- Carbon monoxide, carbon dioxide, chlorofluorocarbons, etc, are some examples of air pollutants.
- Air pollution can be extremely harmful to the health and wellbeing of all living things on earth.

Causes, Effects and Prevention of Environmental Pollution

Causes of Air Pollution

- Sulfur dioxide is released when fossil fuels such as coal and petroleum are burned.
- Carbon monoxide is produced when fossil fuels are incompletely burned.
- Automobiles, aircraft, thermal power plants, and factories are the major sources of nitrogen oxides.

- Carbon dioxide is released into the atmosphere in large quantities by the combustion of fossil fuels. Additionally, it is produced by volcanic eruptions.
- Ammonia is a typical byproduct of agricultural processes. Agricultural activities that employ insecticides, pesticides, and fertilisers release harmful chemicals into the air.
- Industries degrade air quality by emitting large quantities of carbon monoxide, hydrocarbons, organic compounds, and chemicals.
- Dust and chemicals are released into the air during the mining process, causing air pollution.
- Industries, refrigerators, air conditioners, cosmetics, and other products emit chlorofluorocarbons.

Effects of Air Pollution

- When fossil fuels like coal and petroleum are burned, Sulphur dioxide is produced.
- When fossil fuels are incompletely burned, carbon monoxide is produced.
- Automobiles, aircraft, thermal power plants, and factories account for the majority of nitrogen oxide emissions.
- By burning fossil fuels, large amounts of carbon dioxide are emitted into the atmosphere. Additionally, it results from volcanic eruptions.
- Agricultural processes typically produce ammonia as a byproduct. Agricultural activities that employ insecticides, pesticides, and fertilisers release harmful chemicals into the atmosphere.
- Industries degrade air quality by emitting large amounts of carbon monoxide, hydrocarbons, organic compounds, and chemicals.
- The mining process causes air pollution by releasing dust and chemicals into the atmosphere.
- Chlorofluorocarbons are emitted by various industries, appliances, cosmetics, and other products.

Prevention of Air Pollution:

- In order to reduce pollution, more people must be encouraged to utilise public transportation.
- Water spraying, filtration, or absorption can be used to remove gaseous pollutants.

- Efforts should be made to minimize the use of fossil fuels.
- The engines of automobiles will be redesigned in order to reduce the emission of toxic gases. Mandatory vehicle emission testing will be implemented.
- The industrial areas should be situated a safe distance away from the residential areas.
- There should be a green belt surrounding settlements, industrial zones, and villages.
- The prevention of forest fires should be a priority. Deforestation must also be controlled.
- The height of smoke chimneys should be adequate to dilute the smoke.
- Due to the extensive use of fossil fuels in the production of electricity, electrical energy must be used efficiently.
- Alternative energy sources, such as solar and wind power, must be encouraged.

NOISE POLLUTION

- Noise pollution is when the environment is filled with unwanted or unpleasant sounds that are harmful to humans, animals, and plants.
- The most common sources of noise pollution include automobiles, machinery, industries, loud music, etc.
- Noise pollution can lead to chronic illnesses such as cardiovascular disease. It can also have severe psychological effects on people.
- Noise Pollution may not appear as dangerous as air or water pollution.
- Unlike other pollutants, noise does not accumulate in the environment. The unit for measuring sound is the decibel (dB).

Causes of Noise Pollution

- Numerous industries, such as iron and steel, automobiles, power plants, textiles, petroleum, and fertilisers, among others, employ a variety of noise-generating processes.
- Noisy household appliances include the television, radio, music systems, refrigerators, washing machines, and food processors.
- Transportation on the ground is one of the major contributors to urban noise pollution. The horns of cars, buses, trucks, bicycles, and two-wheeled vehicles generate a great deal of noise.

- When public address systems are utilised at festivals and religious gatherings, a great deal of noise is often produced.
- Noise pollution is also caused by construction activities that employ heavy machinery.
- Markets, shopping malls, fairs, and expositions are also significant contributors to noise pollution.

Effects of Noise Pollution

- The most direct negative effect of excessive noise is physical damage to the ear and temporary or permanent hearing loss.
- By elevating blood pressure and altering pulse rates, excessive sound levels can have detrimental effects on the circulatory system.
- Noise pollution can affect the biological functioning of the body and lead to anxiety, insomnia, hypertension and dizziness, loss of physical control, etc.
- Additionally, chronic noise may result in abortions and congenital defects.
- Noise pollution can result in psychological effects such as irritability, stress, inability to concentrate, and mental fatigue.
- Severe Noise impairs normal auditory communication and, as a result, increases the rate of accidents, especially in industrial settings.
- Additionally, domestic animals can be negatively impacted by excessive noise.

Prevention of Noise Pollution

- Noise-producing factories should be located far away from residential areas.
- At least 20 kilometres should separate airports from residential areas.
- Vehicles must be maintained properly. There should be restrictions on horns that emit loud sounds.
- A silencer with advanced technology must be used. The use of horns near public places such as hospitals and schools should be prohibited.
- High-powered sound amplifiers should be prohibited at religious, social, and political events.
- By planting trees along the roadside, noise pollution can be reduced.
- Encourage the construction of soundproof rooms for noisy industrial machinery.
- Using earplugs can reduce loud noises to a more manageable level.

RADIOACTIVE / NUCLEAR POLLUTION

- Radioactive pollution is the result of the presence of radioactive substances in areas where their presence is undesirable.
- Highly toxic to all forms of life on the planet.
- Radioactive substances cause mutations in the genetic material of living organisms, resulting in a variety of cancer types.
- These toxins can also have detrimental effects on the body's various systems.

Causes of Radioactive Pollution

Due to its high latent power, nuclear energy is regarded as the most powerful source of energy. Nuclear accidents in nuclear energy generation plants, such as the Fukushima Daiichi nuclear disaster and the Chernobyl nuclear disaster, resulted in the death of many people and the exposure of even more to radiation.

During war, the use of nuclear missiles and atomic bombs results in radioactive pollution.

Radioisotopes are utilised in the manufacturing of detectors and industrial procedures. Isotopes such as uranium contain high levels of radiation.

Extraction of mineral ores constitutes the mining process. Examples of highly radioactive substances include radium, uranium, thorium, and plutonium.

Chemotherapy is a cancer treatment that uses radiation to inhibit the growth of cancer cells. Scientists who have been exposed to radiation have died or developed complications.

Cosmic rays from space that bombard Earth with intense radiation are the cause of radioactive pollution. For instance, gamma rays are said to have the highest radiation level.

Effects of Radioactive Pollution

- In terms of genetics, radiation is harmful. It causes DNA strands to become damaged, resulting in genetic fragmentation. The resulting mutation renders an individual cancer-prone.

- Radiation results in cancer, leukaemia, anaemia, haemorrhage, premature ageing, and premature deaths. Radiation in the bone marrow, for instance, is a cause of leukaemia.
- Radioactive substances in the soil react with the various nutrients, leading to the destruction of these nutrients and rendering the soil infertile and toxic.
- Radiation causes permanent damage to the various organs and organ systems by distorting the cells present in living organisms.
- Radiation causes burns, blemishes, and sores, and can cause skin cancer.

Prevention of Radioactive Pollution

- Proper methods are to be used for disposing of radioactive waste. For example, it should be stored in heavy and thick concrete containers.
- It is necessary for any material with radioactive content to be labeled and the necessary precautions advised on the content of the label.
- There should be a banning of nuclear tests which contribute greatly to the overall presence of radioactive substances.
- We need to focus on alternative and environmentally friendly energy sources namely solar, hydroelectric, and wind power.
- Radioactive materials are to be stored in radiation-proof containers to ensure no leakage during handling.

LIGHT POLLUTION

- Light Pollution has recently been identified as a separate type of pollution.
- Artificial light sources, such as billboards and other light sources that emit bright light, have contaminated the tranquil moonlight in large cities.
- It disrupts ecosystems and degrades the environment's aesthetics.
- It has a negative impact on human health and psychology as well as ecosystems.
- According to astronomers, it has become increasingly difficult to observe celestial bodies at night in large cities due to this Light Pollution.
- Light pollution is the addition of excessive light to the atmosphere in a manner and intensity that disrupts the normal functioning of organisms and ecosystems.
- Light pollution is also known as Photo pollution or luminous pollution. Thus, this is the explanation for those who search for **photopollution** or **luminous pollution**.

- ❖ Light sources must be planned, designed, and positioned to maximise their utility.
- ❖ These should be adjusted to illuminate what needs illumination. A street lamp should illuminate the street.
- ❖ A display light should illuminate the objects on display. Any light not falling on the desired object is then directed upwards, resulting in light pollution.

Sources (Causes) of light pollution

- A light source that emits light in all directions is a significant source of light pollution. This is because when an open bulb emits light, the majority of it is directed upward rather than to a specific location. Moreover, the light that is scattered upwards is wasted and lost. For example, a street light that directs light downwards towards the street serves its purpose more effectively. It is also an efficient use of electricity as a form of energy. wasted light also wastes valuable energy sources.
- Electronic advertising lights – the majority of billboards are illuminated from below with enormous, intense light. Additionally, the light is reflected off of the board.
- Commercial centres - Malls, restaurants, discos, shops, pubs, and other commercial centres attract customers through the use of numerous light sources that are not focused on a specific area. This results in dispersed, wasted light.
- Floodlights create a brilliant halo over the stadium or sports field when a match is in progress, which can be seen from miles away. This is diffuse light.
- The majority of urban light pollution is caused by inefficient and unnecessary traffic lighting. Hundreds of miles of streetlights remain on throughout the night, scattering light in undesirable directions.
- In certain urban parks, airports, and public spaces, one may wonder, "Is so much light truly required?" Is it necessary to illuminate each and every crevice?
- Residential Areas – Although landscape and garden lighting is intended to provide aesthetic illumination, it is also a source of annoyance for nearby residents and pedestrians who find the excessive light disturbing.

Types of Light Pollution

Light pollution is differentiated into few types, but these are not separate from each other. A single source can fall into one or more category.

Light Trespass

Remember that night when you were so tired and desperately trying to sleep. But the neighbours lights and street light combined brightened up your room and your sleep was disturbed. Or it could have been the other way round. You may have received a call in the night asking you to switch off your porch light because it was shining into the next door baby's room. This is light trespass. This happens when unwanted light enters someone's property. It causes problems like sleep deprivation. There are strict rules concerning this in a number of cities in the US to protect the rights of their citizens against light trespass.

Over illumination

In order to enhance the architecture of beautiful buildings, designers typically install upward-facing, intense illumination all around them. This is known as over illuminations because the majority of the light does not illuminate the structure but rather escapes upwards. This is a form of light pollution that is also problematic because it wastes valuable energy. Every day, approximately 19 million barrels of oil are used to generate electricity in the United States, and at least 2 million barrels of oil are wasted due to excessive lighting. All public spaces, commercial centres, industrial and residential sectors are overlit.

Glare

The blinding effect caused by reduced contrast because of light scattering in the eye by excessive brightness is Glare. The different kinds of glare are

- **Blinding glare-** such as staring straight at the Sun.
- **Disability glare-** blinded by oncoming car lights or scattering of light in fog; this leads to unsafe driving conditions. This kind of glare can also be intensified by a dirty wind shield.
- **Discomfort glare-** staring at the screen of the computer or the mobile, causes fatigue if done for extended periods.

Light Clutter

Referring to excessive grouping of lights causing confusion and distracting from obstacles, clutter is noticed in badly planned street lighting, or in poorly placed advertising surrounding roadways. This is likely to cause accidents.

Light clutter is a hazard for aviation industry, such as when runway lights are confused with an array of suburban lights.

Skyglow

Light that is reflected from illuminated surfaces, light escaping directly upwards from light fixtures is then scattered by the atmosphere back to the ground. This creates a diffuse glow over that area. It is mostly seen in populated areas.

White light sources contribute more to sky glow than yellow light.

Effects of Light Pollution

1. Effects on People

It has been demonstrated that the wrong type of light or too much light has negative health effects and reduces the quality of life. Humans on Earth are programmed with a specific circadian rhythm in their DNA, requiring a regular pattern of light during the day and darkness at night. When these circadian rhythms are disrupted, it can have detrimental effects on health and lead to cancer, cardiovascular disease, depression, and insomnia..

2. Effects on Animals

Animals and insects can be attracted or repelled by lights. The majority of animal life operates on a diurnal or nocturnal schedule that is disrupted by light pollution. This can put entire species at risk. Previously uninhabited regions are adversely affected by light pollution to a significant degree. These animals may react quite sensitively to changes in their natural habitat. They may relocate to areas with less light pollution, or undesirable species may become attracted to human areas.

3. Effect on the Earth and Ecosystem

The Earth's ecosystem is dependent on cycles of natural light. Since these ecosystems are usually quite sensitive to changes in their environment, they may not be able to adapt to new artificial conditions developed from human-made light pollution.

Skyglow alone can cause a loss in growth protection as the reflected light off the atmosphere will prevent the natural UV rays from reaching the Earth. This disrupts growth and decay cycles that our food, air and water supply is dependent on.

4. Sleeping Problems

Sleep is essential for both our physical and mental health, and most people prefer to sleep in a dark environment. Numerous individuals find it unsettling to be disturbed by light while they are sleeping. When the environment is made brighter, people may experience sleeping difficulties, which can lead to serious health conditions.

5. Effects on Traffic

Light pollution may also have a negative impact on traffic, as temporary blindness can be caused by excessive lighting or the wrong angle. This is potentially hazardous when driving a car. If the driver's vision is impaired by excessive light clusters on certain streets, the likelihood of collisions may increase. Light pollution can interfere with critical navigational systems for trains, planes, and even automobiles, thereby increasing the danger to people.

6. Air Pollution

Additionally, light pollution contributes to air pollution in the atmosphere. Since enormous amounts of electricity are used for nighttime illumination, this results in a high level of CO2 emissions and other harmful gases.

7. Waste of Resources

Excessive use of light means the use of many fossil fuels at an increasing level. For example, lights need electricity, and in order to produce electricity, huge amounts of coal are used in industrial processes. This means we are also indirectly contributing to the depletion of natural resources like coal.

Certain Measures That Can Be Taken To Reduce Light Pollution

- Utilize the proper indoor and outdoor lighting equipment in our homes.
- Demand that advertising billboards and their lighting in our cities and on our highways be restricted.
- Office and commercial spaces should be designed to maximise space with minimal lighting.

- Utilize technologies such as motion sensors, dimmers, and others to reduce energy consumption when no one is present.
- Developing regulations for the use of correct lighting in public spaces, particularly shielded light fixtures and properly focused lights for outdoor use.
- Many individuals believe that well-lit areas deter criminal activity. This has not been demonstrated to be true, as evidenced by numerous instances and the well-known expression "in broad daylight." Without invalidating their feelings, this can also be mitigated by employing intelligent lighting systems in our spaces.

SOLID WASTE POLLUTION

- Solid waste pollution is the presence or excess presence of solid wastes in the environment (air, water, or soil) that renders it unfit or unsuitable for life.
- Solid wastes are the discarded, abandoned, useless, or unwanted solid materials generated in residential, industrial, commercial, and hospital settings.
- Solid waste also includes semi-solid, semi-liquid, and solid in liquid wastes.
- Solid wastes are synonymously referred to as garbage, trash, and litter in common parlance.

Cause of Solid Waste Pollution

Major factors causing solid waste pollution:

- Residential and household wastes (Municipal Solid Wastes) are one of the most significant contributors to solid waste pollution. Garbage from these locations consists of consumer goods such as food waste, plastic, paper, glass, leather, cardboard, metals, ash, and electronic waste such as IC boards, wires, etc.
- By improperly disposing of papers, cups, plastic plates, packaging materials, cans, bottles, polythene bags, etc., businesses such as stores, malls, markets, and hotels contribute to solid waste pollution.
- The improper disposal of industrial waste such as metals, dyes, and chemicals from light and heavy manufacturing units causes solid waste pollution.
- Dust, concrete, scrap metals, and wood are generated in construction and mining sites.

- Sponge, syringe, needle, and bandages are examples of hospital biomedical waste generated during the diagnosis, treatment, or prevention of disease. Also included are infectious fluids or substances.
- Agricultural and dairy waste from farmland, orchards, and dairies also contribute to solid waste contamination.
- Animal carcasses left on roads, rivers, and lakes contribute to organic waste pollution.
- The digitalization of our world has increased the use of electronic devices such as televisions, mobile phones, laptops, and digital watches. And the short shelf life of these items and the social trends surrounding these devices lead to their early disposal, resulting in the pollution of electronic solid waste.

The exponential increase in solid waste generation and solid waste pollution can be attributed to unchecked population growth, rapid urbanization, and industrialization.

Reasons for the rise of solid waste pollution:

- Solid waste pollution has been exacerbated by irresponsible conduct, lack of awareness, and "throwaway culture."
- Disbelief in science and scientific prediction has resulted in inaction on solid waste pollution issues.
- Inadequate public investment in infrastructure for solid waste management, such as incineration plants and boilers, and in awareness-raising has led to the accumulation of solid wastes in landfills and open areas, resulting in increased solid waste pollution.
- Less emphasis on research and development in solid waste management technologies has slowed the rate of proper disposal of solid wastes, while the rates of solid waste generation and solid waste pollution continue to rise.
- Also lacking is the manpower necessary to address solid waste pollution, management, mitigation, prevention, reuse, and recycling.

Effects of Solid Waste Pollution

Due to solid waste pollution, human health is negatively impacted. Disease-causing microorganisms proliferate in dump sites for solid waste.

- Pollution of water sources is caused by the leaching of solid waste into groundwater, lakes, and rivers.
- Due to the aforementioned factors, animal lives and health are also affected.
- Through their roots, plants absorb solid and semi-solid waste, resulting in the spread of disease and decreased yield. Humans are impacted by afflicted crops.
- Air and water pollution are linked to solid waste pollution, and each feeds the other.
- Numerous solid wastes cannot be decomposed. They persist for many decades in the environment.
- The accumulation of contaminated water is caused by the clogging of drains by plastics, papers, and other solid waste.
- Present-day solid waste pollution will have an impact on future generations.
- The aesthetic and beauty of the natural environment is compromised by solid waste pollution.

Solid Waste Management

Solid waste management refers to the gathering, treatment, and disposal of solid waste.

Diverse processes and procedures are utilised to treat and dispose of solid waste and to reduce solid waste pollution:

- Here, wastes are dumped untreated and unsorted, far from residential areas, in an open dump field. This method of waste disposal is becoming obsolete.
- In landfills, solid waste is deposited in holes dug in the ground. After the pits have been filled, they are sealed with thick mud layers.
- Sanitary landfills are landfills that have been modified. To prevent waste from leaching into underground water, the bottom and sides of the pits are lined with plastic, clay, or concrete.
- In large, high-temperature furnaces at incineration plants, solid wastes are burned.
- As an alternative to incineration, pyrolysis is the combustion of solid waste under pressure in the absence of oxygen. Because incineration is a relatively less clean process, pyrolysis is favoured.
- Composting: Microorganisms such as bacteria and fungi are used to degrade organic waste into humus from biological solid waste.
- Vermiculture is the use of earthworms to decompose organic waste.

Solid Waste Pollution in India

- The Planning Commission of India predicted in 2014 that by 2030, the quantity of municipal solid waste will increase to 165 million tons.
- In 2014, approximately 43 million tons of solid wastes were collected, of which approximately 25 percent were treated and the remaining 75 percent were dumped in landfills.
- According to the International Telecommunication Union (ITU) and the United Nations University, India produced 1,975,000 metric tons of electronic waste in 2016. Per capita, Indians generated approximately 1.5 kg of electronic waste.

Solid Waste Pollution in Worldwide

According to the United Nations Environment Programme (UNEP), approximately 11,2 billion tons of solid waste are collected annually throughout the globe. And decomposition of the organic portion of solid waste contributes approximately 5% of global greenhouse gas emissions.

PREVENTION AND MANAGEMENT OF POLLUTION

- Environmental Management is concerned with comprehending the structure and operation of the earth's system.
- concerned with the description and monitoring of environmental changes, environmental prediction seeks to maximize human benefit and minimize Environmental Degradation caused by human activities.
- Environmental Management also encompasses the process of determining how to utilise natural resources.
- It is more concerned with the management of human activities and their impact on the environment than it is with the management of the natural environment.

The **components of Environmental Management** are based on five fundamental aspects. They are:

1. Environmental perception and public awareness include

(a) sources of environmental perception and public awareness

(b) level of environmental perception

(c) the role of environmental perception in environmental planning and management.

2. Environment Education and training to be given at school, college, and university levels by professionals.

3. Resource management includes

(a) classification of natural resources

(b) survey and evaluation of ecological resources

(c) preservation of resources

(d) conservation of resources.

4. Control of Environmental Degradation and pollution includes

(a) adopting suitable preventive mechanisms to reduce natural hazards and disasters (b) regeneration of the degraded environment.

