MAA OMWATI DEGREE COLLEGE

HASSANPUR

NOTES

SUBJECT NAME –ENVIRONMENTAL SCIENCE (VAC)

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COURSE-B.COM AND B.B.A 1ST SEM

UNIT-1

Q1 Describe in detail the structure of the ecosystem.

Ans **Introduction**

An ecosystem is a 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 interactions between organisms and their environment. The term “Ecosystem” was first coined by A.G.Tansley, an English botanist, in 1935. An ecosystem is a complex system that consists of living and non-living components, which interact with each other and form a balanced system.

The main components of an ecosystem are:

1. Living Components: - Plant - Animals - Microorganisms

2. Non-Living Components: - Water - Air - Soil - Light - Temperature

Meaning of ecosystem

An ecosystem is a complex network of living organisms (plants, animals, microorganisms) and non-living components (water, air, soil, light, temperature) that interact and exchange materials in a specific environment. It's a self-sustaining system that supports life and maintains a balance between the living and non-living components. In simpler terms, an ecosystem is like a big web of life that connects all living things and their environment. It's a community of living and non-living things that work together to create a healthy and balanced environment.

Example: A forest ecosystem includes trees, animals, insects, microorganisms, water, air, soil, and sunlight all interacting and depending on each other for survival.

STRUCTURE OF THE ECOSYSTEM

The structure of an 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 an 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 living components 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.

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> **Primary consumers** are always herbivores as they rely on producers for food.
>
> **Secondary consumers** depend on primary consumers for energy. They can either be carnivores or omnivores.
>
> **Tertiary consumers** are organisms that depend on secondary consumers for food. Tertiary consumers can also be carnivores or omnivores.
>
> **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 the ecosystem are as follows:

1 It regulates the essential ecological processes, supports life systems and renders 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 involve the exchange of energy.

So the functional units of an ecosystem or functional components that work together in an ecosystem are:
1 **Productivity** – It refers to the rate of biomass production.
2 **Energy flow** – It is the sequential process through which energy flows from one trophic level to another. The energy captured from the sun flows from producers to consumers and then to decomposers and finally back to the environment.
3 Decomposition – It is the process of breakdown of dead organic material. The top-soil is the major site for decomposition.
4 Nutrient cycling – In an ecosystem nutrients are consumed and recycled back in various forms for the utilisation by various organisms.

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
1 Terrestrial Ecosystem
Terrestrial ecosystems are exclusively land-based ecosystems. There are different types of terrestrial ecosystems distributed around various geological zones. They are as follows:
Forest Ecosystem
Grassland Ecosystem
Tundra Ecosystem
Desert Ecosystem
Forest Ecosystem
1 A forest ecosystem consists of several plants, particularly trees, animals and microorganisms that live in coordination with the abiotic factors of the environment. Forests help in maintaining the temperature of the earth and are the major carbon sink.

2 Grassland Ecosystem
In a grassland ecosystem, the vegetation is dominated by grasses and herbs. Temperate grasslands and tropical or savanna grasslands are examples of grassland ecosystems.

3 Tundra Ecosystem

Tundra ecosystems are devoid of trees and are found in cold climates or where rainfall is scarce. These are covered with snow for most of the year. Tundra type of ecosystem is found in the Arctic or mountain tops**.**

4 Desert Ecosystem

Deserts are found throughout the world. These are regions with little rainfall and scarce vegetation. The days are hot, and the nights are cold.

Aquatic Ecosystem

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

1Freshwater Ecosystem

2Marine Ecosystem

1 Freshwater Ecosystem

The freshwater ecosystem is an aquatic ecosystem that includes lakes, ponds, rivers, streams and wetlands. These have no salt content in contrast with the marine ecosystem.

2 Marine Ecosystem

The marine ecosystem includes seas and oceans. These have a more substantial salt content and greater biodiversity in comparison to the freshwater ecosystem.

CONCLUSION: THE STRUCTURE OF AN ECOSYSTEM IS TE ORGANIZATION OF LIVING AND NON LIVING COMPONENTS**, AND HOW THEY INTERACT WITH EACH OTHER.**

Q2 What is population explosion? Explain its cause and its effect on environment.

Ans

Population explosion refers to the rapid increase in the number of people in a given area or country, leading to an unsustainable growth rate. This occurs when the number of births exceeds the number of deaths, resulting in an exponential growth in population.

