ENVIRONMENTAL STUDIES

B.A/B.COM/B.SC-I YEAR (I-SEM)

1.7 Environmental Studies (Skill Enhancement Course)

Unit – I

Ecosystem, Biodiversity & Natural Resources

1. Definition, Scope & Importance of Environmental Studies.
2. Structure of Ecosystem – Abiotic – Biotic components Producers, Consumers, Decomposers, food chains, Food weds, ecological Pyramids
3. Function of an Ecosystem: Energy flow in the Ecosystem (single channel energy flow model)
4. Definition of Biodiversity, Genetic, Species & Ecosystem diversity, Hot-Spots of Biodiversity, Threats to Biodiversity, Conservation of Biodiversity (Insitu&Exsitu)
5. Renewable & non – renewable resources, Brief account of Forest, Mineral & Energy (Solay Energy & Geothermal Energy) resources
6. Water Conservation, Rain water Harvesting & Watershed Management.

Unit – II

EnvironmentalPollution, Global Issues & Legislation

1. Causas, Effects & Control measures of Air Pollution, Water Pollution
2. Solid Waste Management
3. Golbal Warming & Ozone layer depletion.
4. Ill – effects of Fire – works
5. Disaster Management – floods, earthquakes & cyclones\
6. Environmental legislation:-
   a) Wild life Protection Act
   b) Forest Act
   c) Water Act
   d) Air Act
7. Human Rights
8. Women and Child welfare
9. Role of Information Technology in environment and human health

- Field Study:

1. Pond Ecosystem
2. Forest Ecosystem

References:

1. Environmental Studies– from crisis to cure – by R. Rajagopalan (Third Edition) Oxford University Press.
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3. A text of Environmental Studies by D. K. Asthana and Dr.Meera Asthana.

Environmental studies

1.1 INTRODUCTION

The word 'Environment' is derived from the French word 'Environner' which means to encircle, around or surround. The biologist Jacob Van Uerkal (1864-1944) introduced the term 'environment' in Ecology. Ecology is the study of the interactions between an organism of some kind and its environment. As given by Environment Protection Act 1986, Environment is the sum total of land, water, air, interrelationships among themselves and also with the human beings and other living organisms. Environmental Science is the interdisciplinary field and requires the study of the interactions among the physical, chemical and biological components of the Environment with a focus on environmental pollution and degradation. Environment studies is a multidisciplinary subject where different aspects are dealt with in a holistic approach. The science of Environment studies comprises various branches of studies like chemistry, physics, life science, medical science, agriculture, public health, sanitary engineering, geography, geology, atmospheric science, etc. It is the science of physical phenomena in the environment. It studies the sources, reactions, transport, effect and fate of a biological species in the air, water and soil and the effect of and from human activity upon these. Environmental Science deals with the study of processes in soil, water, air and organisms which lead to pollution or environmental damages and the scientific basis for the establishment of a standard which can be considered acceptably clean, safe and healthy for human beings and natural ecosystems.

The Environment is about the surrounding external conditions influencing development or growth of people, animal or plants; living or working conditions etc. This involves three questions ie., what is surrounded, by what surrounded and where surrounded. The answer to the first is living objects in general and man in particular.Human life is concerned to be the main in the study of environment. However, human life cannot exist or be understood in isolation from the other forms of life like animal life and from plant life. Environment belongs to all living beings and is thus important for all. Hence, environment refers to the sum total of conditions surround in space and time. The scope of the term 'Environment' has been changing and widening by the passage of time. In the primitive age, the environment consisted of only physical aspects of the planet earth ie., land, water and air as biological communities. As of now, it includes social, economic and political conditions also.The answer for the question where surrounded is in nature that physical component of the planet earth, viz land, air, water etc., support and affect life in the biosphere..

1.2 DEFINITIONS OF ENVIRONMENT:

Some important definitions of environment are as under:

1. According to Boring, 'A person's environment consists of the sum total of the stimulation which he receives from his conception until his death.' Indicating that environment comprises various types of forces such as physical, intellectual, mental, economical, political, cultural, social, moral and emotional.

2. Douglas and Holland defined that 'The term environment is used to describe, in aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms'.

1.3 SCOPE OF ENVIRONMENT:

The environment consists of four segments of the earth namely atmosphere, hydrosphere, lithosphere and biosphere:

1. Atmosphere: The Atmosphere forms a distinctive protective layer about 100 km thick around the earth. A blanket of gases called the atmosphere surrounds the earth and protects the surface of earth from the Sun's harmful, ultraviolet rays. It sustains life on the earth. It also regulates temperature, preventing the earth from becoming too hot or too cold. It saves it from the hostile environment of outer space. The atmosphere is composed of nitrogen and oxygen besides, argon, carbon dioxide and trace gases.

The atmosphere has a marked effect on the energy balance at the surface of the Earth. It absorbs most of the cosmic rays from outer space and a major portion of the electromagnetic radiation from the sun. It transmits only ultraviolet, visible, near infrared radiation (300 to 2500 nm) and radio waves. (0.14 to 40 m) while filtering out tissue-damaging ultra-violate waves below about 300 nm.

2. Hydrosphere: The Hydrosphere comprises all types of water resources oceans, seas, lakes, rivers, streams, reservoirs, polar icecaps, glaciers, and ground water. Oceans represent 97% of the earth's water and about 2% of the water resources is locked in the polar icecaps and glaciers. Only about 1% is available as fresh water as surface water in rivers, lakes, streams, and as ground water for human use.

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

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

The scope of environmental studies is very wide and it deals with many areas like i) Conservation of natural resources, ii) ecological aspects, iii) pollution of the surrounding natural resources, iv) controlling the pollution, v) social issues connected to it, and vi) impacts of human population on the environment.

Elements of Environment

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

(1) Physical elements

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

(2) Biological elements

Biological elements such as plants, animals, microorganisms and men constitute the biosphere.

(3) Cultural elements

Cultural elements such as economical, social and political elements are essentially man- made features, which make the cultural background.

1.4 ENVIRONMENT STUDIES: IMPORTANCE

The environment studies make us aware about the importance of protection and conservation of our mother earth and about the destruction due to the release of pollution into the environment. The increase in human and animal population, industries and other issues make the survival cumbersome. A great number of environment issues have grown in size and make the system more complex day by day, threatening the survival of mankind on earth. Environment studies have become significant for the following reasons:

1. Environment Issues are being of Global:

It has been well recognised that environment issues like global warming and ozone depletion, acid rain, marine pollution and biodiversity are not merely national issues but are global issues and hence require international efforts and cooperation to solve them.

2. Development and Environment:

Development leads to Urbanization, Industrial Growth, Telecommunication and Transportation Systems, Hi-tech Agriculture and Housing etc. However, it has become phased out in the developed world. The North intentionally moves their dirty factories to South to cleanse their own environment. When the West developed, it did so perhaps in ignorance of the environmental impact of its activities. Development of the rich countries of the world has undesirable effects on the environment of the entire world.

3. Explosive Increase in Pollution

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

4. Need for an Alternative Solution

It is essential, specially for developing countries to find alternative paths to an alternative goal. We need a goal as under:

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

It is utmost important for us to save the humanity from extinction because of our activities constricting the environment and depleting the biosphere, in the name of development.

5. Need for Wise Planning of Development

Our survival and sustenance depend on resources availability. Hence Resources withdraw, processing and use of the products have all to be synchronised with the ecological cycle. In any plan of development our actions should be planned ecologically for the sustenance of the environment and development.

6. Misra (1991) recognized four basic principles of ecology, as under:

(i) Holism, (ii) Ecosystem, (iii) Succession and (iv) Conversation.

Holism has been considered as the real base of ecology. In hierarchical levels at which interacting units of ecology are discussed, are as under:

Misra (1991) has recognised four basic requirements of environmental management as under:

1. Impact of human activities on the environment,
2. Value system,
3. Plan and design for sustainable development,
4. Environment education.

Keeping in view of the goal of planning for environmentally sustainable development, India contributed to the United Nations Conference on Environment and Development (UNCED), also referred to as "Earth Summit" held at Rio de Janeiro, the Capital of Brazil, 3rd-14th June, 1992.

Ecosystem Definition

"An ecosystem is defined as a community of lifeforms in concurrence with non-living components, interacting with each other."

What is an Ecosystem?

The ecosystem is the structural and functional unit of ecology where the living organisms interact with each other and the surrounding environment. In other words, an ecosystem is a chain of interaction between organisms and their environment. The term "Ecosystem" was first coined by A.G.Tansely, an English botanist, in the year 1953.

Read on to explore the types, structure, components, types and functions of ecosystem.

Types of Ecosystem

An ecosystem can be as small as an oasis in a desert, or as big as an ocean, spanning thousands of miles. There are two types of ecosystem:

- Terrestrial Ecosystem
- Aquatic Ecosystem

Terrestrial Ecosystems

Terrestrial ecosystems are exclusively land-based ecosystems. There are different types of terrestrial ecosystems distributed around various geological zones. They are as follows:

1. Forest Ecosystems
2. Grassland Ecosystems
3. Tundra Ecosystems
4. Desert Ecosystem

Aquatic Ecosystem

Aquatic ecosystems are ecosystems present in a body of water. These can be further divided into two types, namely:

1. Freshwater Ecosystem
2. Marine Ecosystem

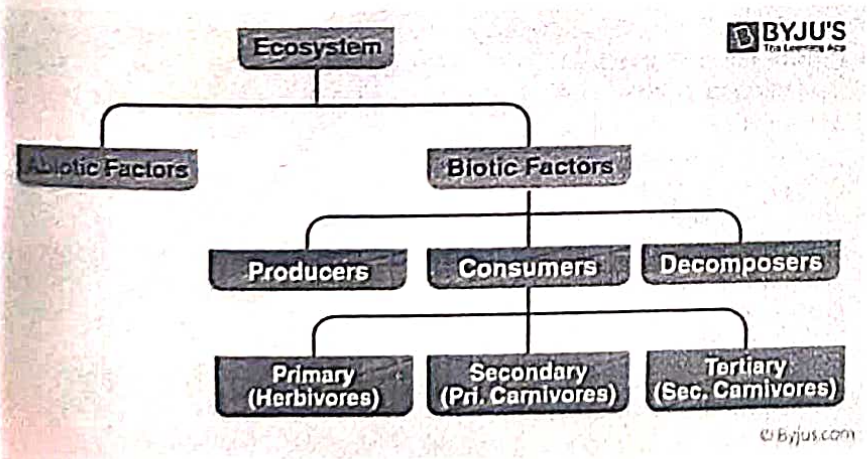
Structure of Ecosystem

The structure of ecosystem is characterised by the organisation of both biotic and abiotic components. This includes the distribution of energy in our environment. It also includes the climatic conditions prevailing in that particular environment.

The structure of ecosystem can be split into two main components, namely:

- Biotic Components
- Abiotic Components

The biotic and abiotic components are interrelated in an ecosystem. It is an open system where the energy and components can flow throughout the boundaries.



Biotic Components

Biotic components refer to all life in an ecosystem. Based on nutrition, biotic components can be categorised into autotrophs, heterotrophs and saprotrophs (or decomposers).

- **Producers** include all autotrophs such as plants. They are called autotrophs as they can produce food through the process of photosynthesis. Consequently, all other organisms higher up on the food chain rely on producers for food.
- **Consumers** or heterotrophs are organisms that depend on other organisms for food. Consumers are further classified into primary consumers, secondary consumers and tertiary consumers.
    - ***Primary consumers*** are always herbivores that they rely on producers for food.
    - ***Secondary consumers*** depend on primary consumers for energy. They can either be a carnivore or an omnivore.
    - ***Tertiary consumers*** are organisms that depend on secondary consumers for food. Tertiary consumers can also be an omnivore.
    - ***Quaternary consumers*** are present in some food chains. These organisms prey on tertiary consumers for energy. Furthermore, they are usually at the top of a food chain as they have no natural predators.

Decomposers include saprophytes such as fungi and bacteria. They directly thrive on the dead and decaying organic matter. Decomposers are essential for the ecosystem as they help in recycling nutrients to be reused by plants.

Abiotic Components

Abiotic components are the non-living component of an ecosystem. It includes air, water, soil, minerals, sunlight, temperature, nutrients, wind, altitude, turbidity etc.

Functions of Ecosystem

The functions of ecosystem are as follows:

1. It regulates the essential ecological processes, supports life systems and renders the stability.
2. It is also responsible for the cycling of nutrients between biotic and abiotic components.
3. It maintains a balance among the various trophic levels in the ecosystem.
4. It cycles the minerals through the biosphere.
5. The abiotic components help in the synthesis of organic components that involves the exchange of energy.

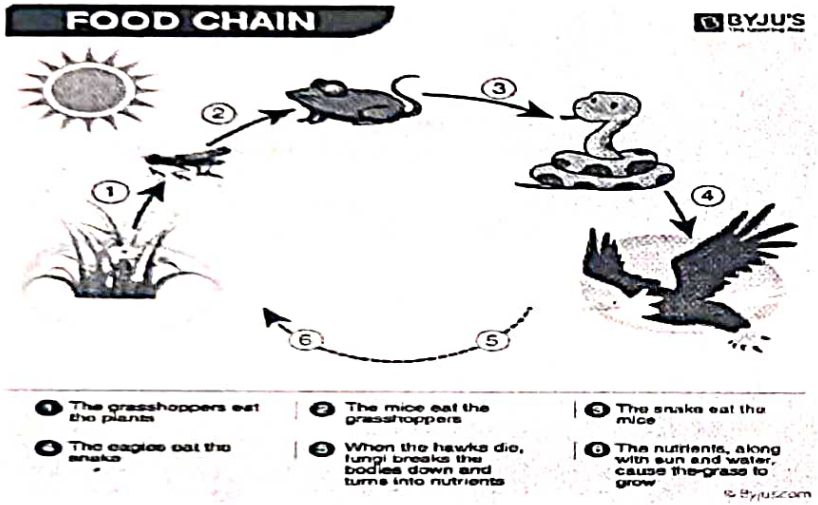
Important Ecological Concepts

1. Food Chain

The sun is the ultimate source of energy on earth. It provides the energy required for all plant life. This energy is utilised by the plants for the process of photosynthesis, which is used to synthesise their food.