5. Environmental impact assessment includes

(a) appraisal of existing environmental conditions

(b) appraisal of existing and proposed production methods

(c) probable impacts of existing and proposed project

(d) review of technology and required improvement.

6. Educating the general public about the urgent need for conservation and preservation of the environment.

Controlling pollution is a crucial duty. There are four types of control: legal, social, economic, and technological measures, which help to prevent pollution through a variety of methods of operation.

Need for Management of Environment

Environmental Management is necessary for development to occur without the destruction or overexploitation of natural resources, and to reduce pollution and environmental degradation. Taking into account the welfare of future generations, it is necessary to make environmentally responsible decisions.

Environmental Management is essential for the following reasons

1. For use of resources: Limited resources are available. If these resources are not utilised effectively, they will quickly become depleted. Environment management is necessary for the appropriate and reasonable utilisation of resources.

2. To overcome the environment and ecology crisis: Current development has reached a point where the environment and ecology are in a critical crisis, which necessitates environmental management. If this continues, the consequences for the environment will be catastrophic. The entire planet will perish.

3. For sustainable development: Environmental Management is necessary for development to occur without the destruction or overexploitation of natural resources, and to reduce pollution and environmental degradation.

4. For economic need and values: Environmental Management is required to give our economic needs and values new directions and to maintain a clean environment at the same time.

5. To reduce disasters: Effective Environmental Management reduces the likelihood of catastrophes such as floods, forest fires, earthquakes, desertification, transportation accidents, global warming, etc. To prevent man-made disasters, appropriate measures must be taken.

6. To decide the limiting line between development and environment: Environmental Management is necessary for establishing a boundary between development and the environment.

Objectives and Characteristics of Environmental Management

The main objectives of Environmental Management are

- To prevent and solve environmental problems.
- To impose restrictions on the utilisation of natural resources.
- To establish Environmental Research Institutions and Monitoring Systems.
- To inform of environmental threats.
- To suggest conservation measures for resources.
- To develop strategies for the enhancement of life quality.
- To suggest long-term and short-term sustainable development policies.

- To identify new sustainable development technologies.
- Provide opportunities for everyone to acquire the knowledge, values, attitudes, and skills necessary to protect and improve the environment.
- To develop new environmental behaviour patterns among individuals, groups, and society.

Characteristics of Environmental Management

The Characteristic features of Environmental Management are:

- It focuses on a world influenced by humans.
- It supports sustainable development.
- It requires an interdisciplinary approach.
- It must incorporate diverse development perspectives.
- It is concerned with both short- and long-term planning, as well as local and global scales.
- It aims to combine natural and social science, policymaking, and planning.

Conservation of the Environment

- Environmental Protection is the practise of individuals, organisations, and governments safeguarding the natural environment.
- Its goals are to preserve natural resources and the existing natural environment and to repair environmental damage.
- The biophysical environment is degrading as a result of the effects of consumption, population growth, and technology.
- Environmental Protection is the prevention of unintended alterations to ecosystems and their component parts.
- Protection of the environment has become a necessity for survival.
- When it comes to urbanization, human needs are limitless and are never satisfied.
- Our living environment is comprised of air, water, soil, trees, sunlight, etc. Everything that makes up the environment is important to us.

Measures to protect environment

1. Plant trees: Growing a tree can be a lengthy process. However, they serve the next generation. In addition to providing shade, plants reduce pollution by absorbing carbon dioxide.

2. Conserve water: Since we cannot survive without water, water conservation is vital. Never use a shower as a bathtub. While brushing your teeth, turn off the faucet. It is necessary to prevent water loss.

3. Limit car use: Because cars emit a great deal of carbon dioxide, their use should be restricted. Public transportation is an alternative method. Carpooling is also beneficial for reducing carbon emissions.

4. Minimize food wastage: Food waste results in the waste of energy and water used in food preparation. According to research, the amount of food that is lost annually could feed nearly a billion hungry people around the world.

5. Switch off: Turn off the lights, computer, and television when not in use. This helps save a substantial amount of electrical energy. Consider using LED bulbs to conserve energy.

6. Using second – hand products: New products require resources for their production and manufacture. The majority of these productions rely on natural resources. Thus, you can protect the environment by purchasing used items.

7. Reuse and recycle: Use an eco-friendly water bottle instead of bottled water and bring a reusable bag to the supermarket. Recycling and reuse can help reduce pollution.

8. Go paperless: Select electronic communication as the mode of transmission. Implementation is required in all government offices.

9. Buy local products: Whenever possible, buy local goods. This eliminates the pollution caused by long-distance transportation of goods.

10. Work from home: It reduces pollution and saves money if your employer allows you to work from home.

Waste Minimization

- Waste minimization is a collection of processes and procedures designed to reduce the amount of waste generated.

- Reducing, reusing, and recycling are the "three R's" of waste management.

HAZARDS AND DISASTER MANAGEMENT

- The effects of environmental hazards on adverse health events were numerous.
- This risk is affected by natural and man-made physical, chemical, and biological factors.
- In addition, examples of environmental hazards such as air, water, and soil pollution from transportation, agriculture, industry, and other sources such as "Chemicals, Toxic waste, and Radiation" are provided.
- Another type of hazard, such as "hazard resulting from chemical, biological, or physical agents, either as a result of ongoing or previous human activity"
- Natural hazards also include difficulties such as earthquakes, volcanic eruptions, and flooding.
- Environmental hazards also have various effects on the working environment and on employees.

There are numerous categories of environmental hazards such as

- Physical hazards
- Biological hazards
- Chemical hazards
- Cultural/practice-related hazards
- Social hazards

DISASTER MANAGEMENT

Policy, administrative decisions, and operational activities pertaining to the various phases of a disaster at all levels.

Characteristics of Disasters

- To be able to identify a situation as a disaster, the following characteristics must be apparent and must appear to correspond with the preceding events:
- It is an exceptional occurrence.

- Typically occurs as a result of one of the danger sources, whether natural or human-caused.
- Significantly affect the most vulnerable populations
- Resulting in a severe imbalance of community functions.
- Resulting in significant human, material, and environmental losses
- Exceeds the affected community's capacity to respond with its own resources.

Types of Disasters

Disasters can be classified as:

- Natural disaster
- Human-Made disaster
- Incidences of Mass Trauma

Natural Disasters

These occurrences are acknowledged to be unavoidable and unaccountable. There is no one to blame, with the possible exception of God or a higher power, so survivors typically do not have anger or a desire for vengeance to compound their losses, thereby facilitating their ability to adapt. Natural disasters are large-scale geological or meteorological events that can result in loss of life or property.

These types of disasters include:

- Tornadoes and Severe Storms
- Hurricanes and Tropical Storms
- Floods
- Wildfires
- Earthquakes
- Drought

Human-Made Disasters

Industrial accidents, shootings, acts of terrorism, and acts of mass violence are examples. These types of traumatic events may also result in loss of life and property,

similar to natural disasters. In the aftermath of the tragic loss of life that occurred on September 11, 2001, the loss of security and well-being—arguably the most essential ingredients for leading a happy and healthy life—had a profound impact on the American populace. The staff of the Disaster Distress Helpline is also trained to respond to calls and texts related to these disasters.

Incidences of Mass Trauma

Infectious disease outbreaks, community unrest, and other traumatic events can also elicit strong emotions in individuals. The outbreak of Ebola affecting several countries in West Africa, with limited cases reported in the United States and other nations, may induce feelings of anxiety and confusion, even to the point of interfering with a person's normal routine. Community upheaval, such as that which occurred in Ferguson, Missouri, can also have an effect on emotional health. When these types of occurrences occur, news reports and the 24-hour news cycle can heighten people's anxiety.

Disaster Management Life Cycle

- Demonstrates the ongoing process through which governments, businesses, and civil society reduce the impact of disasters.
- Reacts during and immediately after a disaster and recovers after a disaster has occurred.
- Includes the development of public policies and plans that modify the causes of disasters or mitigate their effects on people, property, and infrastructure.

The disaster life cycle includes several phases:

1. Mitigation: Work in disaster mitigation entails preventing future disasters and/or mitigating their negative effects. It necessitates hazard risk analysis and the implementation of strategies to reduce the likelihood that hazards will become catastrophes, such as flood-proofing homes or purchasing insurance.

2. Disaster preparedness: Included in disaster preparedness efforts are plans or preparations made prior to an emergency that aid in the readiness of individuals and communities. Such preparations may include the stockpiling of food and water or the

recruitment and screening of volunteers who are ready for mobilization in the aftermath of a disaster.

3. Disaster response: Work related to disaster response encompasses any measures taken during or immediately after an emergency, including efforts to save lives and prevent additional property damage. Ideally, disaster response entails implementing previously established plans for disaster readiness. Typically, the most attention is paid to this phase of the disaster life cycle. This is also called "disaster relief."

4. Disaster recovery: After assessing the extent of the damages, disaster recovery entails restoring the affected community to its pre-disaster condition or better, and, ideally, making it less susceptible to future risk. In order to identify risks, it is necessary to comprehend both the nature of threats and vulnerabilities. Subsequent initiatives may include physical enhancements, education, training, and public awareness campaigns.

EARTHQUAKE

Earthquakes are extremely destructive natural disasters that cause significant loss of life and extensive property damage annually on a global scale. The shaking of the earth's surface caused by a sudden release of energy within the earth's crust is referred to as an earthquake. This energy release produces seismic waves, also known as S waves. Seismic activity in a specific region determines the magnitude and characteristics of an earthquake. The sudden release of stored energy within the earth's crust during an earthquake causes the rapid movement and displacement of rock masses along fault lines. This motion generates vibrations that propagate throughout the earth as seismic waves. S (secondary) and P (primary) waves are the two principal types of seismic waves. S waves, also known as shear waves, travel through the earth by causing particles to move perpendicular to the wave's propagation direction. The side-to-side shaking motion felt during an earthquake is caused by these waves. Compression waves, or P waves, cause particles to move in the same direction as the propagation of the wave. P waves are the first to be detected during an earthquake and are accountable for the initial jolts. Understanding the nature of earthquakes and the behaviour of seismic waves is essential for determining the potential dangers associated with these natural disasters. It allows scientists and experts to study seismic patterns, develop early

warning systems, establish building codes for earthquake-resistant structures, and educate the public about preparedness and response measures.

Causes an Earthquake

Sudden tectonic movements within the Earth's crust cause earthquakes. When magma rises through the Earth's crust, creating pressure and fracturing the rocks around the volcano, volcanic activity can cause earthquakes.

Before the Earthquake

- Create adaptable connections
- Develop a Seismic Preparedness Plan
- Consult Architects and Structural Engineers Spread Awareness

During the Earthquake

- Remain Indoors and Avoid Dangerous Areas
- Find a Safe Location If Outside, Proceed to an Open Area.

After the Earthquake

- Perform First-Aid CPR and Rescue Breathing
- Be Aware of Dangers
- Verify Gas and Electricity Connections
- Keep away from power lines.

Effects of Earthquake

- Ground Shaking
- Damage to Man-Made Structures
- Fires and Hazardous Chemical Spills
- Landslides and Avalanches
- Tsunamis

LANDSLIDES

- A landslide or landslip is primarily the result of multiple geological processes, including earth movements such as extensive slope failure, rocks falling, and debris flow under the influence of gravity.
- When gravitational and other types of shear stresses within a slope exceed the shear strength (resistance to shearing) of the slope-forming materials, landslides occur.

Causes

- **Extensive Rainfall**: Prolonged and heavy intensity rainfall triggers landslide.
- **Melting of Snow**: In several cold mountain places, during snowmelt the water produced infiltrates into the earth .This increases pore water pressures, causing the initiation of the landslide process.
- **Rivers**: Rivers can damage the slopes, particularly during the floods triggering a landslide.
- **Seismic Shaking and volcanic eruption**: They cause slope failure triggering landslide.
- **Deforestation**: Roots of plants hold soil particles firmly thereby avoiding soil erosion. But removal of vegetation makes rocks prone to landslides.
- **Geology**: Type of rock or soil such coarse particles have low cohesive strength making it vulnerable to landslide.
- **Developmental activities**: Excavation for minerals, tunnels etc. and road construction can too trigger landslide.

Effects

- Landslides blocks streams with debris and stones, leading to overflowing.
- It disrupts vehicular movement, damages vegetation, roads, communication networks and buildings.
- It also results in accidents.

Management and mitigation methods:

1) **Afforestation**: It consolidates the slope thus checking slope instability. Degraded areas should be afforested and existing patches should be preserved.

2) Wired stone blocks: Stone ridge is strapped with wire mesh to protect against landslides.

3) Retaining wall: Construction of concrete retaining walls to prevent slippage from slope.

4) Landslide hazard zonation mapping: Zonation mapping will help in preventing settlements in hazard prone area and also developing and continuously updating the inventory of landslide incidences affecting a country.

5) Surface drainage: Draining of surface and subsurface rivers to allow smooth flow of water.

6) Landslide Warning Techniques: Sensors have been developed which are used for the landslide warning and detection Early warning systems can disseminate information to masses on time, hereby saving many lives.

7) Managing of catchment: Excess water in catchments areas should be stored to reduce the effect of flash floods, this will also recharge the ground water level in areas prone to landslide in India.

8 Public awareness: An aware and vigilant community can reduce the impact of impending landslides.

VOLCANIC ERUPTION

Volcanoes are fissures in the Earth's crust that allow hot gases, molten lava, and small fragments of rock to erupt by exposing the magma within. A volcano is an opening in the earth's surface that allows lava, volcanic ash, and gases to escape from its magma chamber below the surface. A volcanic eruption is the sudden occurrence of a violent discharge of steam and volcanic material from a volcano.

Three meta types of volcanic eruptions.

The most common are magmatic eruptions, which involve the decompression of gas within magma that propels it forward. Another type of volcanic eruptions is known as phreatomagmatic eruptions. These are driven by the compression of gas within magma, direct opposite of the process powering magmatic activity. The third type of volcanic eruption is known as phreatic eruption. It occurs as a result of the superheating of steam via contact with magma.

Eruption of Volcanoes

- Some rocks slowly melt and transform into magma as a result of the intense heat that exists deep within the planet.
- Magma rises and accumulates in magma chambers because it is lighter than solid rock. Some magma penetrates the earth's surface through fissures and vents. Consequently, a volcanic eruption takes place, and the erupted magma is referred to as lava.

Earth's structure to know how volcanoes erupt

The lithosphere is the outermost layer, consisting of the upper crust and the mantle. In mountainous regions, the thickness of the crust ranges from 10 to 100 kilometers and is predominantly composed of silicate rock. Depending on individual seismology, the mantle of the Earth is divided into various sections within the crust. The upper mantle ranges from 8 to 35 kilometers to 410 kilometers, the transition zone from 400 to 660 kilometers, and the lower mantle from 660 to 2,891 kilometers. From the crust to the mantle, conditions are drastically different. Extremely high pressures and temperatures of up to 1000 degrees Celsius occur. This viscous and molten rock accumulates in large chambers within the crust of the Earth.

Magma, being lighter than the surrounding rock, rises to the surface and seeks out fissures and weaknesses in the mantle. It eventually erupts from the peak of a volcano after reaching the surface. Magma refers to the molten rock beneath the surface, which erupts as ash when it reaches the surface. Each time a volcano erupts, rocks, lava, and ash are deposited across its vent. Primarily, the viscosity of the magma dictates the nature of an eruption. When lava flows freely, it spreads far and creates expansive shield volcanoes. It forms a familiar cone-shaped volcano when it is excessively thick. Within a volcano, extremely viscous lava can accumulate and erupt to form lava domes.

Causes of Volcanic Eruption

The three main causes of volcanic eruptions are:

- The buoyancy of the magma
- Pressure from the gases in the magma

- Increase in pressure on the chamber lid

FOREST FIRES

- The most common hazard in forests is forests fire.
- Forests fires are as old as the forests themselves.
- They pose a threat not only to the forest wealth but also to the entire regime to fauna and flora seriously disturbing the bio-diversity and the ecology and environment of a region.

Causes of Forest Fire

Forest fires are caused by Natural causes as well as Man-made causes

Natural causes - Numerous forest fires are sparked by natural causes like lightning, which ignites trees. However, rain extinguishes these fires without causing a great deal of damage. High atmospheric temperatures and dryness (low humidity) provide favourable conditions for the onset of a fire.

Man-made causes - When a source of ignition, such as a naked flame, cigarette, bidi, electric spark, or any other source of ignition, comes into contact with flammable material, a fire results.

Classification of Forest Fire

Forest fire can broadly be classified into three categories;

- Natural or controlled forest fire.
- Forest fires caused by heat generated in the litter and other biomes in summer through carelessness of people (human neglect) and
- Forest fires purposely caused by local inhabitants.

Types of Forest Fire

The types of forest fire are as follows

Surface Fire - A forest fire may primarily burn as a surface fire, spreading along the ground as the surface litter on the forest floor is consumed by the flames.

Underground Fire - Underground fires are low-intensity fires that consume the organic matter beneath the forest floor and the surface litter. In the majority of dense forests, a

thick layer of organic matter covers the mineral soil. This fire spreads by consuming these substances. Typically, these fires spread entirely underground and burn several metres beneath the surface. This fire spreads very slowly, making it difficult to detect and control in the majority of instances. They may continue to burn for months, destroying the soil's vegetative cover. This type of fire is also referred to as Muck fires.

Ground Fire - These fires involve subsurface organic fuels, such as duff layers beneath forest stands, Arctic tundra or taiga, and the organic soils of swamps and bogs. There is no discernible difference between underground and surface fires. Sometimes, underground fires transform into ground fires. This fire consumes root and other material on or below the surface, i.e., it consumes the herbaceous growth on the forest floor as well as the layer of decaying organic matter. They are more destructive than surface fires because they can completely eradicate vegetation. Ground fires are caused by smouldering combustion below the surface and are typically ignited by surface fires.

Crown Fire - A crown fire is a fire that burns the crowns of trees and shrubs and is frequently fueled by a surface fire. In a coniferous forest, a crown fire is especially dangerous because the resinous material released by burning logs burns ferociously. On hill slopes, if a fire begins downhill, it quickly spreads uphill because heated air adjacent to a slope tends to flow up the slope, carrying the flames with it. If a fire begins on an incline, it is less likely to spread downward.

Firestorms - The forest fire that spreads the most rapidly is the firestorm, which is a large-scale, intense fire. As a fire burns, heat rises and air rushes in, which causes the fire to expand. Additional air causes the fire to spin erratically, like a storm. The fiery tornado emits flames from its base and embers from its peak, igniting smaller fires around it. Inside these storms, temperatures can reach approximately 2,000 degrees Fahrenheit.

Vulnerability

The youngest mountain ranges of the Himalayas are the most susceptible to forest fires in the world. Western Himalayan forests are more frequently susceptible to forest fires than Eastern Himalayan forests. This is because the forests of the Eastern Himalayas have a high rainfall concentration. In many regions of the Himalayas where

chirr (Pine) forests have expanded on a large scale, the frequency and severity of forest fires have increased.

Preparedness and Mitigation Measures

Typically, forest fires are seasonal. They typically begin during the dry season and can be prevented by taking the necessary precautions. Various Five Year Plans have provided funding for forest protection. During the British era, forest fires were prevented in the summer by removing forest litter along the entire perimeter of the forest. This was known as the Forest Fire Line. This line once prevented forest fires from spreading from one compartment to another. The collected trash was burned separately. Generally, the fire will only spread along its path if there is a continuous supply of fuel (dry vegetation). The most effective way to control a forest fire is to prevent it from spreading, which can be accomplished by creating firebreaks in the form of small clearings of ditches in the forests.

Precautions

The followings are the important precautions against fire:

- To maintain a safe distance between the source of fire or ignition and combustible and flammable materials.
- To keep the source of the fire under constant observation and control.
- Not allow combustible or flammable materials to accumulate unnecessarily, and store them according to the procedure recommended for the safe storage of combustible or flammable materials.
- To adopt safe practices in areas adjacent to forests, including factories, coalmines, oil depots, chemical stores, and even kitchens.
- To implement fire prevention and suppression techniques and equipment

TSUNAMI

The word 'Tsunami' literally means 'harbour waves'. These are the series of waves and the characteristic feature that differentiates these waves are is their long wavelength.

- Tsunamis are a series of extremely long water waves caused by a large and sudden displacement of the ocean caused by earthquakes, volcanic eruptions, etc.

- These are also known as seismic sea waves and are among the most destructive and powerful natural forces.
- When they reach the coast, they can cause hazardous coastal flooding and strong currents that last for several hours or days.
- The majority of tsunamis are triggered by large earthquakes. Nevertheless, not all earthquakes result in tsunamis.