Introduction:

The world's population has been growing at an alarming rate, with the global population reaching over 7.9 billion people as of 2023. The population explosion is a pressing concern, as it puts a strain on resources such as food, water, housing, and infrastructure. If left unchecked, population growth can lead to:

1. Resource depletion
2. Environmental degradation
3. Increased poverty and inequality
4. Decreased quality of life
5. Strain on social services and infrastructure

Factors contributing to population explosion:

1. High birth rates
2. Improved healthcare and sanitation
3. Increased life expectancy
4. Lack of family planning and education
5. Cultural and religious factors

Consequences of population explosion:

1. Overcrowding and urbanization
2. Water scarcity and food insecurity
3. Increased greenhouse gas emissions
4. Loss of biodiversity
5. Social and economic instability

Meaning of population explosion

The rapid and dramatic rise in population of an area is termed as population explosion. The combination of factors like high birth rate and the low death rate is responsible for the population explosion.

As of 2024, the five most populated countries in the world are:

India: 1,450,935,791 people

China: 1,419,321,278 people

United States: 345,426,571 people
Indonesia: 283,487,931 people
Pakistan: 252,363,571 people

Characteristics of population-
Population is a group of individuals of a particular species which can interbreed and are occupying a particular area at a specific time e.g., population of frogs in a pond human population in a city etc. It has following characteristics.
(i) Population density (ii) Birth rate (Natality) (iii) Death rate (Mortality) (iv) Age structure (v) Gender ratio (vi) Dispersion (vii) Migration

Population Density

It is the number of individuals per unit area of the region in which they It can be crude density (number per unit total area) or specific or ecological is number per unit area of the space which the population can actually COLONISE.
D = N/ A
D= DENSITY ,N=NO OF INDIVIDUAL,A=AREA OCCUPIED

Cause of POPULATION EXPLOSION

(1) Decreased Death Rate: There is decrease in both birth and death rate, particularly during last few decades. Every second, there is net gain of 3 people. At this rate world population will double every 40 years.

(2) Food Security There has been remarkable increase in the agricultural production. The recent scientific techniques ie. High yielding seeds, fertilizers, pesticides, sophisticated mechines, improved irrigation has made rapid expansion of agriculture possible. This has extended availability of food to wider population.

(3) Improvement in Public Health-The biggest population story of the last hundred years has been conquest of diseases. Scientists have learnt to cure and prevent many diseases. Thus millions of people, who would have died of diseases a century ago are more likely to live to older age. Incidence of epidemic diseases (such as cholera) which earlier stabilized population has decreased. The improvement in availability of medical facilities to wider population has increased the average life span.

(4) Vaccination-Another important factors in population growth is lowering of infant mortality rate. This has happened because of discovery of vaccines of influenza, small pox, polio, rubella, T.B. etc.

Progress in medical science therefore, had a great effect on the population of most nations. Nearly everywhere death rates have fallen. At the same time birth rates have remained high at least in less developed countries. This combination of high birth rate and low death rates have led to population explosion in many countries throughout the world.

Effect of Population Explosion

As argued by Thomas Malthus in "An essay on the principal of population" in 1798, while resources tend to grow linearly, population grow exponentially. As the population exceed resources, mortality will increase. The main consequences of over population are:

(1) Pressure on natural resources-Increase in population reduces the per capita availability of natural resources. The quality of natural resources also being degraded. The increased consumption of non-renewable resources has reduced the life span of these limited resources. Moreover desire to live a comfortable life put extra pressure on resources leading to rapid depletion of natural resources.

(2) Pollution-Energy intensive life style means consumption of more and more resources. The process of extraction, refining, conversation and eventual consumption of natural resources has increased air, water and land pollution. To get maximum yield to toed growing population, intensive agricultural practices are followed. These have resulted in water logging salinity and desertification of land, hence degradation of land resources Degradation of forest resources have also resulted due to over population as more and more forests are cleared for crop lands and for human settlements.