During this biological process, light energy is converted into chemical energy and is passed on through successive levels. The flow of energy from a producer, to a consumer and eventually, to an apex predator or a detritivore is called the food chain.

Dead and decaying matter, along with organic debris, is broken down into its constituents by scavengers. These constituents are then absorbed by the reducers. After gaining the energy, the reducers liberate molecules to the environment, which can be utilised again by the producers.



2. Ecological Pyramids

An ecological pyramid is the graphical representation of the number, energy, and biomass of the successive trophic levels of an ecosystem. Charles Elton was a first ecologist to describe the ecological pyramid and its principals in the year 1927.

The biomass, number, and energy of organisms ranging from the producer level to the consumer level are represented in the form of a pyramid; hence, it is known as the ecological pyramid.

The base of the ecological pyramid comprises of the producers, followed by the primary and secondary consumers. The tertiary consumers hold the apex. In some food chains, the quaternary consumers are at the very apex of the food chain.

The producers generally outnumber the primary consumers, and similarly, the primary consumers outnumber the secondary consumers. And lastly, apex predators also follow the same trend as the other consumers; wherein, their numbers are considerably lower than the secondary consumers.

For example, Grasshoppers feed on crops such as cotton and wheat, which are plentiful. These grasshoppers are then preyed upon by common mice, which are comparatively less in number. The mice are preyed upon by snakes such as cobras. Snakes are ultimately preyed on by apex predators such as the brown snake eagle.

In essence:

Function of Ecosystem:

An ecosystem is a discrete structural, functional and life sustaining environmental system. The environmental system consists of biotic and abiotic components in a habitat. Biotic component of the ecosystem includes the living organisms; plants, animals and microbes whereas the abiotic component includes inorganic matter and energy.

Abiotic components provide the matrix for the synthesis and perpetuation of organic components (protoplasm). The synthesis and perpetuation processes involve energy exchange and this energy comes from the sun in the form of light or solar energy.

Thus, in any ecosystem we have the following functional components:

(i) Inorganic constituents (air, water and mineral salts)

(ii) Organisms (plants, animals and microbes), and

(iii) Energy input which enters from outside (the sun).

These three interact and form an environmental system. Inorganic constituents are synthesized into organic structures by the green plants (primary producers) through photosynthesis and the solar energy is utilized in the process. Green plants become the source of energy for renewals (herbivores) which, in turn become source of energy for the flesh eating animals (carnivores). Animals of all types grow and add organic matter to their body weight and their source of energy is complex organic compound taken as food.

They are known as secondary producers. All the living organisms whether plants or animals in an ecosystem have a definite life span after which they die. The dead organic remains of plants and animals provide food for saprophytic microbes, such as bacteria, fungi and many other animals. The saprobes ultimately decompose the organic structure and break the complex molecules and liberate the inorganic components into their environment.

These organisms are known as decomposers. During the process of decomposition of organic molecules, the energy which kept the inorganic components bound together in the form of organic molecules gets liberated and dissipated into the environment as heat energy. Thus in an ecosystem energy from the sun, the input is fixed by plants and transferred to animal components.

Nutrients are withdrawn from the substrate, deposited in the tissues of the plants and animals, cycled from one feeding group to another, released by decomposition to the soil, water and air and then recycled. The ecosystems operating in different habitats, such as deserts, forests,

grasslands and seas are interdependent on one another. The energy and nutrients of one ecosystem may find their way into another so that ultimately all parts of the earth are interrelated, each comprising a part of the total system that keeps the biosphere functioning.

Thus the principal steps in the operation of ecosystem are as follows:

(1) Reception of radiant energy of sun,

(2) Manufacture of organic materials from inorganic ones by producers,

(3) Consumption of producers by consumers and further elaboration of consumed materials; and,

(4) After the death of producers and consumers, complex organic compounds are degraded and finally converted by decomposers and converters into such forms as are suitable for reutilization by producers.

The principal steps in the operation of ecosystem not only involve the production, growth and death of living components but also influence the abiotic aspects of habitat. It is now clear that there is transfer of both energy and nutrients from producers to consumers and finally to decomposers and transformers levels. In this transfer there is a progressive decrease of energy but nutrient component is not diminished and it shows cycling from abiotic to biotic and vice versa.

The flow of energy is unidirectional. The two ecological processes—energy flow and mineral cycling which involve interaction between biotic and abiotic components lie at the heart of ecosystem dynamics. The principal steps and components of ecosystem are.

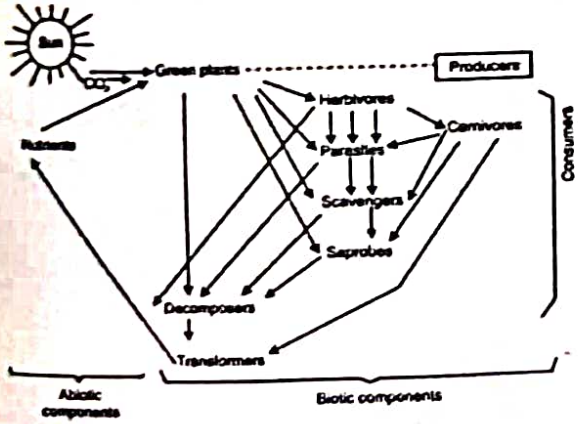


Fig. 3.1. Different components of ecosystem.

Biodiversity Types: Genetic, Species and Ecological Diversity

Definition:

The living world is a complex combination of different levels of organisms. The key components of life are at one extreme and communities of species at the other extreme. The manifestations of all types of diversities are found at all these levels of organisms. Biodiversity is the shorter form of word biological diversity which means diversity in the biological world. Thus one can define biodiversity as the degree of variety in nature with regards to biological species.

Types of Biodiversity:

(a) Genetic diversity:

It is the variation of genes within the species. This results distinct population of one, even same species. It gives genetic variation within a population or varieties within one species. There are two reasons for differences between individual organisms. One is variation in the gene which all organisms possess which is passed from one to its offspring's.

The other is the influence of environment on each individual organism. The variation in the sequence of four base pairs in DNA chain forms the genetic variation in the organism. The recombination) of genetic material during cell division makes it an imperative for genetic diversity within a species. Loss of genetic diversity within a species is called genetic erosion.

The whole area of agricultural productivity and development depend on genetic diversity. The plant as well as animal genetic resources play important role in the economy of a country. Genetic diversity is the whole basis for a sustainable life system in the earth.

Scientists in many parts of the world are trying to introduce genetically modified seeds in the agriculture sector for better yield as well as for the resistance of drought and flood situations. The local people or farmers are not showing any interest to preserve the natural way of genetic diversity.

(b) Species diversity:

This refers to the variety of species within a particular region. The number of species in a region is a measure for such diversity. The richness of species in a given region provides a yard stick for

species diversity. Species diversity depends as much on the genetic diversity as on the environmental condition.

Colder regions support less than the warmer regions for species diversity. The good climate with good physical geography supports a better species diversity. Species richness is a term which is used to measure the biodiversity of a given site.

In addition to species richness, species endemism is a term used to measure biodiversity by way of assessing the magnitude of differences between species. In the taxonomic system similar species are grouped together in general, similar genera in families, families in orders and so on till in the level of kingdom. This process is a genuine attempt to find relationships between organisms. The higher taxa have thousands of species. Species that are very different from one another contributes more to overall biodiversity.

(c) Ecological diversity:

This is the number of species in a community of organisms. Maintaining both types of diversity is fundamental to the functioning of ecosystems and hence to human welfare. India is one of the 12 centres of diversity and origin of several cultivated plants in the world. It is estimated that 15,000 species of plants occur in India. The flowering plants comprise 15,000 species of which several hundred (5000-7500) species are endemic to India. The region is also rich in fauna, containing about 65,000 species of animals.

Among these, more than 50,000 species of insects, 4,000 of molluscs. 6,500 of other invertebrates, 2,000 offish, 140 of amphibians, 420 of reptiles, 1,200 of birds and 340 of mammals are recorded from India. This richness in biological diversity is due to immense variety of climatic and altitudinal conditions coupled with varied ecological habitats.

These vary from the humid tropical Western Ghats to the hot desert of Rajasthan, from the cold desert of Ladakh and the icy mountains of Himalayas to the warm coasts of peninsular India including coastal region of Orissa. Gandhamardan Hills of Sambalpur is rich in biodiversity. The

Indian tradition teaches us that all forms of life, human, animal and plants are so closely linked that disturbance in one gives rise to imbalance in the other. Our old scriptures tell lot about these things.

Materials (Resources) and its Classification

All things that are useful to us are called resources. Air, water, land, soil, forest etc are all resources Resources are useful raw materials that we get from nature. These are naturally occurring materials They are useful for us in many ways, and we keep developing new ways to use them or convert them into useful things. Let us look at the classification of resources.

Classification of Resources

Natural resources are valuable to us. The broadest classification of resources is done on the basis their replenishing ability. Let us take a look, at these two classifications.

- Renewable resources
- Non Renewable resources

Renewable resources

When talking about classification of resources, we will first see the renewable resources. Renewa resources are those resources that can be replenished or renewed naturally over ti Air, water, wind, solar energy etc are all renewable resources. Renewable resources can be ea renewed by nature.

1. Solar energy

Sun is a big source of energy. The energy that we get from the *Sun* is called solar energy. All natural phenomenon like the flowing of wind, water cycle, photosynthesis etc are possible only to solar energy. Now a day, solar energy is being used to cook food with the help of solar cook heat water, light streets, pump water for irrigating fields etc.

2. Hydro-Energy

Water is important natural resources. All living organisms need water to live. Humans need w for many purposes such as drinking, cleaning, cooking and for growing crops. Water flowing the river or water stored in a dam is sources of hydro energy. The Simple method to use hy energy is to convert it into electrical energy.

3. Wind energy

Winds are constantly being created in nature. The windmill is a source of electrical energy. These windmills are generally established only at places where most of the days in a year experience strong winds. The energy from this wind is used for grinding grain, pumping water and to produce electricity. In India, many windmills have been set up in different places such as Tamil Nadu, Maharashtra, Rajasthan, Kerala, West Bengal and Gujarat.

4. Biogas

Biogas is a type of fuel which is a mixture of gases such as methane, carbon dioxide, hydrogen etc which is obtained by decomposition of animal and plant wastes like animal dung, with the help of microorganisms in the presence of water. It is used as fuel in gas stove especially in rural areas.

5. Wood

Wood is an ancient and traditional source of energy. It is mainly a mixture of many carbohydrate compounds. Wood is used to cook food. It leads to deforestation and pollutes air also. In India, still in many villages, they use wood chullas to cook food every day. While having ill effects on the environment, it is also harmful to human health.

6. **Hydrogen** It is a good source of energy because it does not create pollution and produce maximum energy on burning. Hydrogen has the potential to be the answer to all our energy and fuel troubles. Technology is currently being developed to fully utilize hydrogen efficiency.

7. Alcohol

Alcohol has many commercial and medical purposes. It can use for producing energy. It can be obtained while making sugar from sugarcane. Thus it is a very cheap source of energy. A mixture of petrol and alcohol is being used as a fuel in automobiles. This mixture is called 'Gasohol'.

8. Air

All living things need air to breathe. Therefore, air is an important natural resource.

9. Water

All living things water in order to survive. And the water cycle means we will essentially never run out of the water. But we must be careful not to pollute water and make it unusable. Drinking and clean water are already scarce in the world.

10. Soil

It is an important resource as this is the layer where plants grow. We all need food in order to survive. We get most of our food from crops grown in the soil.

Non Renewable resources

The other classification of resources is non-renewable resources. Non-renewable resources are those natural resources that are available in limited quantity. These resources cannot be renewed or replenished in short duration. Therefore they are also known as *exhaustible resources*. Examples- coal, natural gas, petroleum etc

1. Fossil fuel Fossil fuels like coal and petroleum are non-renewable resources. They are found deep inside the earth and are made by natural processes over many centuries. Their quantity is limited and they take thousands of years to get renewed. Example of fossil fuels is coal, petroleum, natural gas etc.

- **Coal**: It is also known as black diamond. Coal is used as a fuel, to generate electricity, and in factories and steam engines.
- **Natural gas**: Natural gas is used as a fuel called *Compressed Natural Gas or CNG*. Some wells dug into the earth produce only natural gas. Natural gases are a good alternative to petrol and diesel and it is used as Compressed Natural Gas. It burns easily and produces a lot of heat. It is a good source of hydrogen.
- **Petroleum**: Petroleum is also known as mineral oil or crude oil. This liquid mineral is refined to make fuels such as petrol, diesel, cooking gas and kerosene. Plastic, cosmetics, and lubricants are also products of petroleum. It is found deep inside the Earth or under the sea floor. It is taken out by drilling wells deep into the Earth or under the seabed.

Fuel Conservation and Conservation of Natural Resources

2. Nuclear energy

In the classification of resources, nuclear energy is classified as non-renewable. The fuel used for nuclear energy is generally uranium, which is in a limited supply. So we classify it as non-renewable. Production of electricity from nuclear energy does not release carbon dioxide. Thus, use of nuclear energy is safe for the environment.