Characteristics of Tsunami

- Tsunamis are among the rarest dangers on Earth, and the majority of them are small and non-destructive.
- Over deep water, tsunami wavelengths are typically hundreds of kilometres long; however, when a tsunami enters shallow water, its wavelength decreases while its period remains the same, resulting in an increase in wave height.
- Offshore, tsunamis have a small amplitude (wave height). This can range in height from a few centimetres to over 30 metres. However, the majority of tsunamis have wave heights below 3 metres.
- It radiates from its source in all directions and covers the entire ocean.
- It typically consists of a series of waves with minute-to-hour-long periods.
- These are the waves generated by tremors as opposed to earthquakes.
- There is no season for tsunamis, and their behaviours vary. It is impossible to predict when, where, or how destructive it will be. A small tsunami in one location could be enormous a few miles away.
- Individual tsunamis may have varying effects on coasts. Any ocean coast is susceptible to a tsunami at any time. They pose a significant danger to coastal communities. Only if the earthquake's epicentre lies beneath oceanic waters and its magnitude is sufficient would a tsunami result.
- The speed of an ocean wave depends on the depth of the water. It is more prevalent in shallow water than in the ocean's depths. As a result, a tsunami has a greater impact near the coast and less impact over the ocean.

Causes of Tsunami

Earthquake – Tsunamis are generated by earthquakes as a result of disturbances to the seafloor and are generally formed by vertical displacement. The majority of tsunamis are caused by earthquakes along the subduction boundaries of plates along ocean trenches. The magnitude of the Tsunami is proportional to that of the earthquake.

Underwater explosion – A Nuclear Testing by the US generated Tsunami in 1940 and 1950s in Marshall island.

Volcanic eruption – Volcanoes that occur along the Coastal waters can cause several effects that can cause a tsunami.

Landslides – Earthquake and volcanic eruptions generally generate landslides, these landslides when moving into the Oceans, bays and lakes can generate Tsunami.

Meteorite Impacts – Though no historic example as such of meteorite impact has caused Tsunami, the apparent impact of a meteorite about 5 million years ago produced Tsunami leaving deposits along the Gulf Coast of Mexico and the United States.

Tsunami Occur

In the Pacific Ocean, a tsunami occurs approximately every 15 years. The tsunami that occurred on the Indian Coast on December 26, 2004 is an example from India itself. It resulted in catastrophic property and life losses.

Tsunami different from a Wind – Generated Wave

Huge wind-generated waves are not to be confused with tsunami. A wind-generated wave lasts for a few seconds, whereas a tsunami can last anywhere from minutes to hours. Unlike wind-generated waves, tsunamis can be catastrophic.

Tsunami Vulnerability in India

INCOIS is the body that is vigilant regarding tsunamis on the Indian coast. To know more about the Indian National Centre for Ocean Information Services – INCOIS.

The possible zones are Andaman – Sumatra or Makran (Pakistan).

Tsunami Risk, Hazard & Mitigation Measures

The destructive nature of waves causes the majority of the Tsunami's damage. The second effect of a tsunami is debris that acts as projectiles, and the third effect is the loss of crops and water, which causes famine and disease.

Mitigation Measures

1. Effective Planning
2. The building of walls was done by Japan.
3. Planting trees as done in Tamil Nadu by a village
4. Proper relief and rehabilitation preparedness
5. Awareness among the masses

CYCLONES

- Cyclone refers to any storm that spins around a centre of low pressure.
- The centre of low pressure is also known as the 'eye' of the storm.
- It is accompanied by strong anticlockwise winds in the northern hemisphere and clockwise winds in the southern hemisphere.
- They are known by various names in various countries.
- Typhoons in the northwestern Pacific Ocean, hurricanes in the north Atlantic Ocean and the northeast and south Pacific Ocean, and tropical cyclones in the southeast and southwest Indian Ocean.

Effects

Cyclones bring destruction to life and property. It is characterized by heavy rains and strong winds.

Storm surge: A severe tropical cyclone causes an abnormal rise in sea level near the coast, resulting in the flooding of low-lying coastal regions. It drowns people and animals, erodes beaches and bluffs, destroys vegetation, and reduces soil fertility.

Floods: Flooding and submersion of low-lying areas may result from cyclone-caused persistent rainfall, resulting in loss of life and property. Inundations and coastal flooding pollute drinking water sources, leading to the outbreak of epidemics.

Strong winds: Extremely strong winds may cause destruction to infrastructure, dwellings, communication systems, trees, etc., endangering human life and property. It interferes with normal life functions.

Crop: It damages crops, which could lead to inflation.

Decline in tourist: Tourist will not come to a cyclone affected area, thereby affecting livelihood of people.

Storm churn: By churning up cold water, tropical cyclones tend to leave a cold wake behind them that can depress ocean temperature and thus, stifling trailing storm.

Psychological impact: The general populace has an enduring fear of any type of disaster. They have witnessed a large number of deaths, the collapse of infrastructure, cries, pain, and a great deal of suffering.

Management and Mitigation of Cyclones

Coastal plantation: Forests serve as a cyclone-buffering zone. In the absence of a forest, cyclones travel unimpeded. The degraded forest land must be replanted, as plantations will serve as a green wall/wind break for cyclones and a water flow reduction in storm surges. Mangrove forest management is required.

Effective weather Monitoring: Cyclones can be predicted days in advance. Therefore, effective weather monitoring and forecasting can aid in minimizing cyclone-related losses. Warnings should be concise and quickly disseminated to the masses.

Land use control:

The land should be utilised in such a way that critical activities are conducted in vulnerable areas as little as possible. Buildings should be resistant to water and wind. The retrofitting of older buildings should be required. The maintenance of riverbanks is required. The communication lines should be buried. Construction of fortified buildings in vulnerable regions.

Coastal Regulation Zone norms: They should be strictly enforced.

Insurance cover: Comprehensive state insurance cover needs to be provided for persons, their properties and cattle.

Preparedness: Coastal areas should have adequate preparedness against cyclones. Wide roads for quick evacuation, disaster resilient buildings, shelter houses etc.

Awareness: Focused awareness activities are required to increase public awareness of storm surge, flooding and rainfall related to cyclone.

FLOODS

Floods occur when normally dry land is submerged by large quantities of water. Flood is the sudden submersion or inundation of a land area with water. There are both natural and human causes for the occurrence of floods.

Anthropogenic causes of floods include: Clearing of forests: The absence of vegetation cover to hold the soil together on slopes causes erosion and deposition in river beds, making them shallow; when these rivers overflow, they cause flooding. Additionally, bare slopes increase surface runoff and river water volume.

Urban development: The clearing of land for the construction of residential, commercial, and industrial complexes has accelerated the growth of urbanized areas. These concrete pavements and roads prevent the infiltration of rainwater into the ground, which, combined with the lack of vegetation cover to intercept the runoff, causes increased runoff to flow into the rivers, causing flooding.

Improper farming and other land use practices: The flood devastation has been exacerbated by the absence of forest cover and improper farming and land-use practises. There are hardly any remaining forests in the rivers' catchment areas. The high infiltration capacity of forest areas is a well-known fact.

Enhanced Greenhouse effect: Human activities that increase the greenhouse effect and cause global warming are causing a variety of climate changes, such as increased precipitation over a shorter period of time and the melting of more ice. All of these have increased the frequency of flooding.

Natural causes of Floods

Excessive rainfall: Floods occur when rainwater cannot soak into the ground quickly enough or when rivers overflow their banks due to insufficient river channel capacity. It is prevalent in tropical regions.

Storm Surges: It occurs when strong winds raise ocean waves to abnormally high levels, causing them to crash into the coastline and inundate the land. It is prevalent in coastal regions with low relief.

Melting Snow: Spring snowmelt causes rivers to overflow their banks by releasing large quantities of water into the waterways. It is prevalent in areas with cool, temperate climate.

Global Atmospheric processes: Abnormal weather conditions like El Nino (warming of surface ocean waters at Southeastern part of Pacific Ocean).

Earthquakes: Earthquakes are capable of causing landslides and tsunamis. When landslides occur, soil, rocks, mud, and other debris may be deposited in rivers, causing these rivers to overflow. Strong undersea earthquakes can trigger tsunamis that can inundate and devastate coastal communities.

Impact of floods

Loss of life: Floods mostly strike people unprepared, leading to loss of lives in drowning. Along with livestock and other life forms. Impact is higher in flood plain areas which are densely populated,

Damage to infrastructure and property: Flood cause huge losses to homes, roads, power supply and other infrastructure.

Spread of Diseases: After flood water recedes, shallow stagnant water may cover areas over a considerable period of times. This may result in outbreak of water borne diseases. Moreover homeless flood victims are housed in temporary shelters which are mostly overcrowded and with poor sanitation conditions which may turn situation worse.

Loss of natural habitat: Trees, vegetation and other natural habitats may get destroyed leading to loss of biodiversity.

Mitigation of floods

Such structural, water control, and non-structural measures can mitigate flooding: Construction of dams, reservoirs, retarding basins, channel management, and embankments are examples of structural methods. Methods for water management include increasing forest and plant cover, watershed management, floodproofing, and catchment modification. Drainage and flood protection systems, Flood forecasting, flood warning and emergency preparedness systems, flood insurance, public information and education, and flood relief are non-structural methods.

NUCLEAR AND INDUSTRIAL ACCIDENTS

Nuclear Hazards

Nuclear hazards are the threat posed by the presence of radioactive materials such as radio-nuclides in the air, water, or soil, which contaminate the environment invisibly and odorlessly. These radionuclides release high-energy particles (alpha and beta rays) as well as electromagnetic radiation (gamma rays). Radio nuclides are radioactive elements with unstable atomic nuclei, such as uranium 235, uranium 283, thorium 232, potassium 40, radium 226, carbon 14, etc., which emit alpha, beta, and gamma rays. Radioactivity is the spontaneous emission of particles and rays by an unstable nucleus, and radioactive or nuclear pollution is the contamination of the environment with these radiations. Radioactive or nuclear pollution can be defined as the release of radioactive substances or high-energy particles into the air, water, or earth, whether by accident or design. When they pose a threat to human health, natural sources of radioactivity, such as radon gas emitted from the ground, are considered pollutants. Radionuclides are a natural component of our environment.

Sources of Nuclear Pollution / Hazards/ Radioactive Pollution

The sources of nuclear pollution include both natural and manmade sources. The human environment has always been radioactive and accounts for up to 85% of the annual human radiation dose. Radiation arising from human activities typically accounts for up to 15% of the public's exposure every year.

Natural Sources: The majority of radiation exposure comes from natural sources. These include radioactivity in the rocks and soil of the Earth's crust; radon, a radioactive gas emitted by numerous volcanic rocks and uranium ore; and cosmic radiations, among others. a. Cosmic rays emanating from space. The quantity varies according to latitude and altitude; it is greater at higher latitudes and higher altitudes. b. Emissions from radioactive materials within the Earth's crust, such as rocks and marine sediments.

Man-Made Sources: These sources include any environmental process that emits radiation. There are numerous sources of radiation pollution, including research and medical procedures and wastes, nuclear power plants, and others.

Nuclear waste handling and disposal:

- The radioactivity may also contaminate and spread via air, water, and soil.

- Their effects are difficult to distinguish and difficult to predict.
- The primary problem with radioactive waste is that it cannot be degraded chemically or biologically.
- If containment is not possible, the waste must be diluted.
- The waste can also be contained by storing it in sparsely populated, remote areas.

b. Use of radioactive materials in Defense weapon production: Production of nuclear weapons may also release radiation from radioactive materials that are handled (usually of high health risks). However, unless an accident occurs, the current regulations prohibit the release of significant quantities of radiation.

c. Nuclear explosions and detonations of nuclear weapons: Probably around the middle of the twentieth century, as a result of various experimental or combat nuclear explosions that ended World War II, the greatest quantities of radiation pollution caused by humans were produced.

d. Mining and processing of radioactive ores: It includes the crushing and processing of radioactive ores and the production of radioactive byproducts. Other ore mining may also generate radioactive waste (such as mining of phosphate ores).

e. Nuclear accidents: Nuclear power plant accidents at Three Mile Island in 1979 and Chernobyl in 1986 are classic examples of radiation pollution from this type of source. Even accidents involving the handling of medical nuclear materials/waste could result in radiation exposure for workers.

f. Use of radioactive isotopes in medical, industrial, and research applications: X-ray diagnostics, radioactive isotopes used as tracers, and the treatment of cancer and other diseases pose the greatest risk to human health.

Effects of Nuclear Pollution / Hazards/ Radioactive Pollution

Typically these effects can be of two types:

Somatic effects affect the function of the exposed individual's cells and organs. It damages cell membranes, mitochondria, and nuclei, leading to abnormal cell functions, cell division, cell growth, and cell death.

Radiation can cause mutations, which are alterations in the genetic makeup of cells that affect future generations as well. These effects are primarily the result of DNA molecule damage. People exposed to higher doses, between 100 and 1,000 roentgens, develop blood cancer and bone cancer.

Some of the possible human health effects are listed as under:

a. Effects on DNA and Mutations : Radiations may break chemical bonds, such as DNA in cells and cause mutations. This affects the genetic make-up and control mechanisms. The effects can be instantaneous, prolonged or delayed types. Even it could be carried to future generations.

b. General Physiological Effects: Exposure at low doses of radiations (100-250 rads), men do not die but begin to suffer from fatigue, nausea, vomiting and loss of hair. But recovery is possible.

c. Effects on Immunity: Exposure at higher doses (400-500 rads), the bone marrow is affected, blood cells are reduced, natural resistance and fighting capacity against germs is reduced, blood fails to clot, and the irradiated person soon dies of infection and bleeding.

d. Effects on Tissues of Vital Organs: Higher radiation doses (10,000 rads) kill the organisms by damaging the tissues of heart, brain, etc. Hypothyroidism may also be a radiation cause due to the destruction of thyroid gland by radioactive accumulated iodine.

e. Occupational Diseases: Few occupations that involve radioactive exposures are uranium mineworkers, radium watch dial painters, technical staff at nuclear power plants, etc. Exposure to radioactive and nuclear hazards has been clinically proven to cause cancer, mutations and teratogenesis.

f. Effects through biomagnifications: Through food chain also, radioactivity effects are experienced by man. E.g. Strontium 90 behaves like calcium and is easily deposited and replaces calcium in the bone tissues. It could be passed to human beings through ingestion of strontium-contaminated milk.

g. Cancers: Cancer generation is the most typical health effect of radiation exposure, especially when high or moderate amounts of radiation are involved. Lung cancer is a typical example of the effect of exposure to radon, which is the second leading cause of

lung cancer in the U.S. Many years of monitoring of radiation effects from detonation of nuclear bombs in Japan in 1940's, showed that cancers may develop immediately following the exposure to radiation or after shorter or longer periods (up to 30 years from the exposure) of time since the exposure occurred.

Control of nuclear hazards

We cannot live without radioactive materials because their peaceful applications are so extensive and effective, but there is no treatment for radiation damage. Controlling and preventing radioactive pollution is therefore the only option against nuclear hazards.

Following are the ways to prevent or control these hazards

a. Leakages from nuclear reactors, careless handling, transport and use of radioactive fuels, fission products and radioactive isotopes have to be totally stopped.

b. Safety measures should be enforced strictly and strengthened against nuclear accidents.

c. There should be regular monitoring and quantitative analysis through frequent sampling in the risk areas.

d. Preventive measures should be followed so that background radiation levels do not exceed the permissible limits.

e. Appropriate steps should be taken against occupational exposure.

f. Waste disposal must be careful, efficient and effective.

The nuclear wastes are usually classified into three categories:

1) High Level Wastes (HLW): High-level wastes have an extremely high radioactivity per unit volume. E.g. Spent nuclear fuel. Before being disposed of, HLWs must be cooled, so their producer stores them for several decades. Since these wastes are too hazardous to be released anywhere in the biosphere, they must be contained either by transforming them into inert solids (ceramics) and burying them deep underground or by storing them in deep salt mines.

2) Medium level wastes (MLW): Medium-level wastes (such as filters, reactor components, etc.) are solidified and mixed with concrete in steel drums prior to being buried in deep mines or below the sea floor in concrete chambers.

3) Low liquid wastes (LLW): Low liquid wastes (such as solids or liquids containing traces of radioactivity) are disposed of in steel drums in trenches lined with concrete at designated sites. In 1985, at Tarapore, India, a Waste Immobilization Plant (WIP) was commissioned. It vouches for HLWs. Precautions following the disposal of radioactive waste: The careful, efficient, and effective treatment and disposal of radioactive waste is insufficient to accomplish the task. The disposal sites must be regularly monitored.

The essential **precautions**, at the disposal sites, that have to be taken include:

- Monitoring radioactivity in the vicinity of disposal sites.
- Erosion prevention at radioactive waste disposal sites.
- Prohibition of all drilling operations within and around the waste disposal site.
- Periodic and long-term surveillance of such disposal sites and areas of naturally uranium-rich rocks.

INDUSTRIAL ACCIDENTS

Thousands of workers die annually as a result of unsafe working conditions, and even more die annually as a result of occupational diseases such as cancer. In addition, industrial accidents result in a large number of injuries of varying severity. Nobody ever plans or schedules accidents, but the vast majority of people can help prevent accidents by using common sense and caution.

Industrial accidents, such as petrochemical plant accidents, can obviously harm workers on the job sites, but they can also cause extensive damage to the surrounding area and the environment. Accidents at chemical plants that pollute the air with noxious substances can have repercussions for people hundreds of miles away. Infrastructure failures, dangerous procedures, and certain human actions have the potential to cause technological hazards in industrial settings, which can even result in wrongful death in industrial accidents.

Industrial Accidents Occur due to accidents, incompetence, or negligence, and may result in property damage, bodily harm, or even death. Additionally, these dangers may degrade the environment and disrupt society and the economy. Industrial accidents, also referred to as technological disasters, are non-natural calamities that encompass a variety of occurrences.

Types of Industrial Accidents

The following accidents are classified as industrial accidents:

Accidental Release – Dangerous chemical substances released inadvertently during their production, handling, or transport pose a threat to anyone in the vicinity of the release site.

Acid Rain – Chemical pollutants such as nitrogen compounds and sulphur can cause ecological and agricultural harm by increasing the soil and water's acidity. When the atmosphere contains a high concentration of acidic compounds, a washout produces acid rain, which deposits the acidic compounds in the soil and water.

Atmospheric Pollution – Nuclear explosions, chemicals, the combustion of artificial or natural fuels, and other industrial practises can produce large quantities of radiation, solids, and gases that pollute the atmosphere and endanger those who live or work in the area.

Chemical Explosion: The explosive detonation of combustible materials typically involving chemicals and resulting in injuries, loss of life, and extensive property damage.

Chemical Pollution – Chemicals that suddenly pollute the air or water in or around industrial areas can cause permanent skin damage and internal body disorders.

Explosion – A calamity is classified as an explosion if the explosion is the actual calamity. If an explosion causes another disaster, then that event is classified as a resultant disaster.

Coal dust or natural gas can react with air and cause explosions in mines.

Nuclear Explosion or Radiation – International laws establish the allowable levels of radiation in civil facilities in order to maintain safety, and the accidental release of radiation can result in higher levels that exceed the safety standards.

Pollution – Synthetic products or other debris, in addition to the improper management of environmental or natural resources, can generate toxic biological, chemical, or industrial wastes that degrade one or more environmental aspects.

Causes of Industrial Accidents

The majority of industrial accidents are caused by unsafe conditions, which is another way of saying that they should never have occurred. These are the most common causes of industrial accidents:

- Improper training and supervision;
- Careless operation;
- Inadequate personal safety gear;
- Defective or malfunctioning equipment;
- Unsafe storage;
- Poor house-keeping;
- Improper ventilation;
- Dangerous working conditions, such as slippery floors and excessive heat;
- Poor maintenance of equipment;
- Poorly-guarded equipment; and
- Insufficient lighting.

OIL SPILLS

Oil spills are occurring more frequently and in a variety of ways. Each year, thousands of oil spills occur in U.S. waters. The majority of these spills are small, such as when oil spills during ship refueling. However, these spills can still cause harm, particularly if they occur in sensitive environments such as beaches, mangroves, and wetlands. Large oil spills are major, dangerous disasters. These typically occur when pipelines rupture, large oil tanker ships sink, or drilling operations fail. After a large oil spill, ecosystems and economies can feel the effects for decades. Oil spills can occur wherever oil is extracted, transported, or utilised. A number of factors, including the location of the spill, the types of plants, animals, and habitats present, as well as the amount and type of oil, can affect the extent of the damage caused by an oil spill.

Generally, oil spills harm ocean life in two ways:

Fouling or oiling occurs when oil causes physical harm to a plant or animal. Oil can coat a bird's wings, rendering it unable to fly, or strip the sea otter's fur of its insulating properties, putting it at risk of hypothermia. Frequently, the degree of lubrication affects the animal's chances of survival.

Oil toxicity: Oil is composed of numerous toxic compounds. These toxic substances can cause severe health issues, including heart damage, stunted growth, immune system effects, and even death.