(3) Poverty-Poverty and rapid population growth are intimately related and it is difficult to say whether rapid population growth is a cause of poverty or poverty is a case of rapid population growth Population grows fastest in poorest countries. High humility rate is associated with poverty and high childhood mortality.is thus also associated with increased deaths and diseases Everyday we share the earth and is resources with 2.500 more people than the day betore. Every year, these are about a 90 million more mouths

(4) Social Unrest-Overpopulation are associated with poverty and decreased availability of natural resources Because of population explosion too many persons lack adequate food, water, shelter, education and employment. This jeopardizes chances for mary to achieve health and security. They fall prey to unsocial activities resulting in social unrest.

Strategies to solve these problems-

Over population is making substantial contribution to the destruction of earth's support system. To ensure that future generations have access to sufficient natural serves, let us devise certain plans to stabilize population. Some of these plans Awareness-Facts like the size and growth rate

of population, its impact on environment should be in the mind of every citizen. Population issues should be discussed at all public platforms in order to make public aware of their importance Education-Literacy rate and fertility rate are closely related population growth rate. 1 Awareness 2 Education 3 Family planning 4 Women status 5 Family planning method.

UNIT-2

Q3 What are minerals. Discuss their uses in details.

ANS INTRODUCTION

Minerals constitute the wealth of any nation. These form backbone of economic growth. This sector accounts for a significant proportion of economic output and employment and attract much needed foreign investments.

India is very rich in mineral resources. There are so many evidences that exploitation of minerals has been going on in this country, from time immemorial but the first recorded history of mining dates back to 1774 when an English company was granted permission by the East India Company for coal mining in Raniganj. After independence, the growth of mining has been quite fast and ambitious plan is there to further explore and exploit mineral wealth.

Definition of Minerals "Minerals are substances which are obtained after mining." Minerals can also be defined as "natural occuring, inorganic, crystalline solids having a definite chemical composition and characterstic physical properties." These are usually formed by inorganic processes.

Types-Minerals can be classified in many ways. They can be classified by chemical composition, crystal structure, luster etc. Broadly they can be divided into metallic and non-metallic. Metallic can further be divided into ferrous (iron containing) and non- ferrous minerals (without iron).

Metallic Minerals-These are found in impure form, known as ores. These are lusterious, malleable and ductile. The ferrous metallic minerals are chromate, pyrite, etc. and non-ferrous are gold, silver, bauxite etc. These occur in igneous rocks with crystalline structure.

Non-metallic Minerals-These are dull, brittle, found in pure form. These are found in stratified, sedimentary rocks e.g. gravel, asbestos, diamond, coal etc.

Extraction

Extraction of minerals from earth is done through mining. Depending upon the location of minerals, mining can be surface or sub surface mining.

1. Surface Mining-When the mineral resources are close to surface, this type of mining is done. It can be:

(i) Quarrying-Quarry is a type of open pit mine from which rock or minerals are extracted. Quarrying are shallower them other open pit mines.

(ii) Open-pit mining-This refers to the method of removing minerals from the earth by their removal from an open-pit.

2 Sub Surface Mining-This method is employed when mineral deposits are deep in earth. It can be

(1) Drift Mining-This is done by cutting into the side of earth. Drift mines have horizontal entries into the mineral seam.

(2) Slope Mines-This method accesses minerals through a sloping access shaft travelling downwards towards the mineral seam.

(3) Shaft Mines-This is underground mining done by using mine shaft, which is a vertical or inclined passageway used to access anunderground mining facility.

Important Minerals and their Uses

Minerals are backbone of any economy. Judicious exploitation of this natural resource is important for suitable use as these are finite resources. India has diverse and significant mineral resources, out of 89 minerals 11 are metallic with iron, 52 are non ferrous metallic, 22 minor and 4 are mineral fuels. India is world's the largest producer of mica; third largest producer of coal and lignite and ranks among the top producers of iron ore, bauxite, manganese and aluminium. The uses of important minerals are given in the table.

Important Minerals and their uses

	Mineral	Uses
	Metallic	
1.	Iron	Steel, building meterials etc.
2.	Aluminium	Electric wires, utensils, aircrafts.
3.	Nickel	Used in alloys, electroplating.
4.	Lead	Batteries, paints
5.	Copper	Alloys, electric products
6.	Chromium	Metellurgy, electroplating
7.	Cobalt	Alloys, radiography
8.	Gold	Jwellery, Economic purposes
	Non-Metallic	
1.	Silica	Sand and gravel for construction work,
2	Asbestos	Roofing, insulation, ceramics.
3	Felspar	Artificial teeth
4	Lime stone	Building material, agriculture,
5.	Phosphate	Fertilizers, Chemicals
6.	Salt	Chemical

Q4 What is meant by energy resources? Explain in renewable and non renewable energy resources.