Water Conservation Methods

1. Protection of Water from Pollution;

If the total fresh water available on the earth remains pollution free, it is sufficient to meet the drinking water needs of the existing population of the world, unfortunately a large portion of fresh water does not remain fit for use of the living world due to increasing economic activities, urbanization etc.

Oceanic water in the form of ecological system of seas is an important environmental system, but during the last century pollution has spread in large proportions.

Surface water is mainly found in rivers and lakes and underground water is found under land at different depths, but which have become polluted.

Large cities located on banks of rivers are directly disposing off different wastes without treatment in rivers. Similarly, tourism has spread pollution at war speed on famous lakes and sea coasts. Man is greatly dependent on groundwater for his water related necessities, but some special industrial units have also polluted this amount of water stored in the security cover of the ground.

All the available water store on the earth should be kept pollution-free because pressure of demand for water is increasing on a large part of the earth. Normally, it is presumed that sea water being saline, is not fit to be used by human beings, but indirectly it is useful for maintaining living organisms with whom man is related, e.g., fish provide nutrition to a large portion of the world.

Hence, it is necessary to have a cooperative policy at the international level for control of oily and radioactive pollution of the oceans. On 18th November, 2002, an oil tanker of Bahama met with an accident and drowned in the sea near the 'Coast of Death' sea area 233 km from north-west coast of Spain. 77,000 metric tones of oil poured out from this tanker and spread over the nearby seas and polluted the sea water. During the Gulf War of 2003 also, the water of Red Sea, Gulf Persian and Mediterranean Sea adjacent to the Arabian Sea became polluted.

The origin of water crisis initially started due to its pollution and qualitative deterioration, which became acute due to increasing demand for it. For preventing water pollution, important water sources should not be made places for disposal of wastes. Industrial units should dispose off water only after its treatment. Bathing and other such activities should be prohibited near drinking water sources.

Weeds produced in water should be controlled. Water should become re-usable after physical, chemical, mechanical and organic processing methods. Rivers and lakes should not be used as canals for transport of goods as is being done in Rhine River of Europe, Volga river of Russia, and the Ganges, Yamuna and Kaveri (Cauvery) rivers in India. Thus, the most important aspect of water conservation is control on water pollution.

2. Redistribution of Water:

Water found on the surface of the earth is not equally distributed. Existing form of distribution also becomes a reason for the water crisis. In the African continent, though there is maximum hydro electric production because of excess availability of water in Mediterranean regions, but the Sahara desert situated in the north of Africa and the greatest desert of the world, suffers from water crisis for the whole year.

Droughts faced by the Sahel region in the north of Sahara desert are world famous. Similarly, there is maximum rainfall of the world (1,187 cm. in Mawsynram) in north-east India, whereas

there is only 50 cm. rainfall in the west. As a result of it, more than 60 per cent portion of water of Brahmaputra and its companion rivers in the north east flows to the saline seas uselessly, whereas rivers of western Rajasthan remain dry for most of the time in a year.

Hence, by arranging supply of water from areas having lesser demand to the areas having greater demand, water crisis can be minimized. By construction of surface water reservoirs and storage of excess water in them, supply can be made to scarcity affected areas. This work can be accomplished by development of water reservoirs and canal network

Excess rainfall water which flows away from rivers without being used, can be stored by construction of water reservoirs, from where it can be supplied for agriculture, industries, urban areas etc. Facilities of fisheries and transport also exist in stored water. These reservoirs are also constructed for protection from floods, and apart from flood protection, such water can also be used for different purposes.

Redistribution of water is also possible through canal system. Canal system transfers water from excess rain water areas to scarce rain water areas and conserves water for different uses. Indira Gandhi Canal is such a type of canal system which has brought water of Himalayas to western Rajasthan and changed the arid ecology. K.L. Rao, the then Irrigation Minister, had drafted this plan by the name of 'Ganga-Kaveri Grid'.

Its length was decided as 2640 km in the beginning, which had to link river Ganges of north India with river Kaveri known as 'Ganges of the South'. It was also proposed to include central rivers Narmada, Tapti, Godavari, Krishna and Pensnar falling in the way. Former President of India A.P.J. Abdul Kalam took a lead in 2003 for its implementation and its work is being started by giving a modern shape to it. It will be able to transfer water from excess rainfall water areas to scarce rainfall areas every year.

Thus, by developing artificial canal system through artificial rivers, excess water can be conserved. For this, canal system should be developed from national level to micro level. Along with big rivers, canal system should also be developed by the side of small rivers to conserve large amounts of water. Though development of canal system will have to face geographical, economic, social, cultural (rehabilitation) and political problems, but its future results would be favourable from the geographical point of view.

Population Control:

Water crisis has assumed dangerous proportions due to fast increase in population and deterioration in quantitative and qualitative aspects of water resources. Demand for water is continuously increasing. Along with population increase, demand for fresh water has increased due to expansion of industries and increasing urbanization.

Demand for water increased 35 times from the year 1700 to the decade of 2000. Demand for water has increased more in developing countries. For the year 2001, demand for quantity of water in the whole world was estimated to be 435 cubic kms. 60 per cent of this is required in agriculture, 30 per cent in industries and 10 per cent for cooking, bathing and drinking. Hence, demand for water can also be controlled through population control and at the same time, qualitative deterioration of water can also be prevented by population.

Population of the world would become around 800 crores by the year 2025. In this context, the United Nations Organization has warned that in case population control is not exercised, the whole world will have to face grave water crisis. United Nations Organization declared the year 2003 as the 'Fresh Water Year'.

Renovation of Traditional Water Sources:

In India, traditional water storage places have been able to meet the demand of drinking water in many regions but they have been renovated from time to time. Water stored in traditional water sources has been used for both purposes, agriculture as well as for drinking.

. Change in Crop Pattern:

Excess water is not required if crops are grown according to agro-climatic conditions but in the present race of development, changing crop pattern with higher profits has replaced them. These commercial crops require more water than the traditional crops. In north-eastern part of Rajasthan, crops were not grown as per availability of water and intensive cultivation was adopted during the last three decades.

Groundwater was over exploited because of non-availability of surface water and plantation of commercial crops requiring more water. It created serious water crisis. Hence, keeping in mind the experience of Rajasthan, crop rotation should be adopted according to agro-climatic conditions. Agro forestry and horticulture should be given priority in areas having scarcity of water.

. Flood Management:

A large portion of fresh water in the world becomes devastating due to floods in India, out of a total land area of 32.8 crore hectares, in India, 4 crore hectare land is flood affected, out of which 3.2 crore hectare land can be protected from floods. By construction of embankments and canals a large part of land can be conserved besides minimizing flood losses.

Intensive afforestation can also provide security from floods. If will be helpful in absorption of water in the soil. Drainage areas of Ganges, Yamuna, Mahanadi, Damodar, Kosi and other rivers have been taken up in flood management and security to some limit has been provided to the 1.44 crore hectare land.

Rainwater Harvesting

All living things including, plants, animals and human beings need water to live and to carry out different cellular activities.

Have you ever imagined a day without water?

No, we have not, and it is hard to imagine. We all use water for a different day to day activities, such as cleaning, washing, bathing, cooking, drinking and other domestic and industrial uses.

Water is a precious, essential and abiotic component of the ecosystem. Today we all are heading toward the scarcity of water, and this is mainly because of the lack of water conservation and pollution of water bodies. So let us not waste a drop of water and start conserving water for further use.

Also read: Water

There are different methods used for conserving water, here let us learn about the rainwater harvesting system.

Table of Contents

What is Rainwater harvesting?

Rainwater harvesting is the simple process or technology used to conserve Rainwater by collecting, storing, conveying and purifying of Rainwater that runs off from rooftops, parks, roads, open grounds, etc. for later use.

Explore more: How Can We Conserve Water?

How to Harvest the Rainwater?

Rainwater harvesting systems consists of the following components:

- Catchment- Used to collect and store the captured Rainwater.
- Conveyance system – It is used to transport the harvested water from the catchment to the recharge zone.
- Flush- It is used to flush out the first spell of rain.
- Filter – Used for filtering the collected Rainwater and remove pollutants.
- Tanks and the recharge structures: Used to store the filtered water which is ready to use.

The process of rainwater harvesting involves the collection and the storage of Rainwater with the help of artificially designed systems that run off naturally or man-made catchment areas like- the rooftop, compounds, rock surface, hill slopes, artificially repaired impervious or semi-pervious land surface.

Quite obviously, several factors play a vital role in the amount of water harvested. Some of these factors are:

- The quantum of runoff
- Features of the catchments
- Impact on the environment
- Availability of the technology
- The capacity of the storage tanks
- Types of the roof, its slope and its materials
- The frequency, quantity and the quality of the rainfall
- The speed and ease with which the Rainwater penetrates through the subsoil to recharge the groundwater.

Why do we harvest Rainwater?

The rainwater harvesting system is one of the best method practised and followed to support the conservation of water. Today, scarcity of good quality water has become a significant cause of concern. However, Rainwater, which is pure and of good quality, can be used for irrigation, washing, cleaning, bathing, cooking and also for other livestock requirements.

Advantages of Rainwater Harvesting

The benefits of rainwater harvesting system are listed below.

- Less of cost
- Helps in reducing the water bill
- Decreases the demand for water
- Reduces the need for imported water
- Promotes both water and energy conservation
- Improves the quality and quantity of groundwater
- Does not require a filtration system for landscape irrigation
- This technology is relatively simple, easy to install and operate
- It reduces soil erosion, stormwater runoff, flooding, and pollution of surface water with fertilizers, pesticides, metals and other sediments.
- It is an excellent source of water for landscape irrigation with no chemicals and dissolved salts and free from all minerals

Disadvantages of Rainwater Harvesting

- Regular Maintenance is required
- Requires some technical skills to install
- Limited and no rainfall can limit the supply of Rainwater
- If not installed correctly, it may attract mosquitoes and other waterborne diseases.
- One of the significant drawbacks of the rainwater harvesting system is storage limits

To know more about Rainwater Harvesting and other Biology related concepts@ BYJU'S Biology

Frequently Asked Questions

What do you understand by rainwater harvesting?

Rainwater harvesting is the process of accumulation and storage of rainwater for reuse rather than allowing it to runoff.

What are the different methods of rainwater harvesting?

The different methods of rainwater harvesting include:

- Rooftop rainwater harvesting.
- Surface runoff harvesting.
- First flush.
- Transportation.
- Catchment.
- Filter.

Why is the importance of rainwater harvesting?

Rainwater harvesting is a sustainable process that helps in preserving water for future needs. Water scarcity is a major concern in today's scenario. The process of rainwater harvesting is a good way to conserve water.

What are the advantages of rainwater harvesting?

The advantages of rainwater harvesting are:

- It is cost-effective
- Conserves water
- A source of water for landscape irrigation
- It is a simple method and easy to practice.
- It reduces soil erosion and pollution of water bodies due to fertilizers and pesticides.

UNIT-II

Air Pollution

What Is Air Pollution?

Air pollution refers to the release of pollutants into the air that are detrimental to human health and the planet as a whole.

The Clean Air Act authorizes the U.S. Environmental Protection Agency (EPA) to protect public health by regulating the emissions of these harmful air pollutants. The NRDC has been a leading authority on this law since it was established in 1970.

What Causes Air Pollution?

"Most air pollution comes from energy use and production," says John Walke, director of the Clean Air Project, part of the Climate and Clean Air program at NRDC. "Burning fossil fuels releases gases and chemicals into the air." And in an especially destructive feedback loop, air pollution not only contributes to climate change but is also exacerbated by it. "Air pollution in the form of carbon dioxide and methane raises the earth's temperature," Walke says. "Another type of air pollution is then worsened by that increased heat: Smog forms when the weather is warmer and there's more ultraviolet radiation." Climate change also increases the production of allergenic air pollutants including mold (thanks to damp conditions caused by extreme weather and increased flooding) and pollen (due to a longer pollen season and more pollen production).

Effects of Air Pollution

"While we've made progress over the last 40-plus years improving air quality in the U.S. thanks to the Clean Air Act, climate change will make it harder in the future to meet pollution standards, which are designed to protect health," says Kim Knowlton, senior scientist and deputy director of the NRDC Science Center.

Smog and soot

These two are the most prevalent types of air pollution. Smog, or "ground-level ozone," as it is more wonkily called, occurs when emissions from combusting fossil fuels react with sunlight. Soot, or "particulate matter," is made up of tiny particles of chemicals, soil, smoke, dust, or allergens, in the form of gas or solids, that are carried in the air. The EPA's "Plain English Guide to the Clean Air Act" states, "In many parts of the United States, pollution has reduced the distance and clarity of what we see by 70 percent." The sources of smog and soot are similar. "Both come from cars and trucks, factories, power plants, incinerators, engines—anything that combusts fossil fuels such as coal, gas, or natural gas," Walke says. The tiniest airborne particles in soot—whether they're in the form of gas or solids—are especially dangerous because they can penetrate the lungs and bloodstream and worsen bronchitis, lead to heart attacks, and even hasten death.

Smog can irritate the eyes and throat and also damage the lungs—especially of people who work or exercise outside, children, and senior citizens. It's even worse for people who have asthma or allergies—these extra pollutants only intensify their symptoms and can trigger asthma attacks.