Recovery, cleaning, and rehabilitation of wildlife are frequently crucial components of oil spill response. However, it is difficult to find and capture wildlife, oil spills can affect vast areas, and some animals (such as whales) are too large to recover. Unfortunately, it is impossible to save all wildlife affected by oil spills.

Causes of Oil Spills

- There are oil spills in rivers, the ocean, and bays.
- Most spills derive from tanker accidents.
- When oil tankers collide with marine objects, significant damage can result in oil leaks.
- Land-based spills may also result from pipeline damage and insufficient drilling techniques. Furthermore, natural disasters can impact oil spills. Storm surges and high winds may cause damage to oil rigs, pipelines, barges, and other structures.
- Malicious intent is the ultimate cause of oil spills.
- Terrorists and war criminals may deliberately damage pipelines and oil rigs in order to deplete the resources of their opponents.
- When large quantities of oil are released into the environment, local ecosystems and societal health suffer.

Impact

- Loss of biodiversity is an important oil spill effect.
- Oil may be ingested by marine animals because it contaminates their natural habitats.

- When animals consume the oil, they may develop ulcers, bleeding, gastrointestinal irritation, and other digestive problems.
- In oil-contaminated environments, aquatic animals also experience liver damage, anaemia, respiratory complications, and emphysema. In addition to harming the environment, spills degrade coral reefs.
- When petroleum settles on the ocean floor, it inhibits the reproduction of adult corals.
- Regularly, coral reefs are exposed to high levels of ultraviolet (UV) radiation. UV light can make petroleum components more toxic. It may also have a negative impact on algae production.

Impact on Human Health

Additionally, oil spills can negatively impact the health and well-being of society.

Some spills result from explosions on oil rigs, directly affecting maintenance personnel and operators.

Also evaluated were the long-term health effects of oil spills on Amazonian indigenous populations.

Following an oil spill, residents of the Amazon exhibited concerning health complications. They suffered from reproductive problems, respiratory issues, cancer, immune system deficiencies, and other severe health issues.

Researchers also discovered that spill cleanup specialists had elevated mercury levels in their urine.

Oil can also move up the food chain and end up on the plates of people around the world.

When consumers consume petroleum, lipid pneumonia may develop. To cause toxic oil syndrome, individuals must consume vast quantities of oil (TOS).

By increasing their awareness, operators and oil workers may protect the health and well-being of society.

Exploring significant oil spills throughout history can aid in the prevention of future catastrophes. To further their education, individuals may evaluate the causes and effects of three historic spills.

Causes and Effects of Oil Spills

The Gulf of Mexico was contaminated by a significant oil spill caused by BP.

Before the explosion, operators on the Deepwater Horizon rig noticed unusual pressure readings during an inspection. They failed to report the problem, and their response during the explosion was inadequate. Poor concrete placement was a second direct cause of the spill.

Some oil spills are caused by criminal activity or accidents, but the BP incident was caused by human error. The Persian Gulf War spill is another major historical catastrophe. It was a terrorist act committed by Saddam Hussein against Kuwaitis.

The terrorist organisation set fire to hundreds of oil wells. The third significant occurrence was the oil spill at Castillo de Bellver. A fire aboard the oil tanker caused the ship to split in two and capsize.

When the ship reached the ocean floor, it released petroleum into the aquatic ecosystem. Following an examination of three causes and consequences of oil spills, rig operators and oil workers can take precautions to protect themselves and the environment.

Prevention of oil spills

Oil industry workers can prevent future spills by taking preventative measures. They are permitted to conduct routine inspections and report any anomalous data. Moreover, government officials should provide increased protection for oil rigs during wars and terrorist attacks. Engineers can also contribute to the prevention of oil spills through the development of compelling safety features. Safety measures can reduce the likelihood of spills in the event of an accident or capsize. Oil spill prevention measures can protect human and environmental health over time.

UNIT IV – ENVIRONMENTAL PROBLEMS, POLICIES AND PROTECTION OF ENVIRONMENT

Major Environmental Problems: Global Warming, Green House Effect, Climate Change, Ozone Layer Depletion, Acid Rain, Extinction of Flora and Fauna – National Environmental Policies and Programmes: Environmental Legislation, Acts, Rules, Notifications and Amendments, National and Regional Green Tribunals, Pollution Control Board – International NGOs and Environmental Protection, Environmental Foundation for Africa, World Wide Fund for Nature, Conservation International, Green Peace – International Union for Conservation of Nature

GLOBAL WARMING

Climate change that causes an increase in the average temperature of the lower atmosphere is referred to as global warming. There may be numerous causes for global warming, but it is typically attributed to human activity, specifically the emission of excessive quantities of greenhouse gases. The Intergovernmental Panel on Climate Change (IPCC) published a special report in 2018 stating that humans and their activities are responsible for between 0.8 and 1.2 °C of global warming since the preindustrial era. Also predicted was an increase of between 3 and 4 °C in the global mean surface temperature by 2100.78.1 percent of the atmosphere is composed of nitrogen and 20.9 percent of it is composed of oxygen. All other gases, including carbon dioxide (CO2) 0.035 percent, methane (CH4) 0.00017 percent, and ozone 0.00000 percent, account for approximately 1 percent of the total.

Carbon dioxide, methane, water vapour, and fluorinated gases are commonly referred to as greenhouse gases because they act as a greenhouse around the earth. These gases form a partial cover over the Earth's atmosphere, preventing outgoing infra-red radiations from returning to space. This mechanism of trapping gases is widely used in greenhouses to take advantage of the heat generated by such gases to promote the rapid growth of plants. The same mechanism operates in the Earth's atmosphere, so it is also known as the "Greenhouse Effect." Since pre-industrial times, greenhouse gas emissions have been on the rise, but this trend has accelerated in recent years due to industrialization, scientific and technological advancements, overpopulation, land-use change, deforestation, changes in lifestyles, and the increased use of fossil fuels.

Anthropogenic activities added new greenhouse gases to the family, including chlorofluorocarbons (CFCs), per fluorocarbons (PFCs), hydro-fluorocarbons (HFCs), and sulphur hexafluoride (SF6), which further increase the average global temperature. When the stock of greenhouse gases exceeds the Earth's assimilative capacity, manifestations of the same are observed through changes in the weather regime, as well as effects on the world's diverse ecosystems. As a result of the greenhouse effect, the global mean temperature of the Earth rises and persists over time; this is the primary cause of the planet's extensive warming, hence the term 'Global Warming'.

Effect or Impact of global warming

A number of the negative effects of global warming are described below. Due to global warming, glacier ice sheaths begin to melt, resulting in a rise in sea level. Extremely destructive storms are attributed to global warming. Forest fires can be caused by natural causes (lightning, volcanic eruptions, sparks from rock falls) or by human activity (slash-and-burn), which releases vast quantities of carbon dioxide, ash, and other related materials. In 2019, more than 184 individuals perish in India as a result of heat waves caused by global warming. Andhra Pradesh, Telangana, Punjab, Uttar Pradesh, Odisha, and Bihar are the most affected regions. It also severely impacted livestock and crop yield. Increased temperatures on land and in the ocean have shifted the habitat range of many species poleward or upward from their current location; droughts and desertification have accelerated these changes. Increasing temperature causes coral bleaching in various parts of the world, and acidification of oceans affects corals in terms of their skeleton formation; acidified waters make it difficult for corals to absorb calcium from the water, which is essential for shell formation, and dissolves reefs. As flooding and the breeding grounds of mosquitoes and other vectors increase, water-borne and vector-borne disease epidemics occur. As people migrate from regions with higher temperatures to those with relatively lower temperatures, global warming may also facilitate the spread of various diseases to other regions. In countries such as Bangladesh, Khartoum, the Netherlands, Egypt, and Sudan, the number of deaths and injuries caused by flooding and landslides is growing as a result of global climate change.

Preventive measures for global warming

- To combat global warming and climate change, greenhouse gas emissions into the atmosphere must be drastically reduced. This can be accomplished by taking the following steps:
- Improving energy conservation and efficiency, in addition to the production and efficient use of non-fossil fuels.
- By decreasing the use of fossil fuels, it is possible to reduce carbon dioxide emissions.
- Establishing stringent standards for power plants, developing and marketing cost-effective, high-efficiency automobiles, and providing financial incentives for energy efficiency in industries and homes.
- grow green plants Planting more trees is a more direct and practical method of combating global warming and climate change whenever possible, because forests store a great deal of carbon dioxide in their leaves and soil.
- In addition to reducing greenhouse gas emissions, a number of innovative geo-engineering models (such as iron fertilisation) have been proposed to achieve a cooler planet and thus control climate change and other consequences of global warming.
- Reduce nitrous oxide emissions by decreasing the use of nitrogen fertilisers in agriculture.

GREEN HOUSE EFFECT

The greenhouse effect is the increase in Earth's temperature caused by certain gases in the atmosphere (such as water vapour, carbon dioxide, nitrous oxide, ozone, and methane) that trap solar energy. These gases are commonly referred to as greenhouse gases because they behave similarly to greenhouse glass. The greenhouse's glass panels allow light in but prevent heat from escaping, similar to the effect these gases have on the planet. Through the greenhouse gases, sunlight enters the Earth's atmosphere. As the energy of sunlight reaches the Earth's surface, land, water, and the biosphere absorb it. This energy is released back into the atmosphere after being absorbed. Some of the energy escapes into space, but the greenhouse gases trap the majority of it in the atmosphere.

Without these gases, the average temperature of the Earth would be approximately 30 degrees Celsius (54 degrees Fahrenheit) lower. This is a completely natural process, and without them, the average temperature would be about 30 degrees Celsius (54 degrees Fahrenheit) cooler.

Without the greenhouse effect, the earth would be uninhabitable. However, if the greenhouse effect intensifies, global temperatures could increase. Humans, plants, and animals may encounter difficulties if the temperature rises even slightly. Some human activities generate greenhouse gases that continue to build up in the atmosphere. Changes in the balance of greenhouse gases have profound effects on the entire planet. Carbon dioxide is released into the atmosphere by burning coal, oil, and natural gas. Additionally, the felling and combustion of trees generates a substantial amount of carbon dioxide. Chlorofluorocarbons are a type of greenhouse gas utilised in aerosols such as hairspray, refrigerators, and foam plastics. As the concentration of greenhouse gases in the atmosphere rises, more heat is trapped, resulting in global warming. This is referred to as global warming. Numerous researchers concur that human activities exacerbate the natural greenhouse effect. If we continue to pollute the atmosphere with greenhouse gases, the consequences for the planet will be catastrophic.

Major Sources of Greenhouse Gases

The most significant greenhouse gas is carbon dioxide, which is released into the atmosphere when fossil fuels are burned for various purposes, e.g., electricity generation. Each year, electric power plants fueled by fossil fuels, primarily coal and mineral oil, emit a tremendous amount of carbon dioxide into the atmosphere. These power plants are the most significant and widespread sources of carbon dioxide produced by humans. Numerous factories dispersed across the globe burn enormous quantities of coal, mineral oil, and natural gas, releasing vast quantities of carbon dioxide and other harmful gases through their chimneys. The third source is the transportation sector, which includes a variety of coal- and petroleum-powered vehicles. Deforestation and the burning of firewood constitute the fourth largest source of carbon dioxide production.

Greenhouse Gases

Greenhouse gases are gases directly responsible for the greenhouse effect. They trap heat in the earth's atmosphere, which can lead to global temperature increases. Included among the greenhouse gases are:

Carbon Dioxide (Natural): Absorbs, retains, and radiates heat, resulting in global warming.

Methane (Natural): A more potent greenhouse gas than carbon dioxide. Due to a chemical reaction, methane converts into carbon dioxide when it comes in contact with oxygen. This causes an increase in global temperatures.

Nitrous Oxide (Natural): Can remain in the atmosphere for 150 years, and is about 300 times more potent than carbon dioxide.

Chlorofluorocarbons (Man-Made): These gases are utilised as aerosols and refrigerants. When they escape into the atmosphere, they can accumulate and amplify the greenhouse effect.

Hydrofluorocarbons (Man-Made): These chemicals contain fluorine and are primarily employed in the refrigeration industry. They were replaced with chlorofluorocarbons, but they still contribute to global warming.

Carbon Monoxide (Man-Made): Emitted by combustion-based motor vehicles, aircraft, ships, and industrial processes.

Nitrogen Oxide (Man-Made): Nitrogen dioxide is a byproduct of the combustion of fossil fuels and industrial processes, both of which contribute to the formation of acid rain. As a result, it transforms into nitric oxide and nitrous oxide in the atmosphere.

Impact of Green House Effect

(i) Some analysts believe that the average global temperature will increase by 1.5 to 4.5°C by 2050. According to one projection, the tropics will experience the least change, while the poles will experience the most.

(ii) Five degrees of warming would result in a five-meter rise in sea level within a few decades, endangering all densely populated coastal cities from Shanghai to San Francisco.

(iii) It is hypothesised that North America will become warmer and drier. The United States would produce less grains. North and East Africa, the Middle East, India, Western Australia, and Mexico, on the other hand, would be warmer and wetter, allowing them to produce more grain. Both the rice growing season and the area under rice cultivation could extend. This may not occur, however, as the higher surface temperature will increase water evaporation, thereby decreasing grain yield.

(iv) According to American scientist George Woodwell, the annual monsoon rains in India may cease entirely.

(v) According to an estimate, if all the ice on the planet melted, 200 feet of water would be added to the surface of the world's oceans, and low-lying cities such as Bangkok and Venice would be submerged. Warming of the ocean would cause a 50-100 cm rise, which would inundate low-lying areas of Bangladesh and West Bengal.

(vi) As a result of the greenhouse effect, there may be a rise in the frequency of hurricanes and cyclones, as well as earlier snowmelt in the mountains, resulting in more monsoon floods.

(vii) According to some, there will be a 1.5- to 3.5-meter rise in sea levels within the next 25 years, and in Bangladesh alone, 15 million people must relocate or perish. The low-lying cities of Dhaka and Kolkata may be flooded.

CLIMATE CHANGE

Climate change is the long-term increase in the earth's average surface temperature and the large-scale changes in global, regional, and local weather patterns that result from this increase, which is caused by a substantial increase in the levels of greenhouse gases produced by the combustion of fossil fuels. Significant variations in long-term weather patterns are climate change.

Some key climate change statistics gathered by NASA:

Over the last two centuries, the global average temperature of the earth’s surface has risen by 2.12 degrees Fahrenheit (1.18 degrees Celsius).

Between 1993 and 2019, there was an annual loss of 279 billion tons of ice in Greenland and 148 billion tons of ice in Antarctica, as ice sheets break off and eventually melt.

There has been a 0.6 degree Fahrenheit (0.33 degree Celsius) rise in the temperature of the top 100 meters of the ocean since 1969.

Weather and Climate

Weather: The local meteorological conditions experienced over short periods of time, including temperature, precipitation, wind speed, humidity, and visibility.

Climate: The long-term average of patterns and trends in weather, including day-to-day, year-to-year, and even longer time periods.

Global Warming and Climate Change

Global Warming: The rising average temperature of the earth's lower layers, including the ocean and atmosphere. Such warming occurs from the heat being trapped in the earth's atmosphere due to greenhouse gases.

Climate Change: The varying environmental conditions that influence the planet's weather patterns.

Natural Causes of Climate Change

When it comes to natural factors impacting climate change, these three causes are frequently cited as contributors:

Changes in Solar Radiation - The sun's rays heat the earth regardless of changes in weather patterns that occur below. As such, any change in the sun's radiation - either an increase or decrease - will influence our surface temperatures.

Greenhouse Gases - As the temperature increases, more greenhouse gases are released into the air. This traps more heat in the earth's atmosphere while thinning out the ozone layer, which means less radiation can escape. It can cause a nasty cycle where the participants feed off each other.

Drastic Weather Changes - Climate change can also occur through drastic weather changes. Disasters like hurricanes or floods can cause significant damage to the surrounding environment, which in turn can affect the climate.

Man-Made Causes of Climate Change

The most prominent man-made causes of climate change include:

Industrialization - Increased development has led to greater production and allocation of energy, which releases greenhouse gases into the atmosphere in greater percentages than in the past.

Inconsistent Emissions Controls - As technology continues to improve, emissions control standards haven't kept pace. This means that more harmful greenhouse gases are being released into the air.

Deforestation - Plants breathe in carbon dioxide, which makes them an essential part of life on this planet. When increasing amounts of trees are cut down without planting new ones, it means a disproportionate amount of carbon dioxide stays in the atmosphere and heats up the environment.

Agribusiness - Contemporary farms send up large amounts of carbon dioxide and methane into the atmosphere while meeting the food needs of developed countries.

Modernization - The concrete used to build roads, and the vehicles that travel upon them, create high levels of carbon dioxide and exhaust fumes that contribute to higher temperatures.

Climate Change Effects

Climate change impacts our world in a wide variety of ways, including:

Weather: As weather patterns become unpredictable, it affects food production. Also, extreme weather conditions put people at significant risk of disease and injury.

Plants: As the weather becomes warmer and sea levels rise, plant life moves higher or further inland. This can result in problems for local animal life.

Wildlife: Changes in the environment cause changes in animal behavior. Many animals are affected by the lack of food sources and new predators that were previously unable to penetrate into their territories. Consequently, animals are forced into a position where they have to migrate or face extinction.

Businesses: Extreme weather conditions such as hurricanes and tornadoes can destroy vast amounts of property. As such, businesses suffer the losses that these tragedies bring.

Increasing Sea Levels: As polar ice caps melt, sea levels begin to rise. This can potentially displace millions of people worldwide as well as destroy various ecosystems and natural landmarks.

Ocean Acidification: As the oceans absorb carbon dioxide from the atmosphere, they become increasingly acidic, which can be dangerous to coral and marine life.

Climate Change Measured - climate change is something that occurs over a long period of time, measuring it can be challenging. The evidence of climate change relies on tracking specific metrics to measure and monitor these changes, including (in the order of importance):

Surface Temperature: This is the temperature of the air, land, and water on the surface level. It is a direct indicator that climate change has occurred. It's important because measuring the rate of change in temperature helps scientists project how much it will warm or cool over time.

Sea Level Rise: While this is a slower process, melted ice causes sea levels to rise, and monitoring that rise can help scientists project how much the oceans will grow in size. This is essential as rising sea levels threaten to displace millions of people.

Parts per Million of Greenhouse Gases: This is the measurement of greenhouse gases in the atmosphere. For example, when scientists measure how much CO2 humans are emitting into the atmosphere, they can better predict future levels of global warming that will occur as a result

Steps to slow down climate change include

- Electing individuals at all levels of government who are dedicated to passing laws and implementing policies to combat climate change
- Reducing the amount of single-use, disposable plastic items, such as bags, bottles, and cutlery, because the production of these inexpensive items generates significant greenhouse gas emissions.
- Turning off lights and electrical appliances when not in use helps conserve energy.
- As agricultural meat production is one of the leading causes of greenhouse gas emissions, we should consume less meat.

- Taking shorter showers and only using water when necessary, as unnecessary water heating increases energy consumption.

Causes and Effects of Climate Change

Climate change issues become more severe, reversing its effects becomes even more difficult. People, businesses, and governments should work together on a personal and international level, and these efforts should begin immediately. One of the best ways to impact this change is the election of leaders who appreciate the severity of the matter, and are willing to work on reducing its causes and effects. Another way we can all work together to defeat climate change and begin a clean energy revolution is through the installation of solar power systems wherever possible.

OZONE LAYER DEPLETION

Ozone is a naturally occurring gas in our atmosphere that was discovered in 1839 by German-Swiss chemist C. F. Schnbein. Each molecule of ozone, chemically denoted as O3, contains three oxygen atoms and is primarily found in two regions of the atmosphere. The troposphere contains approximately 10 percent of atmospheric ozone, while the stratosphere contains the remaining 90 percent. The troposphere is approximately 10 to 16 kilometers above the surface, while the stratosphere is approximately 50 kilometers above the surface. This large amount of stratospheric ozone is commonly known as the ozone layer. The term ozone comes from the Greek word ozein, which means "to smell." It is a noxious, pale-blue, explosive, and toxic gas, even in low concentrations. Its pungent odour enables it to be detected even in minute quantities. Ozone reacts swiftly with numerous chemical compounds and is explosive in high concentrations. With some variation in altitude and thickness, the ozone layer encompasses the entire globe. The most common unit for measuring stratospheric ozone is the Dobson Unit (DU), named after atmospheric ozone pioneer G.M.B. Dobson. A Dobson Unit measures the total amount of ozone in an aura's overhead column. Dobson Units are calculated based on how dense the ozone layer would be if it were compressed into a single layer at 0 degrees Celsius and one atmosphere of pressure above it.