ANS

Introduction

Energy is derived from the word 'Energos' meaning work. Energy is capacity to do work. Our body requires energy to do work and draw it from food. Similarly societies require energy to remain functional. In the pre-industrialization era, energy requirements were largely met by muscular energy (70%), But after industrialization, energy requirements shot up. Energy is required to run machines, which provide transportation, communication, entertainment, health, household activities such as washing, cleaning, cooking, cooling etc. Agricultural energy requirements are also increased with more and more use of mechanized tools. The development of country is directly related to availability of cheap energy resources. The energy consumption is not uniform throughout the world. Rich nations consume maximum energy e.g. U.S.A. with just 3% of world's population consumes approximate 25% of total energy. The energy demands are so important to maintain the living standards, that countries are ready to fight wars to have control over the sources of energy.

Renewable energy refers to the energy generated from natural resources that can be replenished over time, such as:

1. Solar energy (energy from the sun)
2. Wind energy (energy from wind)
3. Hydro energy (energy from water)
4. Geothermal energy (energy from the Earth's heat)
5. Biomass energy (energy from organic matter)
6. Hydrogen energy (energy from hydrogen gas)

These energy sources are sustainable and non-polluting, reducing our reliance on fossil fuels and mitigating climate change.

Types of Renewable Energy:

1. Solar Energy: Photovoltaic (PV) cells or solar thermal systems convert sunlight into electricity or heat.

2. Wind Energy: Wind turbines convert wind kinetic energy into electricity.

3. Hydro Energy: Hydroelectric power plants harness water flow from rivers or oceans to generate electricity.

4. Geothermal Energy: Heat from the Earth's core is used to generate electricity or provide direct heating.
5. Biomass Energy: Organic matter (wood, crops, waste) is burned or converted into biofuels for energy.
6. Hydrogen Energy: Hydrogen gas is used as a clean fuel for transportation, power generation, or industrial applications.
Renewable energy is a vital component of a sustainable future, offering numerous benefits, including:
- Reduced greenhouse gas emissions
- Energy independence
- Job creation and economic growth
- Improved air and water quality
- Enhanced energy security

Non-renewable energy comes from natural resources that cannot be replenished or replaced over time. These resources are finite and will eventually run out. The main types of non-renewable energy are:
1. Fossil Fuels:
   - Coal
   - Oil (Petroleum)
   - Natural Gas
2. Nuclear Energy:
   - Uranium (used in nuclear power plants)
3. Non-renewable Biomass:
   - Organic matter (wood, crops, waste) that is not sustainably sourced or replenished.

1 Fossil fuels are the most common non-renewable energy sources. They are used to generate electricity, power vehicles, and provide heating and cooling. However, their use contributes to climate change, air pollution, and environmental degradation.
2 Nuclear energy is another non-renewable source, which generates electricity through nuclear reactions. While it doesn't produce greenhouse gas emissions, it poses safety risks and produces radioactive waste.
3 Non-renewable biomass includes organic matter that is not sustainably sourced or replenished, contributing to deforestation and land degradation.

UNIT-3

Q5 What do you understand by the term biodiversity ? Name and discuss the three levels of organization of biodiversity.

ANS

Introduction

Biodiversity word is derived from two Greek letters bios = life; diversity = forms, which refers to all variety and variability of life forms on this earth. All types of life forms have arisen on this planet as a result of 3.5 billion years of evolution involving mutation, genetic recombination and natural selection.

Historical Background-

The term biodiversity is a relatively new term and was coined by an Entomologis ard. O. Wilson in 1986.

Definition-

1. Biodiversity is "all hereditarily based variations at all levels of organization' (E.O. Wilson-1986-in his book Biodiversity II)
2. "The variety and variability of all animals, plants and micro-organisms an the ecological complexes of which they are a part". (UNEP 1992)
3. Biodiversity is "The library of life".
4. The "full variety of life on Earth". (Takacs 1996)
5. It is concerned with the variety of individuals within populations, the diversi of species within communities, and the range of ecological roles with ecosystem." (Graham Bell)
6. Some believe that it has simply replaces the term "nature" or Wildernes

Number of Species on Earth-"Of the estimated 5 to 50 million species of t d's biota, Scientists have named about 1.7 million species of organisms i.e. abc million animal species and 0.5 million plant species and the distribution of the species is highly uneven on this earth.