Hazardous air pollutants

These are either deadly or have severe health risks even in small amounts. Almost 200 are regulated by law; some of the most common are mercury, lead, dioxins, and benzene. "These are also most often emitted during gas or coal combustion, incinerating, or in the case of benzene, found in gasoline," Walke says. Benzene, classified as a carcinogen by the EPA, can cause eye, skin, and lung irritation in the short term and blood disorders in the long term. Dioxins, more typically found in food but also present in small amounts in the air, can affect the liver in the short term and harm the immune, nervous, and endocrine systems, as well as reproductive functions. Lead in large amounts can damage children's brains and kidneys, and even in small amounts it can affect children's IQ and ability to learn. Mercury affects the central nervous system.

Polycyclic aromatic hydrocarbons, or PAHs, are toxic components of traffic exhaust and wildfire smoke. In large amounts, they have been linked to eye and lung irritation, blood and liver issues, and even cancer. In one recent study, the children of mothers who'd had higher PAH exposure during pregnancy had slower brain processing speeds and worse symptoms of ADHD.

Greenhouse gases

By trapping the earth's heat in the atmosphere, greenhouse gases lead to warmer temperatures and all the hallmarks of climate change: rising sea levels, more extreme weather, heat-related deaths, and increasing transmission of infectious diseases like Lyme. According to a 2014 EPA study, carbon dioxide was responsible for 81 percent of the country's total greenhouse gas emissions, and methane made up 11 percent. "Carbon dioxide comes from combusting fossil fuels, and methane comes from natural and industrial sources, including the large amounts that are released during oil and gas drilling," Walke says. "We emit far larger amounts of carbon dioxide, but methane is significantly more potent, so it's also very destructive." Another class of greenhouse gases, hydrofluorocarbons (HFCs), are thousands of times more powerful than carbon dioxide in their ability to trap heat. In October 2016, more than 140 countries reached an agreement to reduce the use of these chemicals—which are used in air conditioners and refrigerators—and find greener alternatives over time. David Doniger, director of NRDC's Climate and Clean Air program, writes, "NRDC estimates that the agreed HFC phase-down will avoid the equivalent of more than 80 billion tons of CO_2 over the next 35 years."

Pollen and mold

Mold and allergens from trees, weeds, and grass are also carried in the air, are exacerbated by climate change, and can be hazardous to health. They are not regulated by the government and are less directly connected to human actions, but they can be considered air pollution. "When homes, schools, or businesses get water damage, mold can grow and can produce allergenic airborne pollutants," Knowlton says. "Mold exposure can precipitate asthma attacks or an allergic response, and some molds can even produce toxins that would be dangerous for anyone to inhale."

Pollen allergies are worsening because of climate change. "Lab and field studies are showing that the more carbon dioxide pollen-producing plants—especially ragweed—are grown in, the bigger they grow and the more pollen they produce," Knowlton says. "Climate change also extends the pollen production season, and some studies are beginning to suggest that ragweed pollen itself might be becoming a more potent allergen." That means more people will suffer runny noses, fevers, itchy eyes, and other symptoms.

How to Help Reduce Air Pollution

"The less gasoline we burn, the better we're doing to reduce air pollution and harmful effects of climate change," Walke says. "Make good choices about transportation. When you can, walk, ride a bike, or take public transportation. For driving, choose cars that get better miles per gallon of gas or choose an electric car." You can also investigate your power provider options—you may be able to request that your electricity be supplied by wind or solar. Buying your food locally cuts down on the fossil fuels burned in trucking or flying food in from across the country. And perhaps most important, "Support leaders who push for clean air and water and responsible steps on climate change," Walke says.

How to Protect Your Health

- "When you see in the newspaper or hear on the weather report that pollution levels are high, it may be useful to limit the time when children go outside or you go for a jog," Walke says. Generally, ozone levels tend to be lower in the morning.
- When you do exercise outside, stay as far as you can from heavily trafficked roads. Then shower and wash your clothes to remove fine particles.
- If the air quality is bad, stay inside with windows closed.

- Wear sunscreen. When ultraviolet radiation comes through the weakened ozone layer, it can cause skin damage and skin cancer.

Water Pollution:

What Is Water Pollution?

Water pollution occurs when harmful substances—often chemicals or microorganisms—contaminate a stream, ri lake, ocean, aquifer, or other body of water, degrading water quality and rendering it toxic to humans or the environment.

What Are the Causes of Water Pollution?

Water is uniquely vulnerable to pollution. Known as a "universal solvent," water is able to dissolve more substanc than any other liquid on earth. It's the reason we have Kool-Aid and brilliant blue waterfalls. It's also why water i so easily polluted. Toxic substances from farms, towns, and factories readily dissolve into and mix with it, causing water pollution.

Categories of Water Pollution

Groundwater

When rain falls and seeps deep into the earth, filling the cracks, crevices, and porous spaces of an aquifer (basically an underground storehouse of water), it becomes groundwater—one of our least visible but most important natural resources. Nearly 40 percent of Americans rely on groundwater, pumped to the earth's surface, for drinking water. For some folks in rural areas, it's their only freshwater source. Groundwater gets polluted when contaminants—fro pesticides and fertilizers to waste leached from landfills and septic systems—make their way into an aquifer, rendering it unsafe for human use. Ridding groundwater of contaminants can be difficult to impossible, as well as costly. Once polluted, an aquifer may be unusable for decades, or even thousands of years. Groundwater can also spread contamination far from the original polluting source as it seeps into streams, lakes, and oceans.

Surface water

Covering about 70 percent of the earth, surface water is what fills our oceans, lakes, rivers, and all those other blue bits on the world map. Surface water from freshwater sources (that is, from sources other than the ocean) accounts for more than 60 percent of the water delivered to American homes. But a significant pool of that water is in peril. According to the most recent surveys on national water quality from the U.S. Environmental Protection Agency, nearly half of our rivers and streams and more than one-third of our lakes are polluted and unfit for swimming, fishing, and drinking. Nutrient pollution, which includes nitrates and phosphates, is the leading type of contamination in these freshwater sources. While plants and animals need these nutrients to grow, they have become a major pollutant due to farm waste and fertilizer runoff. Municipal and industrial waste discharges contribute their fair share of toxins as well. There's also all tOcean water

Eighty percent of ocean pollution (also called marine pollution) originates on land—whether along the coast or far inland. Contaminants such as chemicals, nutrients, and heavy metals are carried from farms, factories, and cities by streams and rivers into our bays and estuaries; from there they travel out to sea. Meanwhile, marine debris—particularly plastic—is blown in by the wind or washed in via storm drains and sewers. Our seas are also sometimes spoiled by oil spills and leaks—big and small—and are consistently soaking up carbon pollution from the air. The ocean absorbs as much as a quarter of man-made carbon emissions

Point source

When contamination originates from a single source, it's called point source pollution. Examples include wastewater (also called effluent) discharged legally or illegally by a manufacturer, oil refinery, or wastewater treatment facility, as well as contamination from leaking septic systems, chemical and oil spills, and illegal dumping. The EPA regulates point source pollution by establishing limits on what can be discharged by a facility directly into a body of water. While point source pollution originates from a specific place, it can affect miles of waterways and ocean.

Nonpoint source

Nonpoint source pollution is contamination derived from diffuse sources. These may include agricultural or stormwater runoff or debris blown into waterways from land. Nonpoint source pollution is the leading cause of water pollution in U.S. waters, but it's difficult to regulate, since there's no single, identifiable culprit.

Transboundary

It goes without saying that water pollution can't be contained by a line on a map. Transboundary pollution is the result of contaminated water from one country spilling into the waters of another. Contamination can result from a disaster—like an oil spill—or the slow, downriver creep of industrial, agricultural, or municipal discharge.

What Are the Effects of Water Pollution?

On human health

To put it bluntly: Water pollution kills. In fact, it caused 1.8 million deaths in 2015, according to a study published in *The Lancet*. Contaminated water can also make you ill. Every year, unsafe water sickens about 1 billion people. And low-income communities are disproportionately at risk because their homes are often closest to the most polluting industries.

Waterborne pathogens, in the form of disease-causing bacteria and viruses from human and animal waste, are a major cause of illness from contaminated drinking water. Diseases spread by unsafe water include cholera, giardia, and typhoid. Even in wealthy nations, accidental or illegal releases from sewage treatment facilities, as well as runoff from farms and urban areas, contribute harmful pathogens to waterways. Thousands of people across the United States are sickened every year by Legionnaires' disease (a severe form of pneumonia contracted from water sources like cooling towers and piped water), with cases cropping up from California's Disneyland to Manhattan's Upper East Side.

Meanwhile, the plight of residents in Flint, Michigan—where cost-cutting measures and aging water infrastructure created the recent lead contamination crisis—offers a stark look at how dangerous chemical and other industrial pollutants in our water can be. The problem goes far beyond Flint and involves much more than lead, as a wide range of chemical pollutants—from heavy metals such as arsenic and mercury to pesticides and nitrate fertilizers—are getting into our water supplies. Once they're ingested, these toxins can cause a host of health issues, from cancer to hormone disruption to altered brain function. Children and pregnant women are particularly at risk.

Even swimming can pose a risk. Every year, 3.5 million Americans contract health issues such as skin rashes, pinkeye, respiratory infections, and hepatitis from sewage-laden coastal waters, according to EPA estimates.

What Can You Do to Prevent Water Pollution?

With your actions

It's easy to tsk-tsk the oil company with a leaking tanker, but we're all accountable to some degree for today's water pollution problem. Fortunately, there are some simple ways you can prevent water contamination or at least limit your contribution to it:

- Reduce your plastic consumption and reuse or recycle plastic when you can.
- Properly dispose of chemical cleaners, oils, and non-biodegradable items to keep them from ending up down the drain.
- Maintain your car so it doesn't leak oil, antifreeze, or coolant.
- If you have a yard, consider landscaping that reduces runoff and avoid applying pesticides and herbicides.
- If you have a pup, be sure to pick up its poop.

Solid Waste Management?

Solid waste management is a term that is used to refer to the process of collecting and treating solid wastes. It also offers solutions for traveling items that do not belong to garbage or trash. As long as people have been living in settlements and residential areas, garbage or solid waste has been an issue. Waste management is all about how solid waste can be changed and used as a valuable resource. Solid waste management should be embraced by each and every household including the business owners across the world. Industrialization has brought a lot of good things and bad things as well. One of the negative effects of industrialization is the creation of solid waste.

According to Britannica, *"Solid-waste management, the collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful. Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and to outbreaks of vector-borne disease—that is, diseases spread by rodents and insects."*

Various Sources of Solid Waste

Everyday, tonnes of solid waste is disposed off at various landfill sites. This waste comes from homes, offices, industries and various other agricultural related activities. These landfill sites produce foul smell if waste is not stored and treated properly. It can pollute the surrounding air and can seriously affect the health of humans, wildlife and our environment. The following are major sources of solid waste:

Residential

Residences and homes where people live are some of the major sources of solid waste. Garbage from these places include food wastes, plastics, paper, glass, leather, cardboard, metals, yard wastes, ashes and special wastes like bulky household items like electronics, tires, batteries, old mattresses and used oil. Most homes have garbage bins where they can throw away their solid wastes in and later the bin is emptied by a garbage collecting firm or person for treatment.

Industrial

Industries are known to be one of the biggest contributors of solid waste. They include light and heavy manufacturing industries, construction sites, fabrication plants, canning plants, power and chemical plants. These industries produce solid waste in form of housekeeping wastes, food wastes, packaging wastes, ashes, construction and demolition materials, special wastes, medical wastes as well as other hazardous wastes.

Commercial

Commercial facilities and buildings are yet another source of solid waste today. Commercial buildings and facilities in this case refer to hotels, markets, restaurants, go downs, stores and office buildings. Some of the solid wastes generated from these places include plastics, food wastes, metals, paper, glass, wood, cardboard materials, special wastes and other hazardous wastes.

Institutional

The institutional centers like schools, colleges, prisons, military barracks and other government centers also produce solid waste. Some of the common solid wastes obtained from these places include glass, rubber wast plastics, food wastes, wood, paper, metals, cardboard materials, electronics as well as various hazardous wastes.

Construction and Demolition Areas

Construction sites and demolition sites also contribute to the solid waste problem. Construction sites include new construction sites for buildings and roads, road repair sites, building renovation sites and building demolition sites. Some of the solid wastes produced in these places include steel materials, concrete, wood, plastics, rubber, copper wires, dirt and glass.

Municipal services The urban centers also contribute immensely to the solid waste crisis in most countries today. Some of the solid waste brought about by the municipal services include, street cleaning, wastes from parks and beaches, wastewater treatment plants, landscaping wastes and wastes from recreational areas including sludge.

Treatment Plants and Sites Heavy and light manufacturing plants also produce solid waste. They include refineries, power plants, processing plants, mineral extraction plants and chemicals plants. Among the wastes

erated by these plants include, industrial process wastes, unwanted specification products, plastics, metal ste just to mention but a few.

griculture Crop farms, orchards, dairies, vineyards and feedlots are also sources of solid wastes. Among the stes they produce include agricultural wastes, spoiled food, pesticide containers and other hazardous aterials.

iomedical This refers to hospitals and biomedical equipment and chemical manufacturing firms. In hospitals ere are different types of solid wastes produced. Some of these solid wastes include syringes, bandages, used oves, drugs, paper, plastics, food wastes and chemicals. All these require proper disposal or else they will ause a huge problem to the environment and the people in these facilities.

ffects of Poor Solid Waste Management

ue to improper waste disposal systems particularly by municipal waste management teams, wastes heap up nd become a problem. People clean their homes and places of work and litter their surroundings which affects he environment and the community.

his type of dumping of waste materials forces biodegradable materials to rot and decompose under improper, nhygienic and uncontrolled conditions. After a few days of decomposition, a foul smell is produced and it ecomes a breeding ground for different types of disease causing insects as well as infectious organisms. n top of that, it also spoils the aesthetic value of the area.

