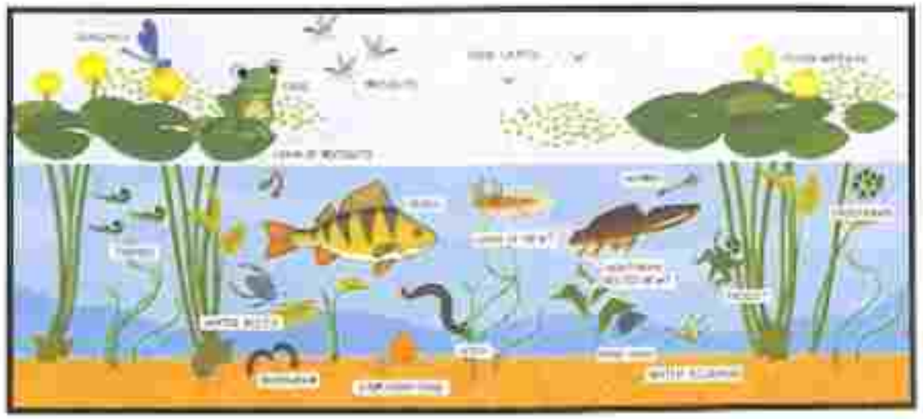
AECC - 2 PROJECT WORK

IN

ENVIRONMENTAL STUDIES

A Brief Field Work on



POND ECOSYSTEM

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College Roll No.: 21/BSCH/0029

Certificate

This is to certify that this AECC-2 project work in **Environmental Studies** under the title of **Pond Ecosystem** is the bona-fide work of **Meghamanti Bhattacharya**, a student of **Economics Honours, Semester-II** of Gokhale Memorial Girls' College, Kolkata – 700 020.

2. Her **CU Registration No.** is **013-1211-0135-21** of the session 2021-22 and **CU Roll No.** is **213013-11-0008**. She has performed this project work as a part and parcel of her Semester-II Course for the academic year 2021-22.

3. This is a field work on pond ecosystem.

4. Under this course, number of her **project work(s) certified is 1 out of 1.**

ACKNOWLEDGEMENT

I, Meghamanti Bhattacharya, student of 1st year, Economics Honours, Semester-2 of Gokhale Memorial Girls' College, Kolkata-700 020 would like to express my special thanks and gratitude to respected professor in Chemistry, Sri Santanu Samanta, SACT-II, Gokhale Memorial Girls' College, Kolkata-700 020 for his valued guidance and support in carrying out my AECC-2 Project Work in Environmental Studies under the title "Pond Ecosystem"; it is based on a brief field work.

I would also like to convey my gratitude to our respected Principal Ma'am, Dr. Atashi Karpha, for her valued support.

I would further like to express my gratitude and thanks to all my teachers in the Department of Economics of the college for their kind co-operation.

Meghamanti Bhattacharya 24.05.2022

Dated
Kolkata – 700 020
24th May, 2022

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Introduction

An ecosystem is a dynamic aggregation of plants, animals and birds, micro-organism communities etc. along with non-living environment, interacting to each other as a functional unit. The organisms living in an ecosystem are broken down into categories: producers, consumers, and decomposers.

The pond ecosystem is a fresh water environment that can reveal the health of a local area. Fresh water environments such as the pond ecosystem have specific life forms that show its overall health. Toxins or pollution can affect the pond ecosystem adversely. The importance of understanding the pond ecosystem involves the life forms and plant cultures that are part of the healthy environment.

The pond ecosystem begins with what lives in the water. From the smallest microbes, single-cell creatures to the guppies, leeches and midges, only clean water can sustain life. The plants that convert oxygen for these creatures are as important as the fauna.

A healthy pond ecosystem will have a balance of both plant and animal living within its parameters. Studying the balance between plant and animal and soil, sedges and underlying strata can give an overall view of the quality of the water table and land.