Levels of Biodiversity There are three levels of biodiversity-

(1) Genetic diversity,

(2) Species diversity,

(3) Ecosystem diversity.

1. GENETIC DIVERSITY

"The genetic variation existing within a species is called genetic diversity" or we can say that this is the variety and variability among individuals of same species e.g., a human beings differs widely from all others due to variation at gene level or allele level and also due to different gene combinations. The genetic diversity can be expressed in the form of breeds, races, varieties and forms. In human being the genetic make up is same, all having 46 number of chromosomes but due to different gene combinations, different races arise like Mongoloid, Protoautraloid, Nordic and Negrito.

Environment also plays an important role in imparting diversity in living organisms because every individual responds to environment through their genetic make up. As the environmental conditions change, these brought changes in the gene set up of an organism which travels generation to generation and this gives rise to different races of the species. Natural selection favours the survival of those genotypes which are best suited for prevailing environement. Thus genetic diversity provides the raw material for adaptation to changing environment and for the evolution of new races and species.

2 SPECIES DIVERSITY

The number of species of plants and animals that are present in a region constitute the species diversity, e.g., Peepal (Ficus, religiosa), Bargad (Ficus, bengalensis), Rubber (F. elastica) belong to the same Genera but all differ at species level. These species have attained the unique biological status of reproductive isolation.

The species diversity of a region is measured on the basis of two parameters ie. Species richness (total number of species in any area)(Species evenness (total number of individuals of a species in given area).Gradation of biodiversity at species level .

1. Alpha (a) diversity-It represents number of species in a given habitat.
2. Beta (8) diversity-The rate of turnover or replacement of species while moving from one habitat to another within the same geographical region e.g.. the differences in species composition between a coastal and the adjoining intertidal zone would be called beta diversity.
3. Gamma (y) diversity-This is the term used for the rate of turnover or replacement of species between similar habitats in different geographical areas, eg., the difference in species composition between the coastal region in Goa and in the Bay of Bengal would be called as gamma diversity.

3 ECOSYSTEM DIVERSITY

This is the diversity among different ecosystems on earth. Each area has a variety of ecosystems which have their own complement of distinctive inter-linked species. Each of them varies functionally and structurally from other system. There are different geographical regions on our earth which have different environmental conditions and in these different environmental conditions, different types of ecosystems prevails like forests, grasslands, deserts and aquatic ecosystem. All these ecosystems have different composition of species e.g., in grassland ecosystem the composition of species both plants and animals is quite different from the composition of species in desert ecosystem.Biogeographical Regions in India-Biogeography is the branch of Science which deals with the "distribution of both plants and animals on the earth." It consists of two branches:

(i) Phytogeography-It deals with the distribution of plants on the earth. Phytogeography is often divided into two types.

(a) Descriptive Phytogeography Describes the actual distribution of plants in different parts of the world.

(b) Dynamic or Interpretive Phytogeography-Explains the reasons for such a distribution.

(ii) Zoogeography-It deals with the distribution of animals on the earth.

Q6 Explain in situ and ex situ conservation along with their merits and demerits

ANS

Introduction

Biodiversity mainly refers to the variety and variability of life existing on the planet Earth. The term biodiversity usually refers to the process of measuring the variation at the genetic, species, and ecosystem level. Biodiversity plays a vital role in boosting the ecosystem. The factors responsible for the cause of changes in biodiversity are:

- Pollution
- Invasive species
- Overexploitation
- Change in the climatic conditions

We all need to conserve biodiversity, as it leads to the conservation of essential ecological diversity to preserve the continuity of food chains. In-situ and Ex-situ conservation are the two strategies practised for the preservation of a variety of living species globally.

What is In-situ Conservation?

It is the methods of conserving all the living species, especially the wild and endanged species in their natural habitats and environment. In-situ conservation of Biodiversity includes biosphere reserves, national parks, wildlife sanctuaries, etc.

What is Ex-situ Conservation?

It is the methods of conserving all the living species in the artful habitats that reflect their natural living habitats. Examples of ex-situ conservation of biodiversity include aquariums, botanical gardens, cryopervation, DNA banks, zoos, etc.