Solid wastes from industries are a source of toxic metals, hazardous wastes, and chemicals. When released to the environment, the solid wastes can cause biological and physicochemical problems to the environment and may affect or alter the productivity of the soils in that particular area.

What is global warming?

A: Here's a simple definition of global warming. (And yes, it's really happening.) Over the past 50 years, the average global temperature has increased at the fastest rate in recorded history. And experts see the trend is accelerating: All but one of the 16 hottest years in NASA's 134-year record have occurred since 2000.

Climate change deniers have argued that there has been a "pause" or a "slowdown" in rising global temperatures, but several recent studies, including a 2015 paper published in the journal Science, have disproved this claim. And scientists say that unless we curb global-warming emissions, average U.S. temperatures could increase by up to 10 degrees Fahrenheit over the next century.

What causes global warming?

A: Global warming occurs when carbon dioxide (CO_2) and other air pollutants and greenhouse gases collect in the atmosphere and absorb sunlight and solar radiation that have bounced off the earth's surface. Normally, this radiation would escape into space—but these pollutants, which can last for years to centuries in the atmosphere, trap the heat and cause the planet to get hotter. That's what's known as the greenhouse effect.

In the United States, the burning of fossil fuels to make electricity is the largest source of heat-trapping pollution, producing about two billion tons of CO_2 every year. Coal-burning power plants are by far the biggest polluters. The country's second-largest source of carbon pollution is the transportation sector, which generates about 1.7 billion tons of CO_2 emissions a year.

Curbing dangerous climate change requires very deep cuts in emissions, as well as the use of alternatives to fossil fuels worldwide. The good news is that we've started a turnaround: CO_2 emissions in the United States actually decreased from 2005 to 2014, thanks in part to new, energy-efficient technology and the use of cleaner fuels. And scientists continue to develop new ways to modernize power plants, generate cleaner electricity, and burn less gasoline while we drive. The challenge is to be sure these solutions are put to use and widely adopted.

: How is global warming linked to extreme weather?

A: Scientists agree that the earth's rising temperatures are fueling longer and hotter heat waves, more frequent droughts, heavier rainfall, and more powerful hurricanes. In 2015, for example, scientists said that an ongoing drought in California—the state's worst water shortage in 1,200 years—had been intensified by 15 percent to 20 percent by global warming. They also said the odds of similar droughts happening in the future had roughly doubled over the past century. And

in 2016, the National Academies of Science, Engineering, and Medicine announced that it's now possible to confidently attribute certain weather events, like some heat waves, directly to climate change.

The earth's ocean temperatures are getting warmer, too—which means that tropical storms can pick up more energy. So global warming could turn, say, a category 3 storm into a more dangerous category 4 storm. In fact, scientists have found that the frequency of North Atlantic hurricanes has increased since the early 1980s, as well as the number of storms that reach categories 4 and 5. In 2005, Hurricane Katrina—the costliest hurricane in U.S. history—struck New Orleans; the second-costliest, Hurricane Sandy, hit the East Coast in 2012.

The impacts of global warming are being felt across the globe. Extreme heat waves have caused tens of thousands of deaths around the world in recent years. And in an alarming sign of events to come, Antarctica has been losing about 134 billion metric tons of ice per year since 2002. This rate could speed up if we keep burning fossil fuels at our current pace, some experts say, causing sea levels to rise several meters over the next 50 to 150 years.

Ozone depletion and its causes

The atmosphere extends a few hundred kilometres above the Earth. It is made of layers that surround the Earth like rings. However, 99% of its total mass lies in two regions within the first 50 kilometres above the Earth's surface. These two regions are called the troposphere and the stratosphere. The troposphere is closest to the Earth. It extends to about 6 to 17 kilometres above the Earth's surface and is thickest at the equator. The stratosphere extends out, beyond the troposphere, to about 50 kilometres above the Earth. The furthest layer, the mesosphere, is found roughly 50 km to 80 km above sea level.

Ozone depletion is the term commonly used to describe the thinning of the ozone layer in the stratosphere. Ozone depletion occurs when the natural balance between the production and destruction of ozone in the stratosphere is tipped in favor of destruction. Human activity is the major factor in tipping that natural balance, mostly from releasing artificial chemicals, known as ozone-depleting substances (ODS), to the atmosphere. These are stable substances that do not break down in the lower atmosphere and contain either/both chlorine and/or bromine.

The theory about ozone depletion was first put forward in 1974 by American scientists Mario Molina and F. Sherwood Rowland. They were concerned about the impact of CFCs on the ozone layer. Their hypothesis was met with a great deal of skepticism, but scientific work over the next 20 years proved them correct and prompted almost every country in the world to action. In 1995, Drs. Molina and

Rowland were given a Nobel Prize in Chemistry, along with a third ozone researcher, Paul Crutzen from the Netherlands.

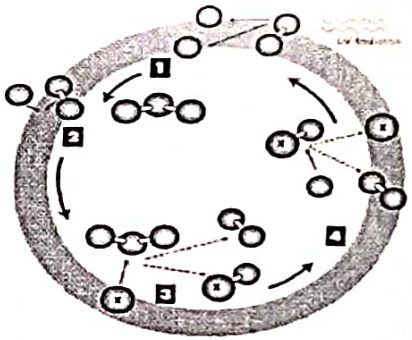
Ozone-depleting substances containing chlorine include chlorofluorocarbons (CFCs), carbon tetrachloride, methyl chloroform and hydrochlorofluorocarbons (HCFCs). Halons, methyl bromide and hydrobromofluorocarbons (HBFCs) are ODSs that contain bromine.

The best-known and most abundant of the ODS are the CFCs. A single atom of chlorine from a CFC can destroy 100,000 or more molecules of ozone. Ozone depletion only stops when the chlorine randomly reacts with another molecule to form a long-lived, stable substance. At that point, it is no longer free to react with ozone.

Find Out About...

- Ozone-depleting substances

While it is true that volcanoes and oceans release large amounts of chlorine, the chlorine from these sources dissolves in water so it washes out of the lower atmosphere in rain. Volcanoes may, in worst-case scenarios, cause temporary ozone loss.



The natural cycle of ozone production and destruction in the stratosphere

1. *O_2 is split into 2 atoms.*
2. *Oxygen atoms attach themselves to oxygen molecules to form ozone.*
3. *Trace substance X destroys ozone, releasing an oxygen molecule.*
4. *Trace substance X released to destroy more ozone molecules.*

Status of ozone depletion

Ozone measurements fluctuate from day to day, season to season and one year to the next. Ozone concentrations are normally higher in the spring and lowest in the fall. In spite of these fluctuations, scientists have determined, based on data collected since the 1950's, that ozone levels were relatively stable until the late 1970's. Observations of an Antarctic ozone "hole"[1] and

atmospheric records indicating seasonal declines in global ozone levels provide strong evidence that global ozone depletion is occurring.

Severe depletion over the Antarctic has been occurring since 1979 and a general downturn in global ozone levels has been observed since the early 1980's. The ozone hole over the Antarctic reached record proportions in the spring of 2000 at 28.3 million square kilometres and vertical profiles from stations near the South Pole showed complete ozone destruction in the lower stratosphere. Ozone decreases of as much as 70% have been observed on a few days.

Severe ozone depletion was also measured over the Arctic. Lowest values over the Arctic occurred in 2000 north of Sweden, with about 60% depletion in some layers of the atmosphere. In addition to the Earth's poles, ozone depletion now affects almost all of North America, Europe, Russia, Australia, New Zealand, and a sizable part of South America. However, smaller decreases in stratospheric ozone have been observed in mid-latitude regions of the world.

The ozone layer over southern Canada has thinned by an average of about 7% since the 1980s. In the late 1990s, average ozone depletion in the summer over Canada was between 3% and 7%. Ozone depletion in Canada is usually greatest in the late winter and early spring. In 1993, for example, average ozone values over Canada were 14% below normal from January to April.

In their assessment of ozone depletion in 2006, the Scientific Assessment Panel, a group of experts established under the Montreal Protocol, made the following key findings:

1. The total abundances of human-made ozone-depleting gases in the troposphere continue to decline from the peak values reached in the 1992-1994 time period.
2. The total abundances of human-made ozone-depleting gases in the stratosphere show a downward trend from their peak values of the late 1990s.
3. Large Antarctic ozone holes continue to occur. The severity of Antarctic ozone depletion has not continued to increase since the late 1990s and, since 2000, ozone levels have been higher than in some preceding years.
4. Arctic ozone depletion shows large year-to-year variability, driven by meteorological conditions. Over the past four decades, these conditions contributed to severe ozone depletion.
5. The decline in stratospheric ozone over mid-latitude (between 60°S and 60°N) seen in the 1990s has not continued.

Recovery of the ozone layer

No one knows for certain how much more ozone depletion will occur. There is a substantial time lag between the time when ODS emissions begin to decline and the point at which the ozone layer begins to recover. It takes years for CFCs and other ozone-depleting compounds to reach the stratosphere. Many of them can persist in the stratosphere for centuries; some have life spans of 25 to 400 years. Almost all of the CFCs and halons ever released are still in the atmosphere and will continue to destroy ozone for many years to come.

In spite of these uncertainties and substantial time lag, the natural balance between ozone creation and destruction can be restored if concentrations of ozone-destroying chemicals are reduced. However, this might require the complete elimination of ozone-destroying chemicals. In addition, there is some concern that the increase in greenhouse gas concentrations may result in delayed ozone layer recovery. Scientists estimate that they will not be able to measure any recovery until 2030.

It is important to note that scientific knowledge of the atmosphere and the processes that deplete the ozone layer is not complete. The sudden and unexpected appearance of the Antarctic ozone

hole reveals that the ozone layer does not respond predictably to the quantities of industrial chemicals we are dumping into it.

[1] The term ozone "hole" refers to a large and rapid decrease in the abundance of ozone molecules, not the complete absence of them. The Antarctic ozone "hole" occurs during the southern spring between September and November.

Fire works

This section provides information about the safe and legal use of fireworks in the community, including planning a fireworks display, on locating a licensed fireworks contractor, a list of upcoming fireworks displays (Opens in new window) and the dangers of illegal fireworks.

Types of fireworks

Categories of fireworks include unrestricted fireworks, display fireworks, close proximity fireworks, special effects fireworks and strings of firecrackers. Fireworks that were once used by Queenslanders on 'cracker night' have been prohibited since 1972.

Unrestricted fireworks

- may be bought by the general public through retail outlets
- include sparklers, bonbons, streamer cones and caps for toy guns
- do not require a licence.

Display fireworks

- are intended for use in outdoor public displays such as fetes, shows and other major events and include:
  - **strings of crackers** used during Chinese New Year celebrations
  - **ground level fireworks** which primarily function from ground level and may project burning stars and other effects (e.g. mines, roman candles and fountains)
  - **aerial fireworks** designed to be fired from a mortar into the air where they burst (e.g. star shells and salute shells).
- may only be used by licensed professionals.

Close proximity fireworks

- are used in venues such as theatres or concert halls
- may only be used by licensed professionals.

Special effects fireworks

- are designed to produce a specific effect (e.g. a flash, sound or smoke for theatrical productions)

may only be used by licensed professionals. Fireworks can only be bought, stored, transported and used by trained and licensed professionals. It has been illegal since 1972 for the general public in Queensland to possess or use fireworks.

Effects of fireworks on people, animals and property

Illegally sold fireworks are usually cheap imports of low quality—with high danger to unsuspecting, untrained and unauthorised buyers.

Illegal fireworks have caused serious injuries to children, adults, animals and property. You should be extremely wary of illegal supplies and avoid any areas where they are being used.

Possession of fireworks by unlicensed persons can incur a penalty of $53,380 and 6 months imprisonment.

If you are responsible for the loss or injury of an animal through your illegal use of fireworks, you may be held liable and accountable.

Information on illegal fireworks activities should be reported to the Explosives Inspectorate or to the police.

Always hire a trained and licensed professional for fireworks displays. Refer to the list of fireworks contractors.

- Illegal use of fireworks can be dangerous to you and to others and is a public nuisance.
- People who use fireworks carelessly, or without knowing what they're doing can be killed or maimed. They can also kill or maim others.
- Fireworks can burn down houses, damage entertainment venues such as nightclubs, frighten children and adults, cause bushfires, and terrify pets and wildlife.
- Noise from fireworks can cause distress, especially as fireworks can sound like gunfire. The noise can also cause tinnitus and deafness, or aggravate a nervous condition.
- People who suffer from asthma can experience discomfort and epileptics can experience seizures following fireworks displays.
- When frightened by fireworks, horses and dogs have been known to injure themselves and others by running away, potentially causing accidents and damage to property.
- For these reasons, animal owners who have been advised of an authorised fireworks display are urged to keep their dogs, cats and other pets inside the house, so that the animals are safe and can't run away. Horse owners should take steps to protect their animals.
- A calming shirt can help relieve a dog's anxiety relating to fireworks, thunderstorms and gunshots. To find out more about these products, search the web for 'dog calming shirt' or 'dog anxiety treatment'.

Penalties

- Illegal use of fireworks is an offence and carries a penalty. **The maximum penalty is $52,250 or 6 months imprisonment.**
- Also, if you are responsible for the loss or injury of an expensive animal through your illegal use of fireworks, you may be sued for damages.

Planning a fireworks display

Fireworks have been entertaining crowds for over a thousand years. Today, spectacular displa still provide excitement and attraction that few can resist.