Leeches have long been an indicator of the pond ecosystems health status. Leeches are found where water quality is good. If the pond ecosystem is not balanced, or there are impurities in the water that the life forms cannot deal with, then one of the first to suffer or leave the environs is the humble leech. Birds, spiders, lizards, rodents, rabbits and larger mammals are all reliant on a healthy pond ecosystem. Without clear clean water, filtered by ample plant life or good drainable soil, the larger animals will need to find other sources of water.

There are some abiotic factors, too, that can have an impact on the pond ecosystem. They are non-living factors. The main abiotic factors of ponds include water quality, temperature, light, soil, and seasonal change.

There is a food chain from tiny water-borne creatures to animals. Water-borne creatures feed midges and insects. Again, midges and insects feed birds, frog etc. that, in turn, feed snakes etc. and terrestrial carnivorous animals. All depend on the pond ecosystem to sustain their lives. Water is essential to life on this planet. Fresh water and the quality of fresh water in the pond ecosystem is actually of global importance.

In this frame of reference, this project is to look into a pond ecosystem in my neighbourhood and to study it with some specific theoretical backdrop.

Objectives of the Project

The objectives of this project are :

1) To study how a pond can form an ecosystem,
2) To study the organisms going and living in the pond habitat
3) To know the food chain existing in that water bo
4) To know producers, consumers and decomposers there
5) To create awareness about the importance of pond in the environment in myself and others living in my surroundings.

Execution of the Project

I, Meghamanti Bhattacharya, visited one of my neighbourhood ponds on 10th May, 2022. With the frame of the theoretical backdrop in my mind, I observed the pond ecosystem, identified some of the aquatic organisms associated with that pond and noted down the information – listed the plants growing on and around the pond, the insects, the fishes and the animals, visible in naked eye. To complete the work, I took some assistance from the local people who were then fishing there.

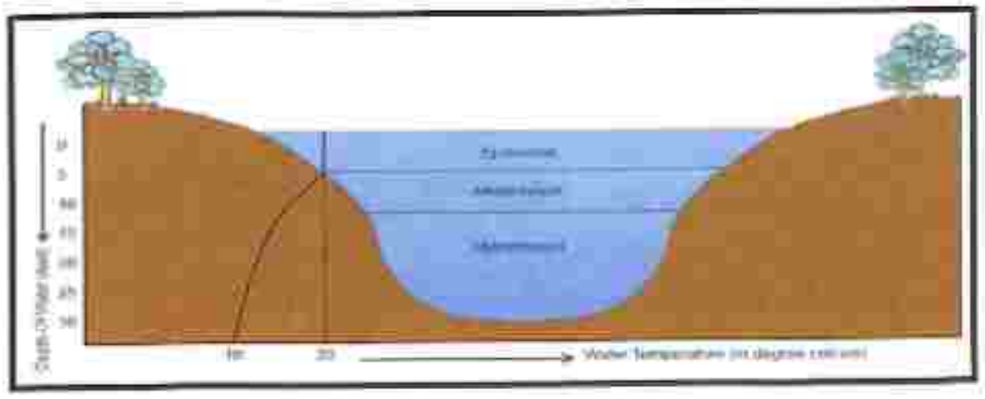
Theoretical Backdrop

Pond Ecosystem

A pond is a quiet body of water that is too small for wave action and too shallow for major temperature differences from top to bottom. It usually has a muddy or silty bottom with aquatic plants around the edges and throughout.

Generally, in a pond, the temperature changes with the air temperature and is relatively uniform. The temperature of the pond water also varies from layer to layer. The temperature of the upper surface of the pond is almost 30°C. Generally, the temperature of pond water decreases with increase in depth. According to the temperature of water we can classify pond water into three different layers.