Formation of Ozone

As discussed above ozone is found in two regions of the atmosphere, therefore here we can explain its formation with regard to its existence:

a. Formation of Stratospheric ozone: - Stratospheric ozone is formed naturally by chemical reactions involving solar ultraviolet radiation (sunlight) and oxygen molecules. In the first step, solar ultraviolet radiation breaks apart one oxygen molecule (O_2) to produce two oxygen atoms ($2O$). In the second step, each of these highly reactive atoms combines with an oxygen molecule to produce an ozone molecule (O_3). These reactions occur continually whenever solar ultraviolet radiation is present in the stratosphere. As a consequence, the largest ozone production occurs in the tropical stratosphere.

b. Formation of Tropospheric ozone: - Fossil fuel combustion is a main source of pollutant gases that contribute to tropospheric ozone production. Near the Earth's surface, ozone is produced by chemical reactions involving naturally occurring gases and gases from pollution sources. Ozone production reactions primarily involve hydrocarbon and nitrogen oxide gases, as well as ozone itself, and all require sunlight for completion.

Importance of Ozone layer

- Ozone may be either hazardous or beneficial, depending largely on its presence.
- Stratospheric ozone is thought safe for human and other forms of life because it absorbs UV-B radiation from the Sun, which otherwise would reach Earth's surface and will cause harm to all forms of life.
- Increased exposure to UV-B radiation increases the risks of skin cancer, cataracts, and a suppressed immune system and can also damage terrestrial plant life, single-cell organisms, and aquatic ecosystems.
- Other UV radiation, UV-A, which is not absorbed significantly by ozone, causes premature aging of the skin.
- On the other hand, Ozone near the Earth's surface in excess quantities is thought as bad ozone, which is hazardous as an oxidant in smog (smog ozone).
- Smog ozone reduces the normal operation of the lungs because it inflames the cells that line the respiratory tract.

- Other health effects include increased incidence of asthma attacks, increased danger of infection, and reduced heart and circulatory functions.
- Smog Ozone also damages plant foliage and reduces their production or yield.

Phenomenon of Ozone depletion

- Ozone hole or Ozone layer depletion, is simply the wearing out of the amount of ozone in the stratosphere.
- The loss of ozone layer occurs when more ozone is being destroyed than being created. The ozone layer is being ruined by a group of manufactured chemicals that are known as Ozone-Depleting Substances (ODS).
- It was first proposed by M. Molina and S. Rowland in 1974 that a man-made group of compounds known as the chlorofluorocarbons (CFCs, extremely long-lived, stable, non-flammable, not too toxic) were likely to be the main source of ozone depletion.
- CFC's are used in air conditioning systems, refrigerants, solvents, foam blowing agents and as propellants for aerosol spray cans.
- Chlorofluorocarbons are not "washed" back to Earth by rain or destroyed in reactions with other chemicals. These compounds merely do not break down in the lower atmosphere and they can remain there from 20 to 120 years or more.
- As a result of their relative stability, CFCs are transported into the stratosphere where they are finally worn down by ultraviolet (UV) rays from the Sun, releasing free chlorine which actively gets involves in the destruction of ozone.
- Scientists have found that 1 atom of chlorine can destroy over 100,000 ozone molecules.
- Researchers have found ozone also thinned over North America, Europe, Asia, Australia, South America, and Africa.

Impact of Ozone depletion

The stratospheric ozone plays an important role in protecting surface life forms from exposure to harmful UV-B radiation. This 'good ozone' typically absorbs 97-99 percent of incoming UV-B radiation. If these radiations enter into our atmosphere they adversely effect on each and every component of our ecosystem (directly or indirectly).

Some of the adverse effects of Ozone depletion on our ecosystem.

A. Human and Animal Health: Increased penetration of solar UV-B radiation to earth is likely to induce a profound impact on human health with potential risks of eye diseases, skin cancer and various other infectious diseases. UV radiation can damage the cornea and lens of the eye; it could lead to cataract. Experiments have shown that UV exposure adversely affects the immune response to skin cancers, infectious agents and other antigens making them prone to many infectious diseases.

B. Terrestrial Plants: The Physiological and developmental processes of plants are also affected by UV-B radiation leading to change the species composition by mutation, which strongly changes the bio-diversity of different ecosystems. UV-B could involve the plant community indirectly resulting in alteration of plant form, secondary metabolism, etc. These alterations can have significant implications for plant competitive balance, plant pathogens and bio-geochemical cycles.

C. Effects on Aquatic Ecosystems: More than 30 percent of the world's animal protein for human consumption comes from the sea alone, it is feared that increased levels of UV exposure can have adverse impacts on the productivity of aquatic ecosystem system. Higher levels of vulnerability in the tropics and subtropics may affect the distribution of phytoplankton's which form the base of aquatic food webs. UV-B can also cause damage to early development stages of fish, prawn, crab, amphibians and other animals and can also decrease the reproductive capacity of many aquatic animals.

D. Effects on Air Quality: Decline in stratospheric ozone increases the penetration of UV-B radiation that results in higher photo dissociation rates of key trace gases that support the chemical reactivity of the troposphere. This can increase both production and destruction of ozone and related oxidants such as hydrogen peroxide which are experienced to cause adverse effects on human health, terrestrial plants and outdoor materials.

E. Effects on Materials: increased level of solar UV radiation is known to have adverse effects on synthetic polymers, and some other materials of commercial interest. These radiations accelerate the photo degradation rates of these materials, thus limiting their life. Typical damages range from discoloration to loss of mechanical integrity.

F. Effects on Climate Change: Ozone depletion and climate change are linked in a number of ways, but ozone depletion is not a major causal agent of climate change. Atmospheric ozone affects the temperature balance of the Earth, as it absorbs solar ultraviolet radiation, which heats the stratosphere. Heating of stratosphere will lead to various climatic changes which vary with the altitude.

Measures to prevent Ozone depletion

The Vienna Convention for the protection of the Ozone layer in 1985 and the Montreal Protocol on substances that deplete the ozone layer in 1987 were the starting points of global cooperation for protection of the ozone layer in the stratosphere. Depletion of the ozone layer is a serious issue and various programmes had been set up by the government of various countries to forbid it. But, steps should be taken both at individual as well as at community level to prevent the depletion of ozone layer.

Steps to assist in the prevention of Ozone depletion

- Avoid consuming gases that are detrimental to the ozone layer. CFCs (chlorofluorocarbons), halogenated hydrocarbons, methyl bromide, and nitrous oxide are among the most hazardous gases.
- Vehicle utilisation ought to be minimised as much as possible.
- Should not use environmentally hazardous cleaning products.
- Air conditioner malfunctions result in the escape of CFC into the atmosphere.
- Ensure that existing restrictions on ozone-depleting substances are implemented correctly and that the global economic consumption of these substances continues to decline.
- Ensure that ozone-depleting substances are disposed of in an eco-friendly manner and replaced with climate-friendly substitutes.
- Make an effort to reduce the use of ozone-depleting substances in applications not specified by the Montreal Protocol.
- Ensure that no new chemicals or technologies that could pose new risks to the ozone layer are developed (e.g. very short-lived substances).
- To get rid of pests and weeds, one should refrain from using pesticides and instead rely on natural methods. To eliminate the pests, one can use eco-friendly chemicals or manually remove the weeds.

- As the majority of cleaning products contain chlorine and bromine-releasing chemicals that are released into the atmosphere and deplete the ozone layer, it is preferable to use eco-friendly cleaning products. These should be replaced with natural alternatives in order to protect the environment.
- The government should prohibit the use of substances containing nitrous oxide that negatively impact the ozone layer. People must be made aware of the harmful effects of nitrous oxide and the products that emit the gas in order to reduce its use on an individual level.

ACID RAIN

Acid rain refers to any precipitation that contains acidic components, such as sulphuric acid and nitric acid. It is precipitation with a pH below 5.6 (pure water pH = 7.0 (neutral); unpolluted rainwater pH is approximately 5.6 (acidic)). When converted to sulphuric (H_2SO_4) and nitric (HNO_3) acids, atmospheric pollutants, specifically sulphur oxides (SO_2) and nitrogen oxides (NO_2), can increase the acidity of precipitation. Acid deposition, acid rain, and acid precipitation are all associated with the chemistry of air pollution and atmospheric moisture. The majority of scientists use the term acid deposition, but all three terms refer to the same concept. In the 1870s, Robert Angus Smith, a scientist working in Manchester, coined the term acid rain. Thus, acid rain is not a new problem, but its nature has shifted from being a problem for cities and towns to a global issue. Acid rain is typically caused by emissions of Sulphur dioxide and nitrogen oxide into the atmosphere from automobiles, certain industrial processes (such as smelting and refining), and power plants that burn fossil fuels such as coal and petroleum. These gases combine with water vapour in clouds to produce sulphuric and nitric acids, which then return to the atmosphere as acid rain.

Types of Acid Rains

Depending upon the nature of precipitation acid rain is of two types

1. Wet deposition
2. Dry deposition

Wet Deposition: If the acid chemicals in the air are blown into areas where the weather is wet, the acids can go down in the shape of rain, snow, haze, or mist and is termed as wet deposition.

Dry Deposition: In areas where the weather is dry, the acid chemicals may get incorporated into dust or smoke and comes down as dry deposition, sticking to the ground, buildings, homes, automobiles, and trees and washed from these surfaces by rainstorms, leading to increased runoff.

Effects of Acid Rains

Acid rain and the air pollution that causes it can severely damage the ecosystem. Every ecosystem is interconnected, and the beings that live there rely heavily on each other. Acid rain may only damage a few organisms in an ecosystem, but everything else is indirectly involved. The damage acid rain causes can also take years, or even decades to reverse. Acid rain not only affects the ecosystems but also bears upon human health and other man made materials. Acid rain has broad economic, social and medical impacts and has been called an unseen plague of the industrial age.

Effect of acid rain

1. Acid rain has many ecological effects, especially in lakes, streams, rivers, bays, ponds, and other bodies of water. Acid rain either falls directly on aquatic bodies or gets run off the forests, roads and fields to flow into streams, rivers and lakes. Over a period of time, acids get accumulated in the water and lower the overall pH of the water body. Aquatic plants grow best between pH 7.0 and 9.0. As the acidity increases, submerged plants, freshwater shrimp, bacterial decomposers, and plankton die off, and below pH 4.5 all the fish perish out.
2. Acid rain harms the surface vegetation. Research has verified that acid rain damages leaves' protective coating, allowing penetration of acids, which disrupts water evaporation and gas exchange to the point that the plant can no longer breathe, convert nutrients, or take up water, henceforth wither off.
3. Acid rain also leaches essential nutrients like calcium, magnesium, and potassium from the land and increases the absorption of toxic metals such as lead, zinc, copper, chromium, and aluminium, which makes it hard for trees to take up water. Thus, stunts the growth of tree, plant, along with mosses, algae, nitrogen-fixing bacteria, and fungi.
4. The effects of acid rain combined with other environmental stressors make trees and plants less healthy, more vulnerable to cold temperatures, insects, diseases

and also inhibit the tree's ability to procreate. Some soil is able to neutralise acids better than others, however, in areas where the buffering capacity of soil is low, the harmful effects of acid rain are seen much greater.

5. When acid rain falls on limestone statues, monuments, and gravestones, it dissolves, discolours, and/or disfigures the surfaces by reacting with the rock, known as dissolute ion. Statues, modern buildings, automobiles, airplanes, steel bridges and pipes are all affected by acid rain; irreplaceable damage can be caused to the old heritage buildings.

6. The toxic metals discharged due to acid rain when mixes with water and absorbed by crops, or animals that human consumes or directly used up by humans cause severe nerve damage, lung problems (asthma and bronchitis), brain damage, kidney problems, cancer, and Alzheimer's disease, that may cause even death.

7. Sometimes the concentration of particulate matter derivatives like sulphates and nitrates degrades the visibility, which can cause accidents leading to serious injuries or even deaths.

Preventive Measures

- One of the most fundamental solutions is to use cleaner-burning fuels or to increase the efficiency with which coal and other fuels are burned. This will substantially reduce the amount of acid released into the atmosphere. Governments must invest in the research of alternative, less polluting energy sources.
- The best solution for industrial power plants is to install scrubbers in their chimneys, which can reduce the amount of Sulphur in the smoke by 90-95 percent.
- Automobiles and other vehicles may contribute to environmental contamination and acid rain. Using public transportation, carpooling, walking to nearby locations instead of driving, etc., will help save fuel and reduce their negative effects.
- All vehicles must be equipped with catalytic converters in their exhaust pipes to reduce Sulphur dioxide emissions.

- We can also contribute by incorporating small changes into our daily routine. In addition to turning off lights, computers, and other electrical appliances when they are not in use, we should always purchase energy-efficient appliances that consume less energy. Adopting these energy-saving measures can support substantially.
- We should refrain from using nonrenewable fuels and switch to renewable energy sources such as solar energy, wind energy, and hydropower.
- Popular chemicals that neutralize the acidity of acid rains can be used to restore lakes and other water bodies that have been damaged. Commonly employed chemicals include calcium oxide, caustic soda, sodium carbonate, slaked lime, and lime stone.

FLORA AND FAUNA

The ecosystem is a complex, interconnected network comprising biotic and abiotic elements. Biotic elements include all living organisms such as plants, animals and microorganisms. Abiotic components, on the other hand, include non-living entities that are vital for the survival of life and these include soil, water, climate, etc. Among all biotic elements, Flora and Fauna are the most fascinating ones.

Flora and Fauna Meaning

In a nutshell, the term flora relates to all plant life and the term fauna represents all animal life. Let us dive deeper into these terms, exploring their origins and etymologies.

Flora Meaning

In Latin, flora means "Goddess of the Flower." Flora is the collective term for the plant life found in a specific region. This name represents the entire kingdom of plants. Numerous factors are used to classify and differentiate floral species. The best location among them is where they grow or are found. Some thrive in desert or aquatic environments, others inhabit hilly terrain, and others are endemic to a particular region. They have adaptations based on the environment in which they thrive. For instance, cactus plants are commonly found in deserts. They have adaptations such as modified leaves and spines to conserve water and ward off predators. The agricultural

flora consists of plants cultivated by men for their use. Horticulture is the practice of growing ornamental and decorative flowers, which are also known as garden flora.

Fauna Meaning

Fauna is the indigenous animal life of a region. There are numerous explanations for the word's origin. According to Roman mythology, Fauna or "Faunus" is the name of the fertility goddess. "Fauns," which means "Forest spirits," is a second source. The animal kingdom consists of numerous animal life forms. Therefore, the classification of fauna is considerably more complex than the division of flowers. Consequently, for ease of categorization;

- Birds are categorized under the name Avifauna.
- Fishes under Pisci Fauna.
- Microorganisms including bacteria and virus are generally considered under animal kingdom, they are known as Microfauna.
- All unknown and undiscovered animals are named as cryptofauna.

Flora and fauna conservation is therefore essential for future survival. Biosphere reserves, national parks, zoos, and sanctuaries are a few examples of the government's efforts to preserve flora and fauna. Another example is the Government of India's Tiger Project, which aims to prevent the extinction of the country's tigers.

Importance of Flora and Fauna

The flora and fauna are significant for the reasons listed below:

Maintains Ecological Balance

Flora and fauna are essential to human survival. The oxygen produced by the flora is consumed by the fauna for respiration. In turn, fauna release carbon dioxide used by flora for photosynthesis.

The medicinal and dietary offerings of flora and fauna are of immense benefit to humanity. Animals maintain the balance by preying on various plants and animals to keep their populations in check.

Animal excrement can be used as fertilizer. The decaying dead animals serve as a mineral supplement for living creatures..

Aesthetic Value

The global distribution of flora and fauna contributes to the planet's aesthetic value. People travel to various biosphere reserves, national parks and zoos, forests, and botanical gardens, among others, to appreciate the beauty of landmarks. This describes the significance of plants and animals in our daily lives.

Expansion of Local Economies

Through tourism, Flora and Fauna benefit local economies. The flora and fauna of Amazonian forests attract tourists and scientists, contributing approximately $50 million to the Brazilian economy. Due to the diversity of their flora and fauna, the Caribbean, Indonesia, and Panama are also popular tourist destinations.

Flora and Fauna of India

India's flora and fauna are comprised of numerous plant and animal species. In India, there are 500 species of mammals, 2000 species of birds, 30,000 species of insects, and numerous species of fish, amphibians, and reptiles. Elephants, Royal Bengal Tigers, rhinoceroses, bison, and lions are among the country's common fauna. The Alpines, temperate forests, deciduous forests, evergreen forests, oaks, rhododendrons, pine, spruce, deodar, laurels, maples, bamboo, and tall grasses are also found in India.

NATIONAL ENVIRONMENTAL POLICIES AND PROGRAMMES

India has unique environmental heritage. Our country encompasses nearly all of the world's habitats, and its landmass and water bodies support an extraordinarily diverse array of living organisms. It is rich in biodiversity, which provides people with numerous resources. Nineteen percent of India's land area is covered by forest. But the purpose of deforestation, indiscriminate killing of wild animals, polluting and energy-intensive industrial technology, population explosion, and poverty have all contributed to the depletion of environmental assets. Therefore, it is imperative to preserve these environmental assets. Through the act and numerous policies, the Indian government made numerous efforts to preserve these environmental assets. In the preceding unit, you learned about environmental dangers. In this unit, we discuss various environmental issues in India and the government's responses to them.

ENVIRONMENTAL POLICY AND LEGISLATIONS IN INDIA

- A policy is a broad guideline for administrators and planners.
- It outlines the general objectives and leaves the execution to the administrators.
- Because policy is a tool for transforming a given environment into a desired environment, the formulation of policy becomes indispensable.
- Through a policy, we are able to precisely identify problems, establish priorities for alternative approaches and solutions, choose among alternatives based on a comprehensive analysis of benefits and costs, articulate the choice in terms of stated goals, provide organisation, personnel, and resources to ensure effective implementation, and establish a system for continuous monitoring of the policy.
- Environmental protection and improvement have received consideration in India from ancient times to the present day.
- People were aware of the importance of environmental protection and the laws pertaining to the improvement of the environment were simple but effective historically.
- The current laws in India are the result of the country's increasing industrialization and population pressure.

Policy and Laws in Ancient India

The essence of Vedic culture in ancient India was the preservation and cleaning of the environment. The conservation of the environment was an ardent tenet of faith, reflected in people's daily lives and enshrined in myth, folklore, art, culture, and religion. In Hindu theology, forests, trees, and wildlife conservation were held in high regard. Cutting green trees was prohibited, and those who do so are punished. Yagyavalkya Smriti and Charak Samhita provide numerous guidelines for the purification of water. According to the Arthashastra, various punishments were prescribed for chopping down trees, causing damage to forests, and killing animals. The state assumed responsibility for forest maintenance, forest product regulation, protection of wildlife, pollution, and unsanitary sanitation. The environmental ethics of nature conservation were applicable not only to the common man, but also to rulers and kings.

Policy and Laws in Medieval India

During the Moghul period, environmental protection received little attention. It is accurate to say that for Moghul rulers, forests were nothing more

than hunting grounds. For their governors, the forests were revenue-generating properties. Other than royal trees, which could not be cut without payment, there were no restrictions on cutting down trees. In addition, Akbar's religious policy, which was based on the principle of complete tolerance, reflects a concern for the protection of birds and animals, as efforts were made in his region to prevent their needless slaughter. During the mediaeval period, a new set of legal principles was introduced, governed by the holy Koran, which states, "We created all living things from water."

Policy and Laws in British India

With the establishment of British Colonial rule, numerous modifications were made to the indigenous system's religious orientation. The Forest Act of 1865 was the first step in asserting the State's monopoly right over forests in the field of forest protection. The Act restricted the customary rights of rural communities to manage forests. The Forest Act of 1927 expressly denied people any rights to forest products based on their place of residence. In terms of wildlife conservation, the British practised a selective approach. During this time, the Bengal Regulation VI of 1819, which did not mention protection of the water environment from pollution but gave the government sovereignty over water resources, marked the beginning of India's concern for water resource protection and management. It represented a radical departure from previous practises, which regarded water resources as "common property" and placed control in the hands of the people. Fouling of water was regulated by the Shore Nuisance (Bombay and Kolaba) Act of 1853 and the Oriental Gas Company Act of 1857. The Merchant Shipping Act of 1858 dealt with oil pollution prevention at sea. Under the Indian Penal Code of 1860, an attempt was made for the first time in 1860 to control especially water and atmospheric pollution through criminal sanctions. The Easement Act of 1882, in contrast to the prohibitive provisions of the IPC, 1860, permitted a prescription right to pollute the water, but it was not an absolute right (one was not to "unreasonably pollute" or cause "material injury to others"). During the British Raj, the Bengal Smoke Nuisance Act of 1905 and the Bombay Smoke Nuisance Act of 1912 were the first laws enacted to control air pollution. Thus, the environmental policy during British rule was not aimed at preserving nature, but rather at the appropriation and exploitation of common

resources with the primary goal of generating income. In addition, these laws had a limited scope and territorial reach.