Advantage of In-situ conservation-
(i) It is a cheap and convenient method of conserving biodiversity.
(ii) In-situ conservation protect the large area so several unknown species are also consrved.
[B] Ex-site Conservation
"Ex-situ conservation involves the conservation of species in suitable envirnmrnt outside their natural habitat"
The Plants and animals growing in their natural habitat experience difficult living conditions, like problem of food, water, diseases. Sometimes they are not able to reproduce due to absence of mating partner. Difficulties faced by plants are grazing animals, forest fires, adverse environmental conditions. Human care eliminates the stress which the organism faces in nature so these are protected in artificial environmental conditions to make their life safe and secure.

The various methods are used in ex-situ conservation
(1) Botanical gardens-Botanical garden is a place where plants are grown artificially. Most of them were established for educational and exhibition. purposes. In India first Botanical garden was established in 1830.
List of a few famous Botanical gardens
1. Botanical garden, Pisa Italy.
2. Royal Botanical garden Kew, England.
3. Indian Botanical Garden, Kolkata,
4. National Botanical Garden, Lucknow.

1 Pollen storage-The pollens of different plant species are stored, this help in conservation of biodiversity although the pollen has to be collected quickly from the nature, as its viability period is very short.

2 Tissue culture-Today this is an effective method of conserving critically Endangered species of plants and animals. The cells and tissues are grown on artificial medium in aspectic conditions to raise plants. This is rapid mode of multiplication and help in conservation of Biodiversity.

3 Genetic engineering-This technique is very useful in transferring the gene of desired character from one species to another species or with in individuals of same species. This evolves highly efficient plant species. So this technique is very useful for conserving the genes of desired characters.

4 Cryopreservation-This is a technique of preserving ova and sperms in liquid nitrogen at a temperature of-196°C. Cryopreservation is the storage.

UNIT-4

Introduction

The ecological balance of bisophere is becoming more and more fragile day by day due to industrial, agriculture development as well as populatim explosion. Large changes take place in the environmental conditions due to interaction between human society and enviornment. Unlimited exploitation of natural resources by human for their self centred intrests disturbed the delicate ecological balance between living and non-living component of the biosphere. The unfavourable conditions generated by man itself not only threatened the survival of living organisms but also himself. We know that development and destruction are the two faces of same coin but we can minimise the destruction of nature by adopting the policy of sustainable development. That is wny pollution these days is called "a necessary evil of all development."

POLLUTION

The word pollution is derived from Latin word "Pollutionem" which means defile or make dirty. Definition: "Pollution is an undesirable change in physical, chemical or biological characteristics of our air, water and land that may or will produce harmful affect on human life, and other living organisms." (Spilhaus 1966)

Kinds of Pollution:

(A) Natural: Natural pollution is due to natural causes like storms, marsh gases, volcanic erruptions, forest fires, earthquakes and erosions etc.
2 Man made Pollution: This pollution originates due to human activities. It is of three types.
(1) Personal Pollution: Caused by an individual and affect a little area, eg smoking.
(2) Occupational Pollution: Arises due to occupation or work and affects all the workers and area around them, e.g. Textile mill, flour mill, stone crushing etc.
(3) Community Pollution: Affects whole community e.g. Fertilizer Industries, Refineries, Power plants etc.

POLLUTANT

A pollutant is any substance, chemical or physical factor which when released into the environment put harmful affect on environment, animals, plants and human beings. "Pollutant is a wrong meterial at wrong place at wrong time."

Types of Pollutants

1. On the basis of the form in which they exist in environment after their release:

(a) Primary pollutants: These are the pollutants which remain in the environment in the same state as they are released. e.g. SO,, CO etc.

(b) Secondary pollutants: These are the pollutants which are formed by modification of primary pollutants or reaction between two primary pollutants. e.g. (PAN) Peroxy-acyl-nitrate which is formed by the reaction between nitrogen oxide and hydrocarbons in the presence of sunlight. These are highly destructive.

(a) Bio-degradable Pollutants: These are the pollutants which are broken down to harmless products by certain micro-organisms like bacteria, fungi and actinomycetes.