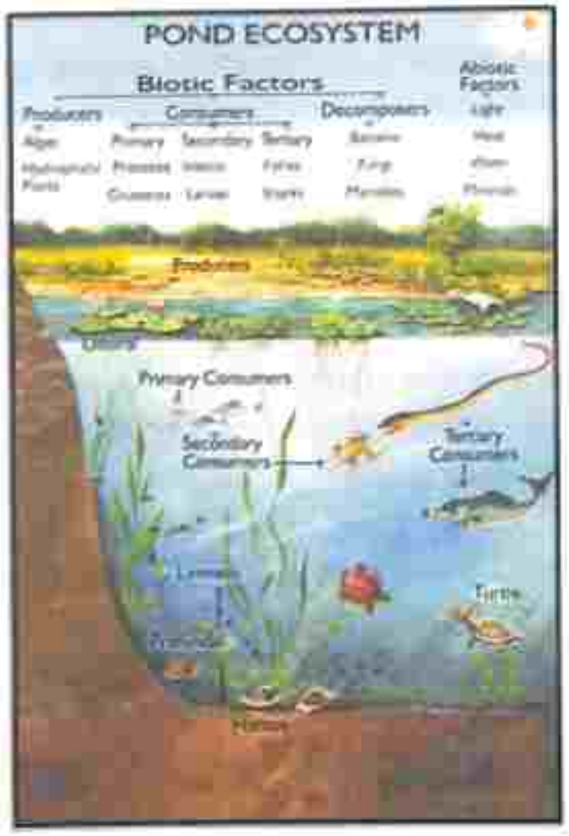
1. **Epilimnion** is the uppermost layer of pond. The temperature is almost 25 - 30°C.
2. **Metalimnion** is the second layer which is just below the Epilimnion. The temperature of this layer is about 20 - 25°C.
3. **Hypolimnion** is the lowermost layer where the temperature is 15 - 20°C.



The pond water may also be divided into three layers as follows.

1. **Littoral layer** is the marginal layer of the pond and good habitat for plants. The producer of this layer are the rooted plants and phytoplankton.
2. **Limnetic layer** is the lower layer of littoral region. It is the habitat for fish.
3. **Profundal layer** is the lowermost layer, the habitat of microbes i.e., decomposers.

Ponds get their energy from the sun. As with other ecosystems, plants are the primary producers. The chlorophyll in aquatic plants captures energy from the sun to convert carbon dioxide and water to organic compounds and oxygen through the process of photosynthesis. Nitrogen and phosphorus are important nutrients for plants. The addition of these substances may increase primary productivity. However, too many nutrients can cause algal blooms, leading to eutrophication.



The pond is the simplest aquatic ecosystem to observe. There are differences in a pond that is temporary and has water only in the monsoon, and a larger tank or lake that is an aquatic ecosystem throughout the year. Most ponds become dry after the rains are over and are covered by terrestrial plants for the rest of the year. When a pond begins to fill during the rains, its life forms such as the algae and microscopic animals, aquatic insects, snails, and worms come out of the floor of the pond where they have remained dormant in the dry phase. Gradually more complex animals such as crab frogs and fish return to the pond. The vegetation in the water consists of floating weeds and rooted vegetation on the periphery which grow on the muddy floor under water and emerge out of the surface of the water. As the pond fills in the monsoon a large number of food chains are formed. Algae is eaten by microscopic animals, which are in turn eaten by small fish on which larger carnivorous fish depend. These are in turn eaten by birds such as kingfishers,

herons and birds of prey. Aquatic insects, worms and snails feed on the waste material excreted by animals and the dead or decaying plant and animal matter. They act on the detritus, which is broken down into nutrients which aquatic plants can absorb, thus completing the nutrient cycle in the pond. The temporary ponds begin to dry after the rains and the surrounding grasses and terrestrial plants spread into the moist mud that is exposed. Animals such as frogs, snails and worms remain dormant in the mud, awaiting the next monsoon.

Pond Biodiversity

A defining feature of a pond is the presence of standing water which provides habitat for a biological community, commonly referred to as pond life. Because of this, many ponds contain large numbers of endemic species that have gone through adaptive radiation to become specialised in their preferred habitat. Familiar examples might include water lilies and other aquatic plants, frogs, turtles, fishes, snakes etc.