Over the years, manufacturers of fireworks have created new colours, sounds and many new effects.

Whether on land or water, at the football or showgrounds, on New Year's Eve or any other da a well-run fireworks display adds excitement to any event.

A fireworks display takes careful planning. There are different types of fireworks displays including strings of firecrackers, outdoor fireworks, close proximity fireworks and special effects. This information will help organisers and hosts hold a successful and legal fireworks display.

Download the brochure: Planning a fireworks display: Keeping our community safe and secur

Fireworks regulations

Fireworks contain explosive compositions that burn and/or explode when ignited. These hazar must be controlled to ensure the safety of the fireworks operators and crowds enjoying the displays. Fireworks are controlled under the *Explosives Act 1999* and the Explosives Regulatio 2017.

Only licensed fireworks contractors may put on fireworks displays. Fireworks contractors and operators must be trained to use fireworks and operate to national standards for firework displays.

Possessing fireworks (other than unrestricted items such as sparklers, bonbons, streamer cones caps for toy pistols) if you are unlicensed is illegal and carries a **penalty of up to $53,380** or 6 **months imprisonment.**

Duty of care with fireworks displays

Any person involved with a fireworks display has a duty of care under Section 32 of the *Explosives Act 1999* which states: 'A person who is doing an act involving explosives must take reasonable precautions and use reasonable care to avoid endangering any person's safety, health or property.'

The three main entities who need to carefully consider their safety obligations and responsibilities for a fireworks display are:

- **event organiser or display host:** the person, organisation, or other party that engages a fireworks contractor to hold a fireworks display
- **fireworks contractor:** the licensed person contracted to plan and organise the display, purchase fireworks and ensure the display is conducted safely by competent fireworks operators, assistants and other personnel

- **fireworks operator:** the person licensed under the *Explosives Act 1999* who is responsible for, or is in charge of, setting up and firing fireworks in accordance with the Queensland code of practice: Control of outdoor fireworks displays.

Disaster Management

- Disaster, as defined by the United Nations, is a serious disruption of the functioning of a community or society, which involve widespread human, material, economic or environmental impacts that exceed the ability of the affected community or society to cope using its own resources [1]. Disaster management is how we deal with the human, material, economic or environmental impacts of said disaster, it is the process of how we "prepare for, respond to and learn from the effects of major failures" [2]. Though often caused by nature, disasters can have human origins. According to the International Federation of Red Cross & Red Crescent Societies a disaster occurs when a hazard impacts on vulnerable people. The combination of hazards, vulnerability and inability to reduce the potential negative consequences of risk results in disaster [3].

- (VULNERABILITY+ HAZARD) / CAPACITY = DISASTER [2]

- Natural disasters and armed conflict have marked human existence throughout history and have always caused peaks in mortality and morbidity. This article examines the advances in the humanitarian response to public health over the past fifty years and the challenges currently faced in managing natural disasters and armed conflict [4].

Types of Disaster

Flood

Floods are the most common and widespread of all natural disasters. India is one of the highly flood prone countries in the world. Around 40 million hectares of land in India is prone to floods as per National Flood Commission report. Floods cause damage to houses, industries, public utilities and property resulting in huge economic losses, apart from loss of lives. Though it is not possible to control the flood disaster totally, by adopting suitable structural and non-structural measures the flood damages can be minimised. For planning any flood management measure latest, reliable, accurate and timely information is required. In this context satellite remote sensing plays an important role.

Rescue & Evacuation

Evacuation is a pre-emptive move to protect life and property, where as rescue is a post-disaster phenomenon of helping people to move from areas that have been hit by disaster to a safer place. However, the situation of evacuation and rescue comes along with numerous unanswered queries in mind. Very often, due to lack of information or in haste, living during evacuation and rescue becomes difficult and painful. However, during such the situations, following precautionary norms should be kept in mind

Preparing for a Flood

Here are some basic steps to take to prepare for the flood:

- Contact the local geologist or town planning department or meteorology department to find out if your home is located in a flash-flood-prone area or landslide-prone area.
- Learn about your community's emergency plans, warning signals, evacuation routes, and locations of emergency shelters.
- Plan and practice a flood evacuation route with your family. Ask an out-of-state relative or friend to be the "family contact" in case your family is separated during a flood. Make sure everyone in your family knows the name, address, and phone number of this contact person.
- Post emergency phone numbers at every phone.
- Inform local authorities about any special needs, i.e., elderly or bedridden people, or anyone with a disability.
- Identify potential home hazards and know how to secure or protect them before the flood strikes. Be prepared to turn off electrical power when there is standing water, fallen power lines etc. Turn off gas and water supplies before you evacuate. Secure structurally unstable building materials.
- Buy a fire extinguisher and make sure your family knows where it is and how to use it.
- Buy and install sump pumps with back-up power.
- Have a licensed electrician to raise electric components (switches, sockets, circuit breakers and wiring) at least 12" above your home's projected flood elevation.
- For drains, toilets, and other sewer connections, install backflow valves or plugs to prevent floodwaters from entering.
- Anchor fuel tanks which can contaminate your basement if torn free. An unanchored tank outside can be swept downstream and damage other houses.

If you are under a flood watch or warning:

- Gather the emergency supplies you previously stocked in your home and stay tuned to local radio or television station for updates.
- Turn off all utilities at the main power switch and close the main gas valve if evacuation appears necessary.
- Have your immunization records handy or be aware of your last tetanus shot, in case you should receive a puncture wound or a wound becomes contaminated during or after the flood.
- Fill bathtubs, sinks and plastic soda bottles with clean water. Sanitize the sinks and tubs first by using bleach. Rinse and fill with clean water.
- Bring outdoor possessions, such as lawn furniture, grills and trash cans inside or tie them down securely.

Emergency Supplies You Will Need

You should stock your home with supplies that may be needed during the emergency period. At a minimum, these supplies should include:

- Several clean containers for water, large enough for a 3-5 day supply of water (about five gallons for each person).
- A 3-5 day supply of non-perishable food and a non-electric can opener.

- A first aid kit and manual and prescription medicines and special medical needs.
- A battery-powered radio, flashlights, and extra batteries.
- Sleeping bags or extra blankets.
- Water-purifying supplies, such as chlorine or iodine tablets or unscented, ordinary household chlorine bleach.
- Baby food and/or prepared formula, diapers, and other baby supplies.
- Disposable cleaning cloths, such as "baby wipes" for the whole family to use in case bathing facilities are not available.
- Personal hygiene supplies, such as soap, toothpaste, sanitary napkins, etc.
- An emergency kit for your car with food, flares, booster cables, maps, tools, a first aid kit, fire extinguisher, sleeping bags, etc.
- Rubber boots, sturdy shoes, and waterproof gloves.
- Insect repellent containing DEET, screens, or long-sleeved and long-legged clothing for protection from mosquitoes which may gather in pooled water remaining after the flood.

Preparing to Evacuate

Expect the need to evacuate and prepare for it. When a flood watch is issued, you should:

- Fill your vehicle's gas tank and make sure the emergency kit for your car is ready.
- If no vehicle is available, make arrangements with friends or family for transportation.
- Fill your clean water containers.
- Review your emergency plans and supplies, checking to see if any items are missing.
- Tune in the radio or television for weather updates.
- Listen for disaster sirens and warning signals.
- Put livestock and family pets in a safe area. Due to food and sanitation requirements, emergency shelters cannot accept animals.
- Adjust the thermostat on refrigerators and freezers to the coolest possible temperature.

If You Are Ordered to Evacuate

You should never ignore an evacuation order. Authorities will direct you to leave if you are in a low-lying area, or within the greatest potential path of the rising waters. If a flood warning is issued for your area or you are directed by authorities to evacuate the area, follow the below mentioned checklists:

- Take only essential items with you.
- If you have time, turn off the gas, electricity, and water.
- Disconnect appliances to prevent electrical shock when power is restored.
- Follow the designated evacuation routes and expect heavy traffic.
- Do not attempt to drive or walk across creeks or flooded roads.

If You Are Ordered NOT to Evacuate

To get through the storm in the safest possible manner:

- Monitor the radio or television for weather updates.
- Prepare to evacuate to a shelter or to a neighbour's home if your home is damaged, or if you are instructed to do so by emergency personnel

Safety and Security

Any natural calamities espouse itself with serious devastation to transportation, communica chaneel, supply of electricity etc. Hence, in the immediate aftermath of any calamity, the surrounding environment becomes dangerous and unsafe due to it's exposure to toxic and harmful objects. This becomes more important for children as they are usually overlooked b parents during the calamity or in the immediate aftermath of it. The following safety and se guidelines can be kept in mind:

EARTHQUAKES

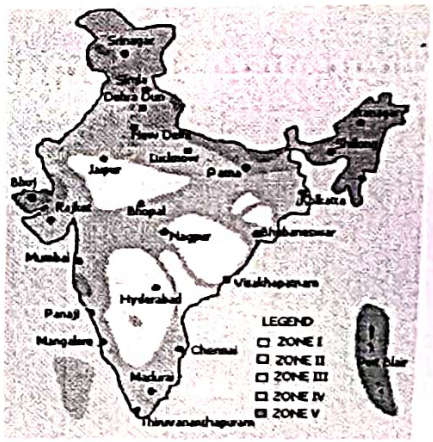
Earthquakes are the manifestations of sudden release of strain energy accumulated in the r over extensive periods of time in the upper part of the Earth.

Seismology (derived from Greek word *Seismos* meaning Earthquake and *Logos* meaning science) is the science of Earthquakes and related phenomena.

Seismograph/ Seismogram

Seismograph is an instrument that records the ground motions. Seismogram is a continuous written record of an earthquake recorded by a seismograph.

Seismic Zonation Map of India



Seismic Zonation map of a country is a guide to the seismic status of a region and its susceptibility to earthquakes. India has been divided into five zones with respect to severity of earthquakes. Of these, Zone V is seismically the most active where earthquakes of magnitude 8 or more could occur recent strong motion observations around the world have revolutionized thinking on the design of engineering structures, placing emphasis also on the characteristics of the structures themselves it should be realized that in the case of shield type earthquakes, histor data are insufficient to define zones because recurrence intervals are much longer than the

recorded human history this may often give a false sense of security. Occurrence of the damaging earthquake at Latur, falling in zone I is a typical example of this situation.

Cause of Earthquake :

The earth's crust is a rocky layer of varying thickness ranging from a depth of about 10kilometers under the sea to 65 kilometers under the continents. The crust is not one piece but consists of portions called **'plates'** which vary in size from a few hundred to thousands of kilometers. The **'theory of plate tectonics'** holds that theplates ride up on the more mobile mantle,and are driven by some yet unconfirmed mechanisms, perhaps thermal convection currents. When these plates contact each other, stress arises in the crust. These stresses can be classified according to the type of movement along the plate's boundaries:

a) pulling away from each other,
b) pushing against one another and
c) sliding sideways relative to each other.

All these movements are associated with earthquakes.The areas of stress at plate boundaries which release accumulated energy by slipping or rupturing are known as 'faults'. The theory of elasticity' says that the crustis continuously stressed by the movement of the tectonic plates; it eventually reaches a point of maximum supportable strain. A rupture then occurs along the fault and the rock rebounds under its own elastic stresses until the strain is relieved. The fault rupture generates vibration called seismic (from the Greek 'seismos' meaning shock or earthquake) waves, which radiates from the focus in all directions. The point of rupture is called the 'focus' and may be located near the surface or deep below it. The point on the surface directly above the focus is termed as the epicenter' of the earthquake

Magnitude:

It is a quantity to measure the size of an earthquake and is independent of the place of the observation.

Richter Scale:

The local magnitude is defined as the logarithm of the maximum amplitude measured in microns on a seismogram written by Wood-Anderson seismograph with free period of 0.8 second, magnification of 2,800, damping factor of 0.8 calculated to be at a distance of 100 kms. The relative size of events is calculated by comparison to a reference event of ML=0,using the formula, ML=log A-log Ao

where A is the maximum trace amplitude in micrometer recorded on a standard seismograph and Ao is a standard value which is a function of epicentral distance (Δ) in kilometers.

Classification of earthquakes	
Category	**Magnitude on Richter Scale**
Slight	Upto 4.9
Moderate	5.0 to 6.9
Great	7.0 to 7.9
Very Great	8.0 and more

Source: www.imd.gov.in

India has witnessed some of the most devastating earthquakes during the last century like the one in Kangra (1905), Bihar-Nepal (1934) and in Assam (1950). In the recent past, earthquakes have caused havoc in Uttarkashi (1991), Latur (1993), Jabalpur (1997), Chamoli (1999) and in Bhuj (2001).

On 26th January 2001, India experienced one of the worst earthquakes in recent times. Measuring 6.9 on the Richter scale, the earthquake caused incalculable damage not just to its epicenter, Bhuj but also to other towns of the district of Kutch and to about 500 villages out of the total of 900 villages. The reported damage to property in Gujarat was about Rs.21, 000crore and the number of human lives lost were about 14,000. Of these, more than 500 deaths were reported from Ahmedabad, situated at a distance of about 350 kms from Bhuj. In the same city, close to 150 multi-storied buildings crumbled down. Cities far away from the epicenter, like Surat, too reported damage to propesty.

Cyclones

Cyclones are caused by atmospheric disturbances around a low-pressure area distinguished by swift and often destructive air circulation. Cyclones are usually accompanied by violent storms and bad weather. The air circulates inward in an anticlockwise direction in the Northern hemisphere and clockwise in the Southern hemisphere. Cyclones are classified as: (i) extra tropical cyclones (also called temperate cyclones); and (ii) tropical cyclones. The word Cyclone is derived from the Greek word Cyclos meaning the coils of a snake. It was coined by Henry Peddington because the tropical storms in the Bay of Bengal and the Arabian Sea appear like coiled serpents of the sea.