(b) Non-degradable Pollutants (Persistent pollutants) These are the pollutants which are not easily broken down to harmless form by biological or chemical degradation. e.g. Glass, Plastic, aluminium cans, radioactive substances, mercury, chromium etc. They are not recycled in nature but accumulate in individuals and show "biological magnification" in successive trophic levels.

Types of Pollution Pollution can be divided into following main categories.

1. Air pollution
2. Soil pollution
3. Radio-active pollution
4. Marine pollution
5. Water pollution
6. Noise pollution
7. Thermal pollution

1Air pollution refers to the contamination of the atmosphere by harmful substances, including:

1. Particulate matter (PM)
2. Ozone (O3)
3. Nitrogen dioxide (NO2)
4. Carbon monoxide (CO)
5. Sulfur dioxide (SO2)
6. Volatile organic compounds (VOCs)

Impact on Environment:

1. Climate Change: Air pollution contributes to global warming and climate change.
2. Respiratory Problems: Air pollution can cause respiratory issues, such as asthma and lung disease.

3. Cardiovascular Disease: Exposure to air pollution can increase the risk of heart disease and stroke.
4. Environmental Damage: Air pollution can damage crops, forests, and aquatic ecosystems.
5. Visibility Reduction: Air pollution can reduce visibility, affecting scenic views and quality of life.
6. Economic Impacts: Air pollution can lead to increased healthcare costs, lost productivity, and damage to infrastructure.

Sources of Air Pollution:
1. Fossil Fuel Combustion
2. Industrial Processes
3. Vehicle Emissions
4. Agricultural Activities
5. Waste Management

To mitigate air pollution, we can:

1. Use renewable energy sources
2. Increase energy efficiency
3. Implement emission controls
4. Promote sustainable transportation
5. Support clean air policies

2 Soil pollution
refers to the contamination of soil with harmful substances, including:
1. Chemicals (pesticides, fertilizers, industrial waste)
2. Heavy metals (lead, mercury, arsenic)
3. Industrial waste
4. Plastics and microplastics
5. Agricultural waste

Impact on Environment:
1. Soil Degradation: Pollution can reduce soil fertility and structure.
2. Water Pollution: Contaminants can leach into groundwater, affecting aquatic ecosystems.
3. Air Pollution: Volatilization of pollutants can contribute to air pollution.
4. Loss of Biodiversity: Soil pollution can harm soil microorganisms and affect plant growth.
5. Food Chain Contamination: Pollutants can accumulate in crops and animals, impacting human health.

Effects on Human Health:

1. Cancer risk
2. Neurological damage
3. Reproductive issues
4. Respiratory problems
5. Gastrointestinal diseases

Sources of Soil Pollution:

1. Industrial activities
2. Agricultural practices
3. Waste disposal
4. Accidental spills
5. Natural disasters

Prevention and Remediation:

1. Implement sustainable agricultural practices
2. Use eco-friendly waste management methods
3. Monitor and regulate industrial activities
4. Clean up contaminated sites
5. Promote soil conservation and restoration

3. Water pollution

Water pollution refers to the contamination of water bodies, including rivers, lakes, oceans, and groundwater, with harmful substances, making them unsafe for human consumption, recreational use, or wildlife habitats.

Impact of Water Pollution:

1. Human Health:
- Waterborne diseases (cholera, typhoid, diarrhea)
- Cancer risk
- Neurological damage

2. Environmental Impact:
- Harm to aquatic life (fish, plants, microorganisms)
- Disruption of food chains
- Loss of biodiversity

3. Economic Impact:
- Decreased fishing and tourism industries
- Increased water treatment costs
- Damage to infrastructure (corrosion, clogging)

4. Social Impact:

- Community displacement (due to water scarcity or contamination)
- Cultural heritage loss (pollution of sacred water sites)

Sources of Water Pollution:

1. Industrial effluent (chemicals, heavy metals)
2. Agricultural runoff (pesticides, fertilizers, manure)
3. Domestic sewage
4. Oil spills
5. Plastic pollution (microplastics, bags, bottles)
6. Climate Change (altered water cycles, increased flooding)

Prevention and Remediation:

1. Implement wastewater treatment technologies
2. Promote sustainable agricultural practices
3. Reduce plastic use and waste
4. Protect and restore natural water habitats (wetlands, forests)
5. Enforce water quality regulations and monitoring
6. Support water conservation and efficiency measures