Policy and Laws after Independence

The Indian Constitution as adopted in 1950 did not address the environment or pollution prevention and control as such (until 1976 Amendment). Article 372(1) of the original text of the Constitution has incorporated the earlier existing laws into the current legal system and provides that, notwithstanding the repeal by this Constitution of enactments referred to in Article 395, but subject to other provisions of the Constitution, all laws in force immediately prior to the enactment of the Constitution shall remain in effect until altered, repealed, or amended by a competent legislature or other competent authority. As a result, even after five decades of independence, the vast majority of these laws remain in effect without significant modification. Prior to 1970, there was little legislative activity in the field of environmental protection during the post-independence period. In the meantime, various aspects of resource depletion sparked concern, including population growth, increased pollution levels, the impact of humans on animal populations and natural landscapes, and others. The 1972 Stockholm Declaration shifted the Indian government's focus to environmental protection from a transnational perspective. The government made its position clear through five-year plans and subsequent legislation enacted to limit and control environmental pollution. After 1970, India's central government enacted comprehensive (special) environmental laws.

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The Wildlife (Protection) Act of 1972 sought rational and contemporary management of wildlife. The Water (Prevention and Control of Pollution) Act of 1974 mandates the establishment of pollution control boards at the federal and state levels to serve as pollution watchdogs. The purpose of the Forest (Conservation) Act of 1980 was to prevent deforestation, forest land conversion for non-forestry uses, and to promote social forestry. The Air (Prevention and Control of Pollution) Act of 1981 required pollution control boards to monitor air pollution. The Environment (Protection) Act of 1986 is a landmark law that provides a single focus in the country for environmental protection and aims to close loopholes in existing laws. It focuses primarily on pollution control and imposes severe penalties for violations. The Public Liability Insurance Act of 1991 mandates insurance coverage for the purpose of providing immediate relief to victims of accidents involving hazardous substances. The National Environment Tribunals Act of 1995 was enacted in recognition of the fact that civil court proceedings are lengthy (as happened in Bhopal case). The Act provides for the expeditious resolution of environmental cases by environmental tribunals. Under the Act, four tribunal benches will be established in Delhi, Calcutta, Madras, and Mumbai, and 8,000 of the most hazardous industrial units in the country will be placed under its protection.

The National Environment Appellate Authority Act of 1997 establishes a National Environment Appellant Authority (NEAA) to hear appeals regarding restrictions in areas in which certain industries, operations, or processes are prohibited or must be conducted subject to certain safeguards under the Environment (Protection) Act of 1986. The Biological Diversity Act of 2002 is a major legislative intervention enacted in the name of communities that are expected to participate in

the protection of local biodiversity. The Act aims to facilitate access to genetic materials while protecting the associated traditional knowledge.

Recent Legislative Measures (Delegated Legislation)

During the 1990s, the Central Ministry of Environment took steps to provide a legal and institutional basis for the management and protection of the environment by means of rules, the notification of standards, the delegation of powers, the identification of agencies for the management of hazardous chemicals, and the establishment of Environmental Councils in certain states. The Factories Act was amended to add a new chapter regulating hazardous industrial processes. In the area of delegated legislation, effluent and emission standards were specified for 24 industries, and the Environment Act prescribes general standards for effluent discharge and noise pollution. Seventy Environmental laboratories have been established across the nation for the analysis of water and air samples. Rules were issued for the production, transport, and disposal of hazardous substances, microorganisms, and toxic wastes. In 1991, the Coastal Zone Regulations (CZR) were issued. Environmental audits are now mandatory for all industries requiring environmental clearance under the Water Act, 1974 or The Air Act, 1981, etc., per a gazette notification on environmental audits. The Central Government also enacted the Chemical Accidents (Emergency, Planning, Preparedness, and Response) Rules in 1996 to supplement the Hazardous Chemical Rules of 1989. To regulate bio-medical waste, the Central Government issued the Bio-Medical Waste (Management and Handling) Rules in 1998.

In 1994, the Central Ministry of Environment issued a notification making environmental impact assessments mandatory for 29 different industrial, mining, irrigation, and power-related activities. A 1997 amendment added a new dimension to the Environment Impact process in India. Prior to this point, the State Pollution Control Boards had no role in the assessment process. They were now assigned a new role. In addition, the state government is now responsible for granting environmental clearance for certain types of thermal power plants. In addition, the Central Government enacted the Prevention and Control of Pollution (Uniform Consent Procedure) Rules in 1999, mandating that all industries listed in Schedule VIII of the Environment Act of 1986 obtain approval from the State Board or the Pollution Control Committee. The Rules prohibit food vendors from packaging their products in

recycled plastic bags or containers. If food is to be sold in plastic carry bags, the bags must be made of virgin plastic. The Municipal Solid Wastes (Management and Handling) Rules, 2000, are applicable to all municipal authorities responsible for municipal solid waste collection, segregation, storage, transportation, processing, and disposal. While the municipality is primarily responsible for enforcing these regulations, the Secretary-in-Charge of the State's Department of Urban Development and the District Magistrate/Deputy Commissioner shall have overall responsibility. It has been assigned to the Central/State Pollution Control Boards to monitor compliance with the standards for ground water, ambient air quality, and compost quality. The Central Government promulgated the Noise Pollution (Regulation and Control) Rules in 2000 under the Environment Protection Act of 1986. These Rules established noise-related ambient air quality standards for industrial, commercial, and residential areas, as well as "silence zones."

Under the Environmental Protection Act, the Central Government enacted the Ozone Depleting Substances (Regulation and Control) rules in 2000. Under the Rules, the producers, dealers, and users who manufacture/use ozone-depleting substances such as CFCs, Carbon tetra chloride (CCI4), etc., are required to register. Thus, India has employed a variety of regulatory instruments in recent decades to preserve and protect its natural resources. These "new" laws cover previously unregulated areas such as noise, hazardous waste, hazardous microorganisms, environmental impact assessment, etc., which is an impressive feat. The new law has generated new enforcement agencies and bolstered the existing ones.

General Legislations on Environment

In India, there are a number of laws which deal with various aspects of environment protection regulation, conduct of environmentally harmful activities and provide for remedies in case of their breach. Some of them are “general” having an “indirect” bearing on environment protection, while others are “special” (viz. Water, Air and Environmental Acts, Forest Act, etc.) being “directly” concerned with environment protection. General legislation comprises of Indian Penal Code, 1860; Code of Criminal Procedure, 1973; Code of Civil Procedure, 1908; and, specific sector legislations having a bearing on the environmental aspects viz.

The Factories Act, 1948, The Mines Act, 1952, The Industries (Development and Regulation) Act, 1951, The Insecticides Act, 1968, The Atomic Energy Act, 1962, The Motor Vehicles Act, 1939 and 1988, The Delhi Municipal Corporation Act, 1957, etc. Under Indian law, for instance, the remedies for a public nuisance are (i) a criminal prosecution for the offence of causing a public nuisance (Indian Penal Code 1860, Sec. 268), (ii) a criminal proceeding before a Magistrate for removing a public nuisance (Criminal Procedure Code 1973, Sections. 133-44), and (iii) a civil action by Advocate General or by two or more members of the public with the permission of the court, for a declaration, an injunction or both (Civil Procedure Code 1908, Section. 91).

The remedy under the civil law is not often used; however this provision is a reservoir for class action against environmental violations. Traditionally, the interpretation of the Indian Penal Code has been viewed as a conservative attempt at enforcement. This is because punishment and fines have been characterized as meager. The law of public nuisance contained in Sec. 133, Cr. P.C. has been used in a number of cases for the purpose of protection of the environment.

In 1987, shortly after the Bhopal gas tragedy and the Supreme Court's ruling in the *Shriram Gas Leak Case*2, the 1987 amendment to the Factories Act introduced special provisions on hazardous industrial activities. The amendment empowers the States to appoint "site appraisal committees" to advice on the initial location of factories using hazardous processes. The occupier of every hazardous unit must disclose to her workers the Factory Inspector the local authority and the general public in the vicinity of all particulars regarding health hazards at the factory, and the preventive measures taken. The regulation of nuclear energy and radioactive substances in India is governed by the Atomic Energy Act of 1962, and the Radiation Protection Rules of 1971. Under the Act, the Central Government is required to prevent radiation hazards, guarantee public safety and the safety of workers handling radioactive substances, and ensure the disposal of radioactive wastes. The control of air pollution resulting from the vehicular emissions which

contributes for about 65-70 per cent of the pollution load in India was taken care of by the Motor Vehicles Act, 1939. The Act empowered the State Government to make rules inter-alia regarding the emission of smoke, visible vapour, sparks, ashes, girt or oil. The 1939 Act has now been repealed by the Motor Vehicles Act, 1988. Section 110 of the new Act empowers the Central Government to make rules regulating the construction equipment and maintenance of motor vehicles and trailers. In the Constitution of India it is clearly stated that it is the duty of the state 'to *protect and improve the environment and to safeguard the forests and wildlife of the country'*. It imposes a duty on every citizen 'to protect and improve the natural environment including forests, lakes, rivers and wildlife'. Reference to the environment has also been made in the Directive Principles of State Policy as well as the Fundamental Rights. The Department of Environment was established in India in 1980 to ensure a healthy environment for the country. This later became the Ministry of Environment and Forests in 1985. The constitutional provisions are backed by a number of laws – acts, rules and notifications. The Environment Protection Act of 1986 (EPA) came into force soon after the Bhopal Gas Tragedy and is considered an umbrella legislation as it fills many gaps in the existing laws. Thereafter a large number of laws came into existence as the problems began arising e.g. Handling and Management of Hazardous Waste Rules in 1989. Following is a list of the environmental legislations that have come into effect.

General

1986 – The Environment (Protection) Act authorizes the central government to protect and improve environmental quality, control and reduce pollution from all sources, and prohibit or restrict the setting and /or operation of any industrial facility on environmental grounds.

1986 – The Environment (Protection) Rules lays down procedures for setting standards of emission or discharge of environmental pollutants.

1989 – Hazardous waste (Management and Handling) Rules objective is to control generation, collection, treatment, import, storage and handling of hazardous waste.

1989 – The Manufacture, Storage and Import of Hazardous Chemical Rules defines the terms used in this context, and sets up an Authority to inspect, once a year, the industrial activity connected with hazardous chemicals and isolated storage facilities.

1989 – The Manufacture, Use, Import, Export and Storage of hazardous Micro-organisms/Genetically Engineered Organisms or Cells Rules were introduced with a view to protect the environment, nature and health, in connection with the application of gene technology and microorganisms.

1991 – The Public Liability Insurance Act and Rules and Amendment, 1992 was drawn up to provide for public liability insurance for the purpose of providing immediate relief to the persons affected by accident while handling any hazardous substance.

1995 – National environmental Tribunal Act has been created to award compensation for damages to persons, property and the environment arising from any activity involving hazardous substances.

1997 – The National Environment Appellate Authority Act has been created to hear appeals with respect to restrictions of areas in which classes of industries etc are carried out or prescribed subject to certain safeguards under the EPA (Environment Protection Act).

1998 – Biomedical waste (Management and Handling) Rules is a legal binding on the health care institutions to streamline the process of proper handling of hospital waste such as segregation, disposal, collection and treatment.

Forest and wildlife

1927 – Indian Forest Act and Amendment 1984 is one of the many surviving colonial statutes. It was enacted to 'consolidate the law related to forest, the transit of forest produce and the duty leviable on timber and other forest produce.

1972 – Wildlife Protection Act, Rules 1973 and Amendment 1991 provides for the protection of birds and animals and for all matters that are connected to it whether it be their habitat or the waterhole or the forest that sustain them.

1980 – The Forest (Conservation) Act and Rules 1981 provides for the protection of and the conservation of the forests.

Water

1882 – The Easement Act allows private rights to use a resource i.e. groundwater, by viewing it as an attachment to the land. It also states that all surface water belongs to the state and is a state property.

1897– Indian Fisheries Act establishes two sets of penal offences whereby the government can sue any person who uses dynamite or other explosive substance in any way (whether coastal or inland) with intent to catch or destroy any fish or poisons fish in order to kill.

1956 – The River Boards Act enables the states to enroll the Central Government in setting up an Advisory River Board to resolve issues in interstate cooperation.

1970 – Merchant Shipping Act aims to deal with waste arising from ships along the coastal areas within a specified radius.

1974 – The Water (Prevention and Control of Pollution) Act establishes an institutional structure for preventing and abating water pollution. It establishes standards for water quality and effluent. Polluting industries must seek permission to discharge waste into effluent bodies. The Pollution Control Board (CPCB) was constituted under this act.

1977 – The Water (Prevention and Control of Pollution) Cess Act provides for the levy and collection of cess or a fees on water consuming industries and local authorities.

1978 – The Water (Prevention and Control of Pollution) Cess Rules contains the standard definitions and indicate the kind of and location of meters that every consumer of water is required to affix.

1991 – Coastal Regulation Zone Notification puts regulations on various activities, including construction, are regulated. It gives some protection to the backwaters and estuaries.

Air

1948 – Factories Act and Amendment in 1987 was the first to express concern for the working environment of the workers. The amendment of 1987 has sharpened its environmental focus and expanded its application to hazardous processes.

1981 – Air (Prevention and Control of Pollution) Act provides for the control and abatement of air pollution. It entrusts the power of enforcing this act to the Central Pollution Control Board.

1982 – Air (Prevention and Control of Pollution) Rules defines the procedures of the meetings of the Boards and the powers entrusted on them.

1982 – Atomic Energy Act deals with the radioactive waste.

1987 – Air (Prevention and Control of Pollution) Amendment Act empowers the central and state pollution boards to meet with grave emergencies of air pollution.

1988 – Motor Vehicles Act states that all hazardous waste is to be properly packaged, labeled and transported.

INTERNATIONAL ENVIRONMENTAL AGREEMENTS

At International level, there are a number of laws which deal with various aspect of environment protection regulation, conduct of environmentally harmful activities and provide for remedies in case of their breach. For this, a number of conventions are arranged and agreements are made.

(a). General

Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, Aarhus, 1998.

Espoo Convention on Environmental Impact Assessment in a Trans boundary Context, Espoo,1991

(b). Atmosphere

Convention on Long-Range Trans boundary Air Pollution (LRTAP), Geneva, 1979.

Environmental Protection: Aircraft Engine Emissions, Annex 16, vol. 2 to the Chicago Convention on International Civil Aviation, Montreal, 1981.

Framework Convention on Climate Change (UNFCCC), New York, 1992, including the Kyoto Protocol, 1997.

Georgia Basin-Puget Sound International Air shed Strategy, Vancouver, Statement of Intent, 2002.

Vienna Convention for the Protection of the Ozone Layer, Vienna, 1985, including the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal 1987.

U.S.-Canada Air Quality Agreement (bilateral U.S.-Canadian agreement on acid rain), 1986

(c). Freshwater resources

Convention on the Protection and Use of Trans boundary Watercourses and International Lakes (ECE Water Convention), Helsinki, 1992.

(d). Hazardous substances

Convention on the Control of Trans boundary Movements of Hazardous Wastes and their Disposal, Basel, 1989.

Convention on Civil Liability for Damage Caused during Carriage of Dangerous Goods by Road, Rail, and Inland Navigation Vessels (CRTD), Geneva, 1989.

Convention on the ban of the Import into Africa and the Control of Trans boundary Movements and Management of Hazardous Wastes within Africa, Bamako, 1991.

Convention on the Trans boundary Effects of Industrial Accidents, Helsinki, 1992.

Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, Rotterdam, 1998.

European Agreement Concerning the International Carriage of Dangerous Goods by Inland Waterways (AND), Geneva, 2000.

European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), Geneva, 1957.

FAO International Code of Conduct on the distribution and use of Pesticides, Rome, 1985.

Stockholm Convention Stockholm Convention on Persistent Organic Pollutants Stockholm, 2001.

Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Trans boundary Movement and Management of Hazardous Wastes within the South Pacific Region, Waigani, 1995.

Minamata Convention on Mercury, Minamata 2013.

(e). Marine environment – global conventions

Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention), London, 1972.

International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), London 1973 and 1978

International Convention for the Prevention of Pollution of the Sea by Oil, London 1954, 1962 and 1969.

International Convention on Civil Liability for Oil Pollution Damage (CLC), Brussels, 1969, 1976,1984 and 1992.

International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND) 1971 and 1992, Brussels, 1971/1992.

International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (HNS), London,

1996.

International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), London, 1990.

International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties Intervention Convention, Brussels, 1969.

Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances OPRC-HNS Protocol, London, 2000.

United Nations Convention on the Law of the Sea LOS Convention, Montego Bay, 1982.

(f). Marine living resources

Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS), Monaco, 1996

Agreement on the Conservation of Albatrosses and Petrels

Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS), New York, 1992

Agreed Measures for the Conservation of Antarctic Fauna and Flora

Convention for the Conservation of Antarctic Seals

Convention for the Conservation of Antarctic Marine Living Resources

Protocol on Environmental Protection to the Antarctic Treaty

Convention on the Conservation of Migratory Species of Wild Animals (CMS), Bonn, 1997.

International Convention for the Conservation of Atlantic Tunas (ICCAT), Rio de Janeiro, 1966.

International Convention for the Regulation of Whaling (ICRW), Washington, 1946.

(g). Nature conservation and terrestrial living resources

World Heritage Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972.

Convention on the International Trade in Endangered Species of Wild Flora and

Fauna, (CITES), Washington DC, 1973.

Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia (Raptors MoU)

International Tropical Timber Agreement, (ITTA), Geneva, 1994.

(h). Noise pollution

Working Environment (Air Pollution, Noise and Vibration) Convention, 1977

(i). Nuclear safety

Comprehensive Test Ban Treaty 1996

Convention on Assistance of a Nuclear Accident, Vienna 1986.

Convention on Early Notification of a Nuclear Accident, Vienna 1986.

Convention on Nuclear Safety, Vienna 1994.

Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water Vienna Convention on Civil Liability for Nuclear Damage, Vienna 1963.

MEDIA AND ENVIRONMENTAL AWARENESS

As a risk communicator or as a promoter of data, information, and best practises of any kind, the media should facilitate people's efforts to become more environmentally conscious and responsible. In order to comprehend the origins and causes of the most significant environmental problems, the media could assist individuals in associating causes and effects, enabling them to become informed and reflect upon the provided information. Creating public awareness and environmentally responsible behaviour is a difficult and multifaceted task. To accomplish this, various types of information and presentation methods should be utilised. In order to cultivate ecological attitudes, it is necessary to use low-cost, environmentally friendly technologies.

Some Internet usages to raise the environmental awareness are the following:

Documentaries and amateur videos:

The ability of images and videos to illustrate, captivate, or shock is inextricably linked to comprehension. People have instant, cost-free, and unrestricted access to a large

number of environmental documentaries or professional and amateur videos about nature and its protection via the Internet and appropriate websites, such as www.youtube.com or similar Blogs, Wikis, Forums, and educational portals: such websites, on the one hand, provide access to a vast amount of information about the planets and their protection, without requiring the use of paper and ink, and on the other hand, provide a platform for

Virtual environments and e-museums: which represent an attractive alternative for the enhancement of the environmental awareness, as the user has the opportunity to navigate and sometimes interact with the presented environment.

e-Learning : such educational practice has a double impact on the enhancement of environmental awareness. Firstly, it is an effective way for organizations and academic institutes to reduce their carbon footprint, with the elimination of face-to-face presence, and the paper and link usage. Secondly, over the Internet there are many available courses regarding the nature, the environmental problems, the use of green technologies, the ecological friendly agriculture, the ecotourism, etc.

ROLE OF NGO'S IN PROTECTION FOR THE ENVIRONMENT IN INDIA

A Non-Governmental Organization is a social service organization working towards a better society. Our mission is to address issues like poverty and ignorance that are threatening and weakening our country's progress.

The NGO's constitute a worldwide network interacting with Governments and Internal intergovernmental organization in shaping international environmental policies

- Creating awareness among the public on current environmental issues and solutions.
- Facilitating the participation of various categories of stakeholders in the discussion on environmental issues.
- Conducting participatory rural appraisal.
- Being involved in the protection of human rights to have a clean environment.
- Protecting the natural resources and entrusting the equitable use of resources.
- Data generation on natural resources, time line history of villages.
- Analysis and monitoring of environmental quality.

- Transferring information through newsletters, brochures, articles, audio visuals, etc.
- Organizing seminars, lectures and group discussion for promotion of environmental awareness.
- Helping the villages' administrative officials in preparation, application and execution of projects on environmental protection.

ENVIRONMENTAL MOVEMENTS IN INDIA

The environment in which we reside is crucial to our survival. The environment comprises all natural resources, including air, water, land, forests, and minerals, among others. It is our responsibility to preserve natural resources. In spite of this, there is a great deal of mismanagement of these natural resources, as evidenced by land degradation, water pollution, air pollution, and deforestation. These factors all contribute to the deterioration of our environment. People have made numerous efforts to reclaim the environment through voluntary organisations that are concerned with the environment. People have renounced and adopted nonviolent action movements for environmental protection on occasion.