Classifications

Cyclones are classified as extra tropical cyclones (also called temperate cyclones); and tropical cyclones.

The World Meteorological Organisation (WMO, 1976) uses the term 'Tropical Cyclone' to cover weather systems in which winds exceed 'Gale Force' (minimum of 34 knots or 63 kph). Tropical cyclones are the progeny of ocean and atmosphere, powered by the heat from the sea; and driven by easterly trades and temperate westerlies, high planetary winds and their own fierce energy.

In India, cyclones are classified by:

- Strength of associated winds,
- Storm surges
- Exceptional rainfall occurrences.

Extra tropical cyclones occur in temperate zones and high latitude regions, though they are known to originate in the Polar Regions.

Cyclones that develop in the regions between the Tropics of Capricorn and Cancer are called tropical cyclones. Tropical cyclones are large-scale weather systems developing over tropical or subtropical waters, where they get organized into surface wind circulation.

Worldwide terminology

Cyclones are given many names in different regions of the world – They are known as typhoons in the China Sea and Pacific Ocean, hurricanes in the West Indian islands in the Caribbean Sea and Atlantic Ocean; tornados in the Guinea lands of West Africa and southern USA.; willy-willies in north-western Australia and tropical cyclones in the Indian Ocean.

Indian Meteorological Department

The criteria below has been formulated by the Indian Meteorological Department (IMD), which classifies the low pressure systems in the Bay of Bengal and the Arabian Sea on the basis of capacity to damage, which is adopted by the WMO.

Type of Disturbances	Wind Speed in Km/h	Wind Speed in Knots
Low Pressure	Less than 31	Less than 17
Depression	31-49	17-27
Deep Depression	49-61	27-33
Cyclonic Storm	61-88	33-47
Severe Cyclonic Storm	88-117	47-63
Super Cyclone	More than 221	More than 120

1 knot - 1.85 km per hour

Cyclones are classified into five different levels on the basis of wind speed. They are further divided into the following categories according to their capacity to cause damage:-

Cyclone Category	Wind Speed in Km/h	Damage Capacity
01	120-150	Minimal
02	150-180	Moderate
03	180-210	Extensive
04	210-250	Extreme
05	250 and above	Catastrophic

Storm surges (tidal waves) are defined as the rise in sea level above the normally predicted astronomical tide. Major factors include:

- A fall in the atmospheric pressure over the sea surface
- Effect of the wind
- Influence of the sea bed
- A funnelling effect
- The angle and speed at which the storm approaches the coast
- The tides

The very high specific humidity condenses into exceptionally large raindrops and giant cumulu clouds, resulting in high precipitation rates. When a cyclone makes landfall, rain rapidly saturates the catchment areas and the rapid runoff may extensively flood the usual water source or create new ones.

How Cyclones are formed

The development cycle of tropical cyclones may be divided into three stages:

Formation and Initial Development Stage

The formation and initial development of a cyclonic storm depends upon various conditions. These are:

- A warm sea (a temperature in excess of 26 degrees Celsius to a depth of 60 m) with abundant and turbulent transfer of water vapour to the overlying atmosphere by evaporation.
- Atmospheric instability encouraging formation of massive vertical cumulus clouds due to convection with condensation of rising air above ocean surface.

Mature Tropical Cyclones

When a tropical storm intensifies, the air rises in vigorous thunderstorms and tends to spread o horizontally at the tropopause level. Once air spreads out, a positive perturbation pressure at hi levels is produced, which accelerates the downward motion of air due to convection. With the inducement of subsidence, air warms up by compression and a warm 'Eye' is generated. Generally, the 'Eye' of the storms has three basic shapes: *(i)* circular; *(ii)* concentric; and *(iii)* elliptical. The main physical feature of a mature tropical cyclone in the Indian Ocean i a concentric pattern of highly turbulent giant cumulus thundercloud bands.

Modification and Decay

A tropical cyclone begins to weaken in terms of its central low pressure, internal warmth and extremely high speeds, as soon as its source of warm moist air begins to ebb, or is abruptly cut off. This happens after its landfall or when it passes over cold waters. The weakening of a cyclone does not mean that the danger to life and property is over.

Indian Context

The Indian subcontinent is one of the worst affected regions in the world. The subcontinent with a long coastline of 8041 kilometres is exposed to nearly 10 per cent of the world's tropical cyclones. Of these, the majority of them have their initial genesis over the Bay of Bengal and strike the East coast of India. On an average, five to six tropical cyclones form every year, of which two or three could be severe. More cyclones occur in the Bay of Bengal than the Arabian Sea and the ratio is approximately 4:1. Cyclones occur frequently on both the coasts (the West coast - Arabian Sea; and the East coast - Bay of Bengal). An analysis of the frequency of cyclones on the East and West coasts of India between 1891 and 1990 shows that nearly 262 cyclones occurred (92 of these severe) in a 50 km wide strip above the East coast. Less severe cyclonic activity has been noticed on the West coast, where 33 cyclones occurred the same period, out of which 19 of were severe.

Tropical cyclones occur in the months of May-June and October-November. Cyclones of severe intensity and frequency in the North Indian Ocean are bi-modal in character, with their primary peak in November and secondary peak in May. The disaster potential is particularly high during landfall in the North Indian Ocean (Bay of Bengal and the Arabian Sea) due to the accompanying destructive wind, storm surges and torrential rainfall. Of these, storm surges cause the most damage as sea water inundates low lying areas of coastal regions and causes heavy floods, erodes beaches and embankments, destroys vegetation and reduces soil fertility.

Cyclones vary in diameter from 50 to 320 km but their effects dominate thousands of square kilometers of ocean surface and the lower atmosphere. The perimeter may measure 1,000 km but the powerhouse is located within the 100-km radius. Nearer the Eye, winds may hit at a speed of 320 km. Thus, tropical cyclones, characterized by destructive winds, torrential rainfall and storm surges disrupt normal life with the accompanying phenomena of floods due to the exceptional level of rainfall and storm surge inundation into inland areas. Cyclones are characterized by their devastating potential to damage structures, viz. houses; lifeline infrastructure-power and communication towers; hospitals; food storage facilities; roads, bridges and culverts; cropss etc. The most fatalities come from storm surges and the torrential rain flooding the lowland areas of coastal territories.

India: Environment Laws In India

The need for protection and conservation of environment and sustainable use of natural resources is reflected in the constitutional framework of India and also in the international commitments of India. The Constitution under Part IVA (Art 51A-Fundamental Duties) casts a duty on every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures. Further, the Constitution of India under Part IV (Art 48A-Directive Principles of State Policies) stipulates that the State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country.

Several environment protection legislations existed even before Independence of India. However, the true thrust for putting in force a well-developed framework came only after the UN Conference on the Human Environment (Stockholm, 1972). After the Stockholm Conference, the National Council for Environmental Policy and Planning was set up in 1972 within the Department of Science and Technology to establish a regulatory body to look after the environment-related issues. This Council later evolved into a full-fledged Ministry of Environment and Forests (MoEF).

MoEF was established in 1985, which today is the apex administrative body in the country for regulating and ensuring environmental protection and lays down the legal and regulatory framework for the same. Since the 1970s, a number of environment legislations have been put in place. The MoEF and the pollution control boards ("CPCB", ie, Central Pollution Control Board and "SPCBs", ie, State Pollution Control Boards) together form the regulatory and administrative core of the sector.

Some of the important legislations for environment protection are as follows:

- The National Green Tribunal Act, 2010
- The Air (Prevention and Control of Pollution) Act, 1981
- The Water (Prevention and Control of Pollution) Act, 1974
- The Environment Protection Act, 1986
- The Hazardous Waste Management Regulations, etc.

These important environment legislations have been briefly explained in the succeeding paragraphs.

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The National Green Tribunal Act, 2010

The National Green Tribunal Act, 2010 (No. 19 of 2010) (NGT Act) has been enacted with the objectives to provide for establishment of a National Green Tribunal (NGT) for the effective and expeditious disposal of cases relating to environment protection and conservation of forests and other natural resources including enforcement of any legal right relating to environment and giving relief and compensation for damages to persons and property and for matters connected therewith or incidental thereto.

The Act received the assent of the President of India on June 2, 2010, and was enforced by the Central Government *vide* Notification no. S.O. 2569(E) dated October 18, 2010, with effect from October 18, 2010. The Act envisages establishment of NGT in order to deal with all environmental laws relating to air and water pollution, the Environment Protection Act, the Forest Conservation Act and the Biodiversity Act as have been set out in Schedule I of the NGT Act.

Consequent to enforcement of the National Green Tribunal Act, 2010, the National Environment Tribunal Act, 1995 and the National Environment Appellate Authority Act, 1997 stand repealed. The National Environment Appellate Authority established under s 3(1) of the National Environment Appellate Authority Act, 1997stands dissolved, in view of the establishment of the National Green Tribunal under the National Green Tribunal Act, 2010 *vide* Notification no. S.O. 2570(E) dated October 18, 2010.

The Air (Prevention and Control of Pollution) Act, 1981

The Air (Prevention and Control of Pollution) Act, 1981 (the "Air Act") is an act to provide for the prevention, control and abatement of air pollution and for the establishment of Boards at the Central and State levels with a view to carrying out the aforesaid purposes.

To counter the problems associated with air pollution, ambient air quality standards were established under the Air Act. The Air Act seeks to combat air pollution by prohibiting the use of polluting fuels and substances, as well as by regulating appliances that give rise to air pollution. The Air Act empowers the State Government, after consultation with the SPCBs, to declare any area or areas within the Sate as air pollution control area or areas. Under the Act, establishing or operating any industrial plant in the pollution control area requires consent from SPCBs. SPCBs are also expected to test the air in air pollution control areas, inspect pollution control equipment, and manufacturing processes.

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

The Water Prevention and Control of Pollution Act, 1974 (the "Water Act") has been enacted to provide for the prevention and control of water pollution and to maintain or restore wholesomeness of water in the country. It further provides for the establishment of Boards for the prevention and control of water pollution with a view to carry out the aforesaid purposes. The Water Act prohibits the discharge of pollutants into water bodies beyond a given standard, and lays down penalties for non-compliance. At the Centre, the Water Act has set up the CPCB which lays down standards for the prevention and control of water pollution. At the State level, SPCBs function under the direction of the CPCB and the State Government.

Further, the Water (Prevention and Control of Pollution) Cess Act was enacted in 1977 to provide for the levy and collection of a cess on water consumed by persons operating and carrying on certain types of industrial activities. This cess is collected with a view to augment the resources of the Central Board and the State Boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974. The Act was last amended in 2003.

The Environment Protection Act, 1986

The Environment Protection Act, 1986 (the "Environment Act") provides for the protection and improvement of environment. The Environment Protection Act establishes the framework for studying, planning and implementing long-term requirements of environmental safety and laying down a system of speedy and adequate response to situations threatening the environment. It is an umbrella legislation designed to provide a framework for the coordination of central and state authorities established under the Water Act, 1974 and the Air Act. The term "environment" is understood in a very wide term under s 2(a) of the Environment Act. It includes water, air and land as well as the interrelationship which exists between water, air and land, and human beings, other living creatures, plants, micro-organisms and property.

Under the Environment Act, the Central Government is empowered to take measures necessary to protect and improve the quality of environment by setting standards for emissions and discharges of pollution in the atmosphere by any person carrying on an industry or activity; regulating the location of industries; management of hazardous wastes, and protection of public health and welfare. From time to time, the Central Government issues notifications under the Environment Act for the protection of ecologically-sensitive areas or issues guidelines for matters under the Environment Act.

In case of any non-compliance or contravention of the Environment Act, or of the rules or directions under the said Act, the violator will be punishable with imprisonment up to five years or with fine up to Rs 1,00,000, or with both. In case of continuation of such violation, an additional fine of up to Rs 5,000 for every day during which such failure or contravention continues after the conviction for the first such failure or contravention, will be levied. Further, if the violation continues beyond a period of one year after the date of conviction, the offender shall be punishable with imprisonment for a term which may extend to seven years.

Hazardous Wastes Management Regulations

Hazardous waste means any waste which, by reason of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics, causes danger or is likely to cause danger to health or environment, whether alone or when in contact with other wastes or substances.

There are several legislations that directly or indirectly deal with hazardous waste management. The relevant legislations are the Factories Act, 1948, the Public Liability Insurance Act, 1991, the National Environment Tribunal Act, 1995 and rules and notifications under the Environmental Act. Some of the rules dealing with hazardous waste management are discussed below:

- **Hazardous Wastes (Management, Handling and Transboundary) Rules, 2008,** brought out a guide for manufacture, storage and import of hazardous chemicals and for management of hazardous wastes.
- **Biomedical Waste (Management and Handling) Rules, 1998,** were formulated along parallel lines, for proper disposal, segregation, transport, etc, of infectious wastes.
- **Municipal Solid Wastes (Management and Handling) Rules, 2000,** aim at enabling municipalities to dispose municipal solid waste in a scientific manner.

In view of the short-comings and overlapping of some categories causing inconvenience in implementation of the Biomedical Waste (Management and Handling) Rules, 1998 as well as t Municipal Solid Wastes (Management and Handling) Rules, 2000, the Ministry of Environmen Forest and Climate Change has formulated the draft Bio-Medical Waste (Management & Handling) Rules, 2015 (Draft BMW Rules) and the draft Solid Waste Management Rules, 201 (Draft SWM Rules) and sought comments on the draft Rules.