Chipko Movement, the Appiko Movement in the Western Ghats, K.M. Munshi's Vana Mahotsav, and environmental organisations such as Green Peace and the World Wide Fund for Nature are all involved in conserving forests and wildlife. These environmental movements are a manifestation of the socio-ecological effects of narrowly conceived, short-term exploitation-based development. The movement illustrates how the resource-intensive requirements of development have engendered ecological devastation and economic deprivation. Members have implemented micro-action plans to protect natural resources and provide the macro concept for ecological development at the national and regional levels. The past half century has been marked by a high rate of resource consumption. Intensive agricultural and industrial productions have created the conditions for a rise in resource demand. This has led to disputes regarding natural resources. These conflicts escalate when the industrial technologies utilising the resources face opposition from communities whose survival depends on these resources and whose existence is threatened by their destruction and overexploitation. These conflicts, which are rooted in the deteriorating state of natural resources, are spawning environmental movements at various levels.

NATIONAL GREEN TRIBUNALS

National Green Tribunal (NGT) was established on 18th October 2010 under the NGT Act of 2010 as a specialised body to handle multidisciplinary environmental disputes.

It replaced the former National Environment Appellate Authority.

It is also influenced by Article 21 of the Constitution of India, which guarantees Indian citizens a healthy environment.

The National Green Tribunal (NGT) is a specialised body established by the NGT Act, 2010 to dispose of cases involving the protection and conservation of the environment, forests, and other natural resources in an efficient and timely manner.

The National Green Tribunal has five sitting locations, including Bhopal, Pune, New Delhi, Kolkata, and Chennai, with New Delhi being the principal location.

Objectives of National Green Tribunal (NGT)

Some of the major objectives of the National Green Tribunal (NGT) are as follows:

- Effective and expeditious disposal of cases that are related to the protection and conservation of the environment, forests, and other natural resources.
- To give relief and compensations for any damages caused to persons and properties.
- To handle various environmental disputes that involves multi-disciplinary issues.

Structure of NGT

The National Green Tribunal (NGT) comprises three major bodies namely:

1. The Chairperson
2. The Judicial Members, and
3. The Expert Members.

Also, there should be a minimum of 10 and a maximum of 20 fulltime Judicial as well as Expert members in the NGT.

All these members are required to hold the office for five years and are not eligible for reappointment.

The Chairperson of the National Green Tribunal (NGT) is appointed by the Central Government of India in accordance with the Chief Justice of India.

A Selection Committee is formed by the central government of India for the appointment of Judicial Members and Expert Members.

Powers of NGT

Some of the major powers of the National Green Tribunal include:

- NGT facilitates the development of environmental law through the creation of an alternative dispute resolution mechanism.
- It contributes to the reduction of environmental litigation in the superior courts.
- The NGT offers a quicker, less formal, and less expensive resolution to numerous environmental disputes.
- It curbs environment-damaging activities. The NGT ensures that the Environmental Impact Assessment (EIA) process is strictly adhered to.
- The NGT provides relief and restitution for damages to persons and property.

The National Green Tribunal resolves various civil cases under the following seven laws that are related to the environment

1. Water Act (Prevention and Control of Pollution), 1974
2. Water Cess Act (Prevention and Control of Pollution), 1977
3. Forest Act (Conservation), 1980
4. Air Act (Prevention and Control of Pollution), 1981
5. Environment (Protection) Act, 1986
6. Public Liability Insurance Act, 1991
7. Biological Diversity Act, 2002

POLLUTION CONTROL BOARD

The Central Pollution Control Board (CPCB) of India is a **statutory** organisation under the Ministry of Environment, Forests and Climate Change.

Established in 1974 under the Water (Prevention and Control of Pollution) Act and later entrusted with functions and responsibilities under the Air (Prevention and Control of Pollution) Act, 1981.

Water Pollution:

The contamination of water bodies is a definition of water pollution. When industrial and agricultural effluents contaminate water bodies such as rivers, lakes, oceans, groundwater, and aquifers, water pollution occurs.

Air Pollution:

Air pollution is any physical, chemical, or biological alteration to the air. The contamination of air by harmful gases, dust, and smoke has devastating effects on plants, animals, and humans. It coordinates the activities of the State Pollution Control Boards by providing technical assistance and direction, as well as resolving disputes between them.

CENTRAL POLLUTION CONTROL BOARD

Organizational Structure

CPCB is led by its Chairman followed by the Member Secretary, and other members. The CPCB performs its various functions through the following nine major project budget heads.

1. Pollution assessment (survey and monitoring).
2. R&D and laboratory management.
3. Development of standards and guidelines for industry-specific emissions and effluent standards
4. Training
5. Information database management and library
6. Pollution control technology
7. Pollution control enforcement
8. Mass awareness and publications
9. Hazard waste management

Powers and Functions of CPCB

- Providing advice to the Central and State Governments regarding the prevention, improvement, and control of Air and Water pollution.
- Developing diverse programmes to prevent and control Air & Water pollution
- Planning and coordinating training programmes for individuals engaged in the prevention, improvement, and control of Air and Water pollution.
- Air & Water Pollution statistical and technical reports are collected, compiled, and published. These reports are utilised to develop preventative measures for pollution control and reduction.
- Developing manuals, codes, and guidelines for the treatment and disposal of sewage and industrial effluents, as well as stack gas cleaning devices, stacks, and ducts.

Air Quality Monitoring

To monitor the ambient air quality, CPCB launched a nationwide programme called **National Air Quality Monitoring Programme (NAMP).**

Water Quality Monitoring

- Fresh water is a limited resource that is indispensable for human survival and activities.
- India is a country of rivers. It has 14 major rivers, 44 medium rivers, and 55 minor rivers, in addition to numerous lakes, ponds, and wells that are used even without treatment as the primary source of drinking water.
- The CPCB collects, compiles, and disseminates technical and statistical data regarding water pollution as one of its essential functions. Additionally, collaborate with diverse stakeholders to control water pollution.

INTERNATIONAL NGOs AND ENVIRONMENAL PROTECTION

ENVIRONMENTAL FOUNDATION FOR AFRICA (EFA)

EFA envisions an environmentally conscious people motivated to maintain the integrity of nature in Africa. The Environmental Foundation for Africa (EFA) aims to protect and restore the environment in West Africa. For over 15 years, EFA has led environmental education (EE) and awareness raising campaigns, restored eroded lands

and conserved pristine forests, minimized the impacts of civil war on the environment and its inhabitants, and equipped thousands of people with sustainable livelihood skills such as agroforestry. Today, capitalizing on its wealth of experience, EFA specializes is environmental awareness raising and capacity building at the national, regional and international levels using high impact communications tools and training programs to build an environmentally conscious society motivated to maintain the integrity of nature in Africa.

WORLD WILD FUND FOR NATURE (WWF)

WWF or world wildlife fund was started in 1961 by 16 of the world's leading conservationists. This organization is functional in 100 countries.

The mission of WWF is to conserve nature and minimize the threats to the diversity of life on earth. It works in the field of food, climate, freshwater, wildlife, forest, and oceans.

Collaborating with the local communities, this organization furthermore conserves the natural resources and **protects the rare species** by restoring their habitat.

Besides, WWF has conserved much wildlife, including tigers, giant pandas, elephants, gorillas, sea turtles, polar bears, rhinos, whales, etc.

CONSERVATION INTERNATIONAL

GREEN PEACE

- Greenpeace was founded in the 1960s in response to a plan by the United States government to test nuclear weapons on the tectonically unstable island of Amchitka, near Alaska.
- Greenpeace employs non-violent and inventive campaigns to bring attention to global environmental issues in order to find solutions for a sustainable future for the planet and all of humanity.
- Its ultimate goal is to ensure that the Earth can support and nurture life not only for the current generation but also for future generations.
- It has launched the following campaign in the years since its founding:
- The conservation of oceans and old-growth forests.

- Stopping climate change requires the elimination of fossil fuels and the promotion of renewable energy.
- The elimination of harmful substances.
- Preventing the release of genetically modified organisms into the environment.
- The elimination of nuclear danger and nuclear contamination.
- Safe and enduring commerce.

Following this Greenpeace has played a pivotal role in, among other things, the adoption of:

- A ban on the export of toxic waste to less developed nations.
- A ban on whaling for commercial purposes.
- A United Nations convention aimed at enhancing the management of global fisheries.
- A whale sanctuary in the Southern Ocean; a 50-year moratorium on mining in Antarctica.
- Prohibitions on dumping radioactive and industrial waste at sea, as well as abandoned oil installations.
- No more large-scale driftnet fishing in the open ocean.

Funding of Greenpeace

The majority of Greenpeace's funding comes from individual donations and foundations. It vets all significant donations to ensure they do not originate from undesirable or dangerous sources. In order to avoid their interference, the organisations do not accept donations from governments, political parties, or other international organisations. Even foundation donations are rejected if they impose unreasonable conditions, restrictions, or constraints on Greenpeace's activities or if they compromise the organization's operational integrity in any way. Since the 1990s, Greenpeace has relied primarily on face-to-face fundraising to make up for its shortfall in funding from monthly direct debit donations.

INTERNATIONAL UNION FOR CONSERVATION OF NATURE

The IUCN is a global union composed of both government as well as civil society organisations. With more than 1400 organisations as its members, the IUCN is an international authority on the status of the natural world.

- It works in the field of sustainable development and recommends measures to combat resource depletion.
- It works to preserve the various plant and animal species.
- Its membership consists of States, non-governmental organisations, indigenous peoples' organisations, experts, and government agencies, among others.
- Established in 1948, the IUCN has the resources and knowledge base to assist the global community in conserving nature and promoting sustainable development.
- It was the first international environmental organisation when it was founded in Fontainebleau, France. Its purpose was to foster international cooperation and provide scientific knowledge and tools to support conservation efforts.
- In 1964, it created the IUCN Red List of Threatened Species.
- In addition, it played a significant role in the formation of major international conventions, including the Ramsar Convention on Wetlands, the Convention on International Trade in Endangered Species, the World Heritage Convention, and the Convention on Biological Diversity.
- In 1980, the IUCN, in collaboration with the UNEP and the World Wildlife Fund (WWF), published the World Conservation Strategy, a document that helped define the term "sustainable development" and shaped the global conservation and sustainable development agenda.
- In 1992, in response to escalating environmental concerns, the United Nations granted the IUCN official observer status.
- The IUCN is the largest and most diverse environmental network at present.

The IUCN convenes the **IUCN World Conservation Congress** every four years.

UNIT V - ENVIRONMENTAL EDUCATION IN SCHOOL CURRICULUM

Status of Environmental Education in School Curriculum – Environmental Education at different levels of School Education – Innovative Methods of Teaching Environmental Education – Problems faced in Teaching Environmental Education – Role of UNEP, CEE and NCERT in promoting Environmental Education

Status of Environmental Education in School Curriculum

- Environmental Education has been incorporated into the curriculum at the pre-school, elementary, and secondary levels in both state board (Tamil Nadu) and Central Board schools (CBSE).
- Both curricula are designed in accordance with the National Education Policy of 1986.
- Environmental Education is inherently interdisciplinary.
- It involves both natural science and social science topics.
- The National Council of Educational Research and Training (NCERT) has developed a national curriculum for all levels of education, with an emphasis on general awareness, land resources and their uses, food and nutrition, conservation, pollution, health and hygiene, and man in nature.

Pre-school Level

- At the pre-school level, a simplified version of a general awareness of personal hygiene and environmental cleanliness is introduced via a series of vibrant diagrams.
- Additionally, nature-related rhymes are introduced.
- The Tamil Nadu government has integrated scientific Tamil (Ariviyal Tamil) into the curriculum at multiple levels.
- Environmental education is a component of the textbook for Scientific Tamil.

Elementary Level

- At the elementary level, emphasis is placed on environmental cleanliness.
- The "ENVIRONMENT" concept is introduced.
- There is an emphasis on the relationship between the child and the environment.

- The child comprehends that he or she is encompassed by land, water, air, plants, and animals. Through 63 songs and narratives, the significance of the environment is emphasised.
- However, less emphasis is placed on various hands-on activities associated with environmental education.

Secondary Level

- In the state of Tamil Nadu, environmental education concepts have been included in science and social science textbooks.
- The course materials are based on an understanding of ecological and biogeographical fundamentals.
- Understanding ecological principles and issues, as well as knowing about conservation, are crucial goals.
- Environmental hygiene is explained in scientific Tamil textbooks at the sixth grade level.
- In sixth standard level
    - ❖ Primary Energy
    - ❖ Water Harvest (through song)
    - ❖ Environmental hygiene
    - ❖ Medicinal plant
    - ❖ Life without disease.

Similarly, in 7th standard of scientific Tamil the following concepts related to environmental education are introduced:

- ❖ Protection of soil, tree(through songs)
- ❖ Electricity from clouds
- ❖ A search for plants
- ❖ Noise pollution
- ❖ Chemicals in our daily life
- ❖ Food as medicine
- ❖ Biosphere
- ❖ Greenhouse effect
- ❖ Ozone layer depletion
- ❖ Wind power

- ❖ Use of fertilizers and pesticides
- ❖ Environmental laws and acts

Higher Secondary Level

- Environmental education is typically limited to students enrolled in science courses such as Mathematics, Physics, Chemistry, and Biology at the secondary level.
- The majority of the concepts are found in the textbooks of the elective subjects Biology, Chemistry, and Geography.
- Accordingly, students who choose any of these subjects would benefit in various aspects of environmental education.

The coverage of environmental education concepts in the text books of various subjects includes:

- Environment and sustainable
- Atmospheric pollution-Global Warming
- Acid rain
- Water pollutions-International Standards of Drinking water
- Land pollution-pesticides
- Ecology

Some of the activities pertaining to Environmental Education from primary, elementary, secondary and higher secondary level.

Environmental Education at Different Levels Of Education

Environmental Education at Different Stages

Primary Stage

- The child's world begins with an awareness of its own body and gradually expands as it explores its immediate surroundings, including family and home, neighbourhood, school, and beyond.
- Interaction with the immediate environment is a source of learning value.

- Children experience the natural environment: seasons, heat, rain, cold, the sky, the sun and moon, various aspects of water, plants, and animals. Children, particularly young children, have a natural desire to learn and make sense of the world.
- The National Curriculum Framework 2005 (NCF) recognizes that "Learning in the early years must be guided by the child's interests and priorities, and should be contextualized by the child's experiences, as opposed to being formally structured."
- An enabling environment for children would be rich in stimulation and experiences that allow them to explore, experiment, and freely express themselves, as well as social relationships that give them a sense of warmth, safety, and trust.

Secondary Stage

- According to the school system, the age group of secondary-level students varies, as they are intermediate between elementary school and university.
- Secondary school includes students of both genders.
- Education crisis is directly related to the so-called generation gap. Students hold negative attitudes toward school and teachers.
- Students should understand why they should care about the environment. Teenagers are now "individuals."
- It is necessary to link long-term ecological and environmental goals with the interests of individuals.
- By predicting future difficulties and problems, students may respond with an implicit "so what?"
- The teacher should explore the environment with students, both intellectually and experientially, in order to acquire factual knowledge and the driving concerns regarding man's relationship and responsibility within the human ecosystem.

Higher Secondary Stage

The Environmental concepts both are at concrete and abstract levels.

The concepts covered are:

- Biosphere
- Green House Effect
- Ozone Layer Depletion

- Use of fertilizers and pesticides
- Wild life protection
- Soil chemistry
- Management of domestic and Industrial Waste
- Ecosystem
- Radiation Hazards

College Stage

Diversification occurs on the college level. Students choose between the academic and vocational streams. Since the content is tailored to the needs of the subject, the treatment of concepts becomes more in-depth and discipline-specific. However, as an independent discipline, Environmental Education is not adequately represented in textbooks.

The coverage of Environmental Education concepts:

- Environment and sustainable development
- Global Warming
- Green House Effects
- Water pollution
- Bio-chemical oxygen demand
- Chemical oxygen demand
- Pesticides
- Ecology

Innovative Methods of Teaching Environmental Education

Discussion Method

- A discussion is an open forum where students can voice their opinions and review factual materials. In addition, discussion provides students with a natural opportunity to demonstrate their command of the communication, inference, and conclusion processes (wonfinger, 1984).

In the discussion method, the instructor provides a brief introduction to the discussion topic. The teachers provide the references.

- The teacher should keep the following points in mind whenever the discussion method is used, as outlined by Sharma (1996):
- The discussion topic should be selected with care and deliberation. It should ordinarily be of a general nature, neither overly simple nor overly technical, but requiring the student to engage in critical interpretation.
- Teacher must exercise extreme caution to ensure that discussion remains on-topic and relevant. No time should be spent on irrelevant discussion.
- Discipline in the classroom must not be disturbed.
- Any contentious issue should be resolved by the instructor at the appropriate time.
- The teacher should supplement the points left out by a particular group.

Objectives of Discussion Method

The objectives of discussion method are listed hereunder;

- To share information
- To clarify ideas
- To inspire interest
- To promote co-operative learning
- To identify the different views on a problem
- To get conceptual clarity
- To develop the skill of expression
- To evaluate progress
- To locate and define a problem
- To allocate responsibilities to find ways of solving the problems

Types of Discussion

There are two types of discussion which are as follows;

1. Open discussion

2. Planned discussion.

Open Discussion

In an open discussion, the student determines the topic, and the teacher's role is to ask questions that prompt the student to consider the various ideas. The open discussion cannot be planned because it is spontaneous by definition. It can be highly effective in encouraging learners to draw inferences and conclusions.

Planned Discussion In a planned discussion, the instructor determines the topic, plans the questions, and guides the students toward predetermined objectives. It is a method for introducing and teaching content to students in a manner that engages them cognitively. Therefore, discussion is a natural opportunity for students to freely share their ideas in order to gain conceptual clarity.

Seminar

The term "seminar" is generally used to refer to a structured group discussion. Individual students also prepare a paper or report and presents before a group of peers, as in the case of seminar paper presentation.

Preparation for Seminar

The teacher should take the initiative to provide students with seminar objectives and goals. Seminar requires extensive planning in terms of referencing relevant literature on seminar topics, organising collected data sequentially, and presenting the paper through effective reporting. Seminar paper presentations vary from subject to subject and discipline to discipline. Generally, 30-45 minutes are allotted for presentations, followed by 10 to 15 minutes for discussion. Students and other participants should have sufficient time to clarify their questions and investigate the topic's major facets. Individual students designated by the teachers, along with the teacher, can observe the presenter's presentation in order to provide him with feedback.

Advantages of Seminar

The ability to recognise and deduce a principle from its context is developed.

The ability to comprehend power and to ask pertinent questions is bolstered.

The development of independence, self-assurance, a spirit of cooperation, and a sense of responsibility.

Workshop

A workshop is a gathering for creative, educational activities. While discussion requires speaking, workshop is a "workshop." It is an activity-based strategy. The group composed of the teacher, students, and administrators may initiate the workshop in general session and develop workshop guidelines. It directly involves both cognitive and psychomotor domain skills. Examples of workshop session activities include preparing reports, syllabi, manuals, and critical reviews, visiting locations, creating teaching-learning aids, and planning instructional designs, instructional materials, and modules.

Advantages of Workshop

The following are the advantages of workshop

- It is an activity-oriented technique.
- The workshop is based on the principles of learning by doing.
- It is co-operative work which promotes the work culture.
- It involves the skill of cognitive, affective and psycho-motor.

Field Trips

Students' curiosity and imagination are sparked by field trips, which are highly educational. Those concepts that are an integral part of the students' environment, according to Keown (1984), are best learned outside. Students have a greater chance of comprehending and retaining the concepts if they can make connections between the concepts and their environment. The outdoor environment improves critical thinking.

Field Survey

A field survey is an analysis of the current condition of a specific area. One can obtain an accurate picture of the status of a particular event through a field survey. Rousseau emphasised that natural observation is the most effective method of education, as opposed to classroom teaching-learning and studying books. In environmental education, the field survey provides students with first-hand knowledge of environmental issues. Similar to field trips, outdoor studies require meticulous planning, but their scope may be limited to local environments.

Types of Field Survey

Based on the objective, the field survey can be classified into many types. Some of these are listed below,

- Local field survey
- Regional field survey
- Geographical survey
- Historical survey
- Industrial survey
- Field survey of natural vegetation
- Field survey of animals
- Survey of soil and fauna
- Field survey of community.

Objectives of Field Survey in Environmental Education

- The following are the objectives of field survey:-
- To promote awareness about learner's environment.
- To develop the tendency to survey it and utilize it for understanding.
- To develop the ability for interpreting the learners' own experience and observation.
- To promote the skill of observation and interpretation.
- To develop the ability of co-operation and group-work.
- To identify the qualities of the environment.

Steps Involved in Field Survey

The environment field survey has the following steps:-

Step-1 Writing objectives

Step-2 Planning

Step-3 Identification of tool and techniques

Step-4 Execution collecting information

Step-5 Evaluation Step-6 Follow- up activities.