The Draft BMW Rules are to replace the Biomedical Waste (Management and Handling) Rule 1998, and the Draft SWM Rules are to replace the Municipal Solid Waste (Management and Handling) Rules, 2000. The objective of the Draft BMW Rules is to enable the prescribed authorities to implement the rules more effectively, thereby, reducing the bio- medical waste generation and also for its proper treatment and disposal and to ensure environmentally sound management of these wastes, and the Draft SWM Rules aim at dealing with the management o solid waste including it segregation at source, transportation of waste, treatment and final disposal.

- **E - Waste (Management and Handling) Rules, 2011** have been notified on May 1, 2011 and came into effect from May 1, 2012, with primary objective to reduce the use o hazardous substances in electrical and electronic equipment by specifying threshold for use of hazardous material and to channelize the e-waste generated in the country for environmentally sound recycling. The Rules apply to every producer, consumer or bulk consumer, collection centre, dismantler and recycler of e-waste involved in the manufacture, sale, purchase and processing of electrical and electronic equipment or components as detailed in the Rules.
- **Batteries (Management & Handling) Rules, 2001** deal with the proper and effective management and handling of lead acid batteries waste. The Act requires all manufacturers, assemblers, re-conditioners, importers, dealers, auctioneers, bulk consumers, consumers, involved in manufacture, processing, sale, purchase and use of batteries or components thereof, to comply with the provisions of Batteries (Managemen & Handling) Rules, 2001.

Human Rights and Slavery

What are Human Rights?

Human rights are rights inherent to all human beings, regardless of gender, nationality, place of residency, sex, ethnicity, religion, color or and other categorization. Thus, human rights are non-discriminatory, meaning that all human beings are entitled to them and cannot be excluded from

them. Of course, while all human beings are entitled to human rights, not all human beings experience them equally throughout the world. Many governments and individuals ignore human rights and grossly exploit other human beings.

There are a variety of human rights, including:

Civil rights (such as the rights to life, liberty and security),
Political rights (like rights to the protection of the law and equality before the law),
Economic rights (including rights to work, to own property and to receive equal pay),
Social rights (like rights to education and consenting marriages),
Cultural rights (including the right to freely participate in their cultural community), and
Collective rights (like the right to self-determination).

Slavery is a Violation of Human Rights

Slavery, forced labor and human trafficking are violations of human rights because these acts strip human beings of their inherent rights. In fact, the Universal Declaration of Human Rights explicitly references slavery, stating in Article 4: No one shall be held in slavery or servitude; slavery and the slave trade shall be prohibited in all their forms.

Slavers and human traffickers grossly violate human rights since they claim ownership, labor and/or the humanity of another human being. The human rights most relevant to trafficking are:

- The prohibition of discrimination on the basis of race, color, sex, language, religion, political or other opinion, national or social origin, property, birth, or other status;
- The right to life;
- The right to liberty and security;
- The right not to be submitted to slavery, servitude, forced labor or bonded labor;
- The right not to be subjected to torture and/or cruel, inhuman, degrading treatment or punishment;
- The right to be free from gendered violence;
- The right to freedom of association;
- The right to freedom of movement;
- The right to the highest attainable standard of physical and mental health;
- The right to just and favorable conditions of work;
- The right to an adequate standard of living;
- The right to social security; and
- The right of children to special protection.

Human Rights for Women and Girls

Many organizations and governments worldwide focus on improving the status of women and girls. According to the International Labour Organization, 11.4 million women and girls are victims of forced labor in different forms – including debt bondage, trafficking and forced prostitution. As

global leaders seek to improve the status of women and girls, it's critical to focus on decreasing women and girls' exploitation in forced labor, trafficking and slavery.

When women and girls are enslaved or trafficked, they do not have access to programs aimed at women's equality and development.

- Trafficked and enslaved women and girls oftentimes do not attend school. Many times these women and girls are illiterate.
- Trafficked and enslaved women and girls face gross sexual violence, whether in forced prostitution, forced marriage or during forced physical labor.
- Trafficked and enslaved women and girls are subject to domestic violence.
- Trafficked and enslaved women and girls do not have access to reproductive and maternal health. The physical and sexual abuse of their exploitation leads to many early pregnancies, forced abortions and exposure to HIV and other diseases.
- Trafficked and enslaved women and girls do not have access to healthcare.
- Trafficked and enslaved women and girls often face critical malnutrition.
- Trafficked and enslaved women and girls do not have access to anti-poverty programs, micro-loans or other economic development initiatives, leaving them dependent on their exploiters.

• Women and child welfare.

Introduction

The Department of Women and Child Development, Government of India, came into existence as a separate Ministry with effect from 30th January, 2006, earlier since 1985 it was a Department under the Ministry of Human Resources Development.
The Ministry was constituted with the prime intention of addressing gaps in State action for women and children for promoting inter-Ministerial and inter-sectoral convergence to create gender equitable and child-centred legislation, policies and programmes.

Vision and Mission

Vision

Empowered women living with dignity and contributing as equal partners in development in an environment free from violence and discrimination. And, wellnurtured children with full opportunities for growth and development in a safe and protective environment.

Mission

Promoting social and economic empowerment of women through cross-cuting policies and programmes, mainstreaming gender concerns, creating awareness about their rights and

facilitating institutional and legislative support for enabling them realize their human rights and develop to their full potential.2. Ensuring development, care and protection of children through cross-cutting policies and programmes,spreading awareness about their rights and facilitating access to learning,nutrition,institutional and legislative support for enabling them to grow and develop to their full potential.

Mandate:

The broad mandate of the Ministry is to have holistic development of **Women and Children.** As a nodal Ministry for the advancement of women and children, the **Ministry formulates plans, policies and programmes; enacts/ amends legislation**, guides and coordinates the efforts of both governmental and non-governmental organisations working in the field of Women and Child Development. Besides, playing its nodal role, the Ministry implements certain innovative programmes for women and children. These programmes cover welfare and support services, training for employment and income generation, awareness generation and gender sensitization. These programmes play a supplementary and complementary role to the other general developmental programmes in the sectors of health, education, rural development etc. All these efforts are directed to ensure that women are empowered both economically and socially and thus become equal partners in national development along with men.

Policy Initiatives:

For the holistic development of the child, the Ministry has been implementing the world's largest and most unique and outreach programme of **Integrated Child Development Services (ICDS)** providing a package of services comprising supplementary nutrition, immunization, health check up and referral services, pre-school non-formal education. There is effective coordination and monitoring of various sectoral programmes. Most of the programmes of the Ministry are run through non-governmental organisations. Efforts are made to have more effective involvement of NGOs. The major policy initiatives undertaken by the Ministry in the recent past include universalisation of ICDS and **Kishori Shakti Yojana**, launching a nutrition programme for adolescent girls, establishment of the Commission for protection of Child Rights and enactment of **Protection of Women from Domestic Violence Act.**

Organisation:

The Ministry of Women and Child Development is headed by **Hon'ble Minister Smt. Smriti Zubin Irani, Minister of State Sushri Debasree Chaudhuri and Shri Rabindra Panwar is the Secretary of the Ministry of Women and Child Development.**The activities of the Ministry are undertaken through seven bureaux.
The Ministry has 6 autonomous organisations viz.

- **National Institute of Public Cooperation and Child Development (NIPCCD)**
- **National Commission for women (NCW)**
- **National Commission for Protection of Child Rights (NCPCR)**
- **Central Adoption Resource Agency (CARA)**
- **Central Social Welfare Board (CSWB)**

- **Rashtriya Mahila Kosh (RMK)**

working under its aegis. NIPCCD and RMK are societies registered under the Societ Registration Act, 1860. CSWB is a charitable company registered under section 25 of the Ind Companies Act, 1956. These organisations are fully funded by the Govt. of India and they as the Department in its functions including implementation of some programmes/schemes. National Commission for Women was constituted as a national apex statutory body in 1992 protecting and safeguarding the rights of women. The National Commission for Protection Child Rights which is a national level apex statutory body constituted in the March 2007 protecting and safe guarding the rights of children.

Subjects Allocated to the Ministry

- Welfare of the family.
- Women and Child Welfare and Coordination of activities of other Ministries and Organisa in connection with this subject.
- References from the United Nations Organizations relating to traffic in Women and Childre
- National Nutrition Policy, national Plan of Action for Nutrition and National Nutri Mission.
- Charitable and religious endowments pertaining to subjects allocated to this Department
- Promotion and development of voluntary effort on the subjects allocated to this Department
- **Implementation of -**
  - **Immoral Traffic in Women and Girl Act. 1956 (as amended upto 1986).**
  - **The Indecent Representation of Women (Prevention) Act, 1986 (60 of 1986).**
  - **The Dowry Prohibition Act. 1961 (28 of 1961)**
  - **The Commission of Sati (Prevention) Act, 1987 (3 of 1988), excluding administration of criminal justice in regard to offences under these Acts.**
- **Implementation of the Infant Milk Substitutes, Feeding Bottles and Infant F (Regulation of Production, Supply and Distribution) Act, 1992 (41 of 1992).**
- Coordination of activities of Cooperative for Assistance and Relief Everywhere (CARE)
- Planning, Research, Evaluation, Monitoring, Project Formulations, Statistics and Train relating to the welfare and development of women and children, including development gender sensitive data base.
- **United Nations Children's Fund (UNICEF)**
- **Central Social Welfare Board (CSWB)**
- **National Institute of Public Cooperation and Child Development (NIPCCD)**
- Food and Nutrition Board
- **Food and Nutrition Board (FNB)**
- Development and popularization of subsidiary and protective foods.

Role of Information Technology in Environment and Human Health

Role of Information Technology in Environment and Human Health!

Information technology has tremendous potential in the field of environment education and health as in any other field like business, economics, politics or culture. Development of interne

facilities, Geographic Information System (GIS) and information through satellites has generated a wealth of up-to- date information on various aspects of environment and health.

A number of software have been developed for environment and health studies which are used friendly and can help an early learner in knowing and understanding the subject.

Database on Environment System:

Database is the collection of interrelated data on various subjects. It is usually in computerized form and can be retrieved whenever required. In the computer the information of database and can be very quickly retrieved. The comprehensive database includes wildlife database, conservation database, forest cover database etc. database is also available for diseases like HIV/AIDS, Malaria, Fluorosis, etc.

(a) National Management Information System (NMIS):

NMIS of the Department of Science and Technology has compiled a database on Research and Development Projects along with information about research scientists and personnel involved.

(b) Environmental Information System (ENVIS):

The Ministry of Environment and Forests, Government of India has created an information System called Environmental Information System (ENVIS). With its headquarters in Delhi, it functions in 25 different centres all over the country.

The ENVIS centres work for generating a network of database in areas like pollution control, clean technologies, remote sensing, coastal ecology, biodiversity, western Ghats and eastern environmental management, media related to environment, renewable energy, desertification, mangroves, wildlife, Himalayan ecology, mining etc.

(c) Remote Sensing and Geographical Information System (GIS):

Satellite imageries provide us actual information about various physical and biological resources and also to some extent about their state of degradation in a digital form through remote sensing.

Satellite imageries provide us actual information about various physical and biological resources and also to some extent about their state of degradation in a digital form through remote sensing.

We are able to gather digital information on environment aspects like water logging,

desertification, deforestation, urban sprawl, river and canal network, mineral and energy reserves and so on.

d) Geographical Information System (GIS):

GIS has proved to be a very effective tool in environmental management. GIS is a technique of superimposing various thematic maps using digital data on a large number of inter-related or inter dependent aspects. Several useful soft-wares have been developed for working in the field of GIS.

Different thematic maps containing digital information on a number of aspects like water resources, industrial growth, human settlements, road network, soil type, forest land, crop land or grassland etc. are superimposed in a layered form in computer using software.

Such information of polluted zones, degraded lands or diseased cropland etc. can be made based on GIS. Planning for locating suitable areas for industrial growth is now being done using GIS by preparing Zoning Atlas. GIS serves to check unplanned growth and helps in providing correct, reliable and verifiable information about forest cover, success of conservation efforts etc.

They also provide information of atmospheric phenomena, like approach of monsoon, ozone layer depletion many new reserves of oil; minerals etc. with the remote sensing and GIS play a key role in resource mapping, environmental conservation, management, planning and environmental impact assessment.

It also helps in identifying several disease infested areas which are prone to some vector-borne diseases like malaria, schistosomiasis etc. based upon mapping of such areas. There are several Distribution Information Centres (DICs) in our country that are linked with each other and with the central information network having access to international database.

They also provide information of atmospheric phenomena like approach of monsoon, ozone layer depletion, inversion phenomena, smog etc. We are able to discover many new reserves of oils, minerals etc. with the help of information generated by remote sensing satellites. Thus remote sensing and GIS play a key role in resource mapping, environmental conservation, management, and planning and environmental impact assessment.

(e) The World Wide Web:

With resources material on every aspect, class-room activities, and digital files of photos, power-point lecture presentations, animations, web-exercises and quiz has proved to be extremely useful both for the students and the teachers of environmental studies.

The role of online learning centre website has the following features:

(a) Student-friendly features:

These include practice quiz, how to study tips, hyperlinks on every topics with detailed information, web exercises, case studies, environmental maps, key-terms, career information, current articles, and interactive encyclopaedia and how to contact your elected officials.

(b) Teacher-friendly features:

These include in addition to above supplement resources charts, additional case studies, answers to web exercises, solutions to critical thinking, questions, editing facility to add or delete questions and create multiple version of same test etc. Information technology is expanding rapidly with increasing applications and new avenues are being opened with effective role in education, management and planning in the field of environment and health.