Thus, field survey provides a vivid picture about a particular area. It is a scientific way of investigating the status of environment.

Projects

A project is a problematic act completed in its natural environment. The project method involves constructing a comprehensive unit around an activity that may be conducted inside or outside the school. The two fundamental tenets of this method are "learning by doing" and "learning by living." The teacher acts as a guide and assists students in discovering facts and principles independently. In the project method, the teacher's role is not that of a dictator, but rather that of a friend, guide, and collaborator. Students are required to complete certain projects. Each student or small group of students is assigned a task for which they are responsible for its successful completion.

Steps in Project Method

Steps involved in project method are as follows:-

- Sensing a problem
- Defining a problem

- Selection of appropriate methodology
- Data collection
- Process of analysis
- Drawing conclusion
- Evaluation
- The cording.

Characteristics of a Good Project

The following are the characteristics of good projects:-

- Projects should allow the active participation of both learners and teachers.
- It should be useful and purposeful.
- It should have definite educational values.
- It should be practicable. • It should not be expensive.

Merits of Project Method

The following are the merits of project method:

1) This method is based upon the laws of learning.

a) Law of readiness

b) Law of exercise

c) Law of effect

2) It promotes co-operative activity and group interaction.

3) It is a democratic way of learning. The children choose, plan and execute the projects themselves.

4) It sets up a challenge to solve a problem and this stimulus constructive and creative thinking.

Demerits of Project Method

The following are the demerits of project method:-

- It absorbs a lot of time.
- It involves much more work on the part of the teacher.
- Text books and materials written on these are not available.
- It is expensive in the sense that a well- equipped library and laboratory are required.

Exhibition

Exhibition in environmental education refers to the display or presentation of material pertinent to environmental studies. It is possible to organise an exhibition or exhibitions to display the students' project work or to obtain suitable solutions. It is essential to form a committee for the exhibition's organisation. It should be divided among the various committees that have been formed for the purpose. The teacher should gradually transfer leadership to the students. The instructor should oversee all procedures.

Advantages of Exhibition:

- Exhibition is based on the principles of learning
- The learners can observe analyze, criticize, and apply the scientific laws.
- They get chance of picking up skills by means of participation in the exhibition.

- ❖ Exhibition promotes scientific attitude among the learners.
- ❖ It helps the learners to use science in life situations.
- ❖ It promotes exploration and creative spirit among the learners .
- ❖ It propagates scientific information.

Important Methods of Instruction in Environmental Education

Videos

- The educator team utilises videos created by native for kids (NFK) in conjunction with UNITE for the environment, the Max Planck Institute for Evolutionary Anthropology (MPI), and the kassisi project.
- As videos are a valuable medium that aids students in comprehending abstract concepts and interacting freely with their teachers while watching a particular episode of a video-show, they should be utilised more frequently.
- As a result of extensive consultation with rural Ugandan communities, the content of these videos is pertinent and meaningful to their intended audience. They address three major environmental threats: snakes, bush meat, and habitat destruction.
- Covering topics such as waste management, grassland maintenance, human-wildlife conflict, and deforestation raises awareness of the dangers associated with each of these issues.
- Occasionally, it is extremely challenging to involve all students in the investigation of environmental issues. As a result, a teacher can organise a video presentation on issues such as the Narmadha controversy and others, so that students can readily comprehend them.
- Historical ecological issues can also be highlighted in a documentary film. For example, in Japan (in March 1973), the Chisso Corporation's aceto-aldehyde plant caused a variety of health problems.
- These aid in revealing the causes of environmental problems, the sharing of international experiences, and, most importantly, what schools and communities can do to address these issues.

Television

- As television has a significant impact on the younger generation and is easily accessible to the public, it facilitates environmental education via satellite.
- Through film, documentaries, animation, debates, and social programmes, students gain extensive knowledge of environmental issues and their solutions.
- Environmental stories told by seasoned filmmakers and aspiring Vloggers to students raises their awareness of the eco-system.
- Educational television (ETV) is a system that presents educational content in a variety of subject areas through centrally produced programmes.
- India Delhi Agricultural Television (DATV) project ETV programming includes the following.
- SITE Secondary School Television Project Port-SITE Project Higher Education Television Project (HETV) of the UGC.

Advantages of Television Programmes

- Customized television lessons can be produced by the educational authorities in response to unique regional needs.
- Develops an authentic interest in the topic or subject being taught.
- In order to provide a wide variety of experiences, these are very different from the typical classroom instruction.
- TV has both audio and video aids, which is an advantage.
- Develop in them a more critical mindset to stimulate less passivity in slow learners.
- The TV-based learning process reduces the need for teachers.

Limitations of Television Programmes

- The screen is too small and the focused screens are insufficiently clear for classrooms with large seating capacities.
- Lesson schedules are rigid and at times inconvenient.
- The classroom instructor has no control over the rate at which a television lesson progresses.
- As communication is unidirectional, the students are neither active nor passive participants.

- Interruptions and distractions at the receiving end can severely undermine the effectiveness of the lesson.
- Due to the individualised nature of teaching and learning on television, viewers do not develop skills such as cooperation, adaptation, and cardinal relationships.
- The range of the transmitter determines the effectiveness of any transmitted aid.

Other Methods

1. Stimulation and Games Stimulation and games can be used to acquire the learner's attention on both attitudes and content. The advantages of games and stimulation, according to Altman (1972) is that they have intrinsic potential, presence of mind for motivation.

2. Debates On arranging debates over the topics of environmental issues, brings discussion about the awareness of environmental issues necessary feasible solutions. Many cotemporary environmental issues could be debated in the classroom in order to gain solution for them.

3. Readings A teacher can ask the students to get further information through additional readings. This will help to grow individually. Reading leads to self- learning and develops one's skill over reading comprehensive.

4. Inquiry On finding a problem over any occasion, the students can take up an inquiry to probe into it. The teacher should develop inquiry guides for the benefit of the students. This will develop their critical analyzing skill and critical thinking.

5. Guest Lectures

Guest lecturers tend to provide further information about the content and provide many activities. Guest lecturers given by eminent personalities will motivate the students and make them participate in such activities.

Environmental Education Programmes to be undertaken in Educational Institutions

- A person's ability to conserve his environment and maintain its quality cannot be influenced merely by his awareness of environmental issues (Lucas 1980).
- The following are some of the suggested important ways to cultivate environmental values and a sense of concern, as well as the motivation to participate actively in environmental protection and development.

Arranging for Video-Clips

- The "Educational Technology Laboratory" of the school could be stocked with video albums depicting environmental factors such as waterfalls, mountains, dense forests, deep seas, and other natural resources, to help students appreciate the eco-system.
- It helps to increase student interest and improve their learning experiences and resources for future cohorts.
- An album could also include copies of photographs taken by students during a school field trip.
- Establishing an Environmental Club Similar to the subject clubs, the school's "Environmental Club" has members who are interested in protecting and conserving the environment.

Talking of Oath

- The environmental oath is committed to minimising its environmental impact.
- Improving environmental performance continuously.
- Promoting positive conduct across the operation.
- Every member of that club should take an oath with the rest of the class stating, "I will never engage in any activity that harms or harms the environment."

Field Trips

- In the majority of schools, field trips are a time-honored custom. Field trips provide students with an opportunity to experience something new outside of the classroom, which is often appreciated by students.
- Typical outcomes of such excursions are as follows.
- Innovative academic setting
- Group dynamics
- Planning Liability
- Increasing visual literacy

Celebrating the World Environmental Day

5th June of every year is celebrating as the “World Environment Day” by planting a sapling in the institutional campus and distributing tree sapling freely to

interested people. It is the United Nations principle vehicle for encouraging worldwide awareness and action for the Protection of our environment.

Creating an Environmental Corner

- In some schools with environmental challenges, a "Environmental Corner" with a bulletin board containing information about environmental issues and programmes has been established.
- Teacher also encourages students to write or paste any environmental news on the bulletin board, such as "In Chennai, an elderly man planted more than 1,000 trees along the roadside and regularly waters them."
- The ECS seeks to instil good environmental and social values in students by heightening their awareness of local environmental issues affecting their community.

Tree Planting

- As a birthday present, everyone will be encouraged to plant a tree either at school or at home.
- Similarly, students should be encouraged to give a plant or tree sapling as a birthday gift.

Conducting Environmental Festival

- Similar to the common culture festivals, school children can annually organise an environmental festival near the villages.
- They organised a variety of cultural programmes, debates, plays, and other art forms on environmental issues.
- The purpose of the environmental festival is for students to interact with professionals who work in the environmental sciences on a daily basis, enabling them to comprehend how scientific concepts can be applied in the real world.

Conducting Competitions in Environmental Awareness

- As stated by Wilson-smith "The competition is designed to encourage participation from a broad cross-section of students because it fosters individual capability while providing them with opportunities to practise a variety of academic and social skills."

- Environmentally conscious schoolchildren could participate in competitions annually.
- Students are encouraged to enter competitions such as "poster design, cartoon drawing, essay writing, poem composition, elocution, group discussion, and debates."

Long Walk to Promote Environmental Awareness

- On the eve of "World Earth Day" and "World Forest Day," etc., students could be encouraged to participate in "paadhayatra" (long walks), cycle rallies, or peace marches to raise environmental awareness.
- Students carry signs with slogans such as "You Smoke, I Cough," "and Say No to Cigarettes," "Each One and Plant One," etc.

Programmers on Hygiene and Sanitation Personal hygiene

- The body should be washed frequently, and if possible, everyone should take a daily shower or bath.
- The teeth should be cleaned at least once per day. Brushing the teeth after every meal is the most effective way to prevent gum disease and tooth decay. It is essential to brush your teeth after breakfast and before going to bed.
- Putting on clean clothing. Before wearing again, filthy garments must be washed with laundry detergent.
- Clothes hung in the sun to dry. The sun's rays will kill some pathogens and parasites that cause disease.
- When coughing and sneezing, turning away from others and covering the nose and mouth with a tissue or the hand.
- Hand-washing prior to food preparation helps keep pathogens out of our bodies.
- Keeping the teeth, mouth, nails, limbs, ears, and hair as well as the rest of the body clean and tidy by washing and brushing daily. Public Hygiene
- The public is provided with protected drinking water facilities in order to maintain public hygiene.
- If the water supply is contaminated. It contributes to the spread of water-borne diseases.
- Utilizing public restrooms correctly is one of the most vital practises for maintaining public hygiene.

- Don't urinate or defecate in the open when you visit public places such as the bus station, railway park, and beach, etc. Pour water into the toilets after use to clean them.
- Consume only the food in the protected area. After cooking, the food is consumed. It must be stored in a closed environment. To prevent flies and other insects from sitting on food.
- Immediately treat skin infections. If left untreated, it tends to worsen and spread throughout the body, and it may also spread to others.
- Launder your socks. This is important for more than just your own health. Additionally, it is of general public interest. As you move around, dust and bacteria accumulate on your socks.

Sanitation

- Sanitation is associated with a variety of descriptors or adjectives to designate specific types of sanitation systems, which may deal exclusively with human excreta management or the entire sanitation system. In addition, solid waste and grey water management are included.
- The purpose of sanitation systems is to protect human health by ensuring a clean environment. This will prevent disease from mutating.
- Sanitation can reduce childhood diarrhoea, malnutrition, and stunted growth.
- There are numerous other diseases that are easily transmissible in communities with poor sanitation. These diseases include cholera, hepatitis, polio, and trachoma.
- In 2010, the United Nations General Assembly acknowledged the Human Right to water and sanitation. Sanitation is a global development priority and a subject of the goal of sustainable development.
- Lack of access to sanitation has a negative effect not only on public health, but also on human dignity and personal safety.

Problems Faced in Teaching Environmental Education

Some of the major problems facing environmental education in the country can be described as follows;

Resource Constrains

Lack of resources is one of the most significant obstacles to promoting environmental education in the country. This is also true for other developing nations. It is a fact that any environmental education programme that is to be successfully implemented requires sufficient financial and human resources.

High Dropout Rate

Due to the high dropout rate in our education system, teachers have no choice but to begin the environmental education component in the primary grades so that students are aware of environmental issues even if they drop out later.

Social Constrain

Occasionally, conclusions derived from the study of environmental thought. This divergence of opinion may result in unwelcome conflict Environmental education is meaningless if not accompanied by action. Assurance of this action is difficult.

Difficulty in Assessment

Oftentimes, it is difficult to come up with a common yardstick for evaluating the work done under different projects, making it difficult to assess the work performed as part of environmental education.

Formal Environmental Education Faces the Following Difficulties

- The national environmental education centre has insufficient support staff and office equipment.
- Environmental education is lacking nationally for teachers and students.
- Weak surveillance system.
- A lack of government priorities or political will for environment policy;
- A lack of appropriate legislative enforcement and institutional support;
- Government control of the mass media;
- A lack of commitment and participation on the part of the affected population.

United Nations Environment Programme (UNEP)

United Nations Environment Programme is a worldwide operation of an international environmental agency supported by the United Nations Organisation. It helps developing countries implement environmentally sound policies and practises by coordinating its activities. As a result of the United Nations Conference on Human

Environment (Stockholm conference) in June 1972, it was established with Maurice strong as its first director. Its headquarters are in the Girir neighbourhood of Nairobi and Kenya. However, there are international discussions on specialised topics such as climate change and fighting decertification. In 1988, the Intergovernmental Panel on Climate Change was founded by the world meteorological organisations and Un Environment. There are 300,100 professionals in a variety of fields and a five-year budget of over 1,200 million dollars. Executive Director In 2016, Erik Solheim succeeded A Steiner as the executive director of the UNEP. As a media-friendly approach frequently uses the term United Nations Environment Programme The position was held for seventeen years, from 1975 to 1992, during which environmental concerns were placed at the forefront of global thought and action.

Structure UNEP structure includes seven substantive divisions;

- Early warning and assessment (DEWA)
- Environmental policy implementation (DEPI)
- Technology industry and economics (DTIE)
- Regional cooperation (DRC)
- Environmental law and conventions (DELG)
- Communications and public (DCPI)

Global environment facility coordination (DGEF) Activities

The primary UNEP activities concern climate change, natural disasters and armed conflicts, ecosystem management, environmental governance, the environment under review, toxic substances, and Resource efficiency. In June 2010, the United Nations Environment Program issued a report stating that a global transition to a vegan diet was required to save the world from hunger shortages and climate change.

Centre for Environment Education

In India, the centre for environment education (CEE) was founded in August 1984. As an exemplary centre supported by the Ministry of Environment and forests. The Organization strives to develop programmes and materials to increase environmental and sustainable development awareness. The headquarters are situated in Ahmadabad. The centre has 41 offices across India, including regional cells in

Bangalore (South), Guwahati (Northeast), Lucknow (north), Ahmadabad (west), and Pune (central), as well as state offices in Delhi, Hyderabad, Rajpur, Goa, and Cochin, and several field offices. It has offices in both Australia and Sri Lanka. Administration of India Director of CEE is Mr. Karthikeya Sarabhai. CEE has inherited the rich multi-disciplinary resource base and diverse experience of its parent organisation, Nehru foundation for development, which has been promoting educational efforts in the fields of science, nature study, health, and environments since 1966. At the time it began its activities, CEE was the only organisation in the country actively engaged in environmental education and implementing programmes throughout the country. It was only found in Ahmadabad. Five years into the activities, it became apparent that for a country as vast and diverse as India, physical presence was necessary for effective implementation.

Based on this, the first southern regional office was established in 1988-1999, and since then there has been a concerted effort to have a regional office or presence in the geographic area of operation. Its primary objective was to raise environmental awareness among communities by implementing a network-wide environmental education and training programme. It has an extensive collection of publications, books, posters, educational materials, bibliographies, and directories. In addition, there is a large computerised database called the environmental education bank that contains a collection of over 300 environment concepts, 2500 environment-related activities, and hundreds of case studies. After completing a decade of activities in 1994, it was determined that environmental education should shift more toward environmental action. This was a result of the income and experience gained during the first ten years. More sustainable development pilot, field-level, and demonstration projects that can be replicated by the CEE organisation. Within the subsequent decade, these projects comprised the majority of centre activities.

Today, CEE serves a vast array of sectors, target groups, and geographic regions. CEE views the UN Decade of Education for Sustainable Development as a significant opportunity to further contribute to sustainable development. CSE is the nodal agency for implementing DESD activities in India under the Government of India's Ministry of Human Resource Development. CEE's programmes for the decade will emphasise training and capacity building, internships and youth programmes, a knowledge centre

and consultancy services for ESD, and an education for sustainable development journal. The work of CEE is organised according to thrust areas.

As an organizing principles

- Education for children
- EE in higher education
- Examination system for EE
- Education system for youth.
- Communicating environment through the media
- Experiencing nature
- EE through Interpretation
- Knowledge management for sustainable development
- Industry Urban development
- Sustainable Rural development
- Water and sanitation
- Water management
- EE for fragile areas
- Bio diversity conservation
- Ecotourism
- Disaster preparedness and rehabilitation
- Training, networking and capacity building
- Facilitating NGO and community initiatives
- Initiatives for the UN decade of education for sustainable development
- Research in EE

Role of N.C.E.R.T in Environmental Education

For the promotion of school-level education, NCERT engages in the following activities: 86 Extension activities, including the publication of a quarterly journal called School Science and the annual organisation of a national science exhibition.

The exhibition focuses primarily on environmental topics.

- A training programme for educators and educators. The production of films and video programmes about the Indian environment. NCERT has a film library which lends films to schools.

- The publication of additional reading materials
- Collaboration with international organisations such as UNESCO, UNICEF, and UNEP, etc.
- In order to raise awareness and inspire youth and young children in INDIA, particularly on the part of the government. The Supreme Court further ordered and directed NCERT to develop a module curriculum on December 18, 2003.
- On 13 July 2004, the Supreme Court ordered that the curriculum developed by the NCERT for classes 1 through 12 MUST BE ADOPTED BY ALL STATES IN THEIR RESPECTIVE SCHOOLS.
- It further directed that NCERT be designated as the nodal agency to oversee the court order's implementation. Applies to all states and union territories and is both required and desirable.
- The National Council of Educational Research and Training (NCERT) designed the curriculum on environmental education for classes one through twelve, which was approved by the Supreme Court. The ministry of environment and forest is the central government agency responsible for the planning, promotion, coordination, and oversight of the implementation of environmental and forestry policies and programmes in India. They have a division for environmental education.

The objective of the division is to

- Create instructional materials and aids for the formal education sector.
- Encourage nongovernmental organisations, mass media, and other concerned organisations to promote public awareness at all levels of society.
- Promote environmental education through existing scientific educational research institutions.
- Ensure environmental education training and human resource development; • Mobilize public awareness for the preservation of the environment.

NCERT Approach for Environment Education

NCERT Lays Emphasis Upon the Following Aspects

- Population
- Land its uses

- Different types of resources and their uses
- Food and nutrition • Pollution
- Man and nature relationship

Role of Teachers in Environmental Education

The objective of environmental education is to develop desirable attitudes, values, and habits through the acquisition of information-gathering skills; therefore, the teacher must act as a guide and encourage students to use their information-gathering skills. The instructor may organise the learning experiences and activities and formulate the questions and points of inquiry. The investigations can be carried out by small groups of students. The group may share their experiences in the general classroom and engage in a discussion of the following functions of the teacher:

- To examine approaches to problems or subjects
- To organise working groups and provide work cards for the lines of investigation.
- To examine approaches to problems or subjects
- To arrange visits; • To provide children with reference materials.
- To provide children with reference materials
- To arrange for visiting speakers.
- To initiate and cultivate discussion and debate;
- To provide space for displays and exhibitions of completed projects.

Education is a powerful instrument for socioeconomic change in a society, community, or nation. It sharpens the knowledge's eye, cultivates consciousness, and logicalizes the mind. As the agent of social change, the teacher must actively shape the children's behaviour to cultivate a concern for the environment. Environmental education is imparted using age-appropriate techniques. In addition to traditional classroom instruction, teachers play crucial roles in providing students with opportunities to observe local environmental characteristics, problems, and phenomena, as well as community changes. Permitting children to categorise living and nonliving things based on their own criteria. Help them draw logical conclusions from their observation and categorization. Organizing extracurricular activities based on

learning from the immediate environment. Incorporate environmental concerns into the curriculum. Students are actively encouraged to acquire social values. Participation in environmental protection activities. Public education regarding renewable and nonrenewable resources Permitting students to acquire fundamental understanding and knowledge of the global environment, its problems, and humanity's role therein. Extensive knowledge and understanding of the Gandhian theory of development The instructor should also inform students of the fundamental responsibilities of an Indian citizen with regard to the environment, as outlined in section IV-A of the Indian Constitution, which are to protect and improve the natural environment, including forests, lakes, and rivers, and to have compassion for all living things.