Often, the entire margin of the pond is fringed by wetland, and these wetlands support the aquatic food web, provide shelter for wildlife and stabilise the shore of the pond. This margin is also known as the littoral zone and contains much of the photosynthetic algae, and plants of this ecosystem called macrophytes. Other photosynthetic organisms such as phytoplankton (suspended algae) and periphytons (organisms including cyanobacteria, detritus, and other microbes) thrive here and stand as the primary producers of pond food webs. Some grazing animals like geese and muskrats consume the wetland plants directly as a source of food. In many other cases, pond plants will decay in the water. Many invertebrates and herbivorous

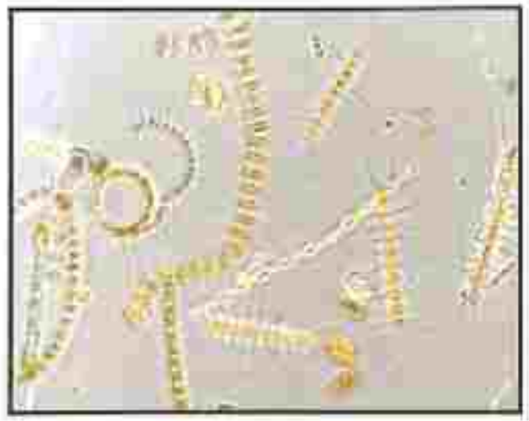
zooplankton then feed on the decaying plants, and these lower trophic level organisms provide food for wetland species including dragonflies, fish and herons both in the littoral zone and the limnetic zone. The open water limnetic zone may allow algae to grow as sunlight still penetrates here. These algae may support yet another food web that includes aquatic insects and other small fish species. A pond, therefore, may have combinations of three different food webs, one based on larger plants, one based upon decayed plants, and one based upon algae and their specific upper trophic level consumers and predators. Hence, ponds often have many different animal species using the wide array of food sources though biotic interaction. They, therefore, provide an important source of biological diversity in landscapes.

Opposite to long standing ponds are vernal ponds. These ponds dry up for part of the year and are so called because they are typically at their peak depth in the spring (the meaning of "vernal" comes from the Latin word for spring). Naturally-occurring vernal ponds do not usually have fish, a major higher tropic level consumer, as these ponds frequently dry up. The absence of fish is a very important characteristic of these ponds since it prevents long chained biotic interactions from establishing. Ponds without these competitive predation pressures provides breeding locations and safe havens for endangered or migrating species. Hence, introducing fish to a pond can have seriously detrimental consequences. In some parts of the world, such as California, the vernal ponds have rare and endangered plant species. On the coastal plain, they provide habitat for endangered frogs such as the Mississippi Gopher Frog.

Often groups of ponds in a given landscape – so-called 'ponds capes' – offer especially high biodiversity benefits compared to single ponds. A group of ponds provides a higher degree of habitat complexity and habitat connectivity.

Pond Ecosystem Producers

Phytoplankton



Phytoplankton are the autotrophic components of the plankton community and a key part of ocean and freshwater ecosystems. They are self-feeding organisms Phytoplankton obtain energy through the process of photosynthesis and must therefore live in the well-lit surface layer of a body of water. Phytoplankton account for about half of all photosynthetic activity on Earth. Their cumulative energy fixation in carbon compounds (primary production) is the basis for the vast majority of oceanic and also many freshwater food webs (chemosynthesis is a notable exception).

Periphyton

Periphyton is a complex mixture of algae, cyanobacteria, heterotrophic microbes, and detritus that is attached to submerged surfaces in most of the aquatic ecosystems. Periphyton serves as an important food source for invertebrates, tadpoles, and some fish. It can also absorb contaminants by removing them from the water column and by limiting their movement through the environment.

The periphyton is also an important indicator of water quality; responses of this community to pollutants can be measured at a variety of scales representing physiological to community-level changes. Periphyton has often been used as an experimental system in, e.g., pollution-induced community tolerance studies.

Macrophytes

Aquatic plants are referred to as hydrophytes or macrophytes to distinguish them from algae and other microphytes. They have adapted to living in aquatic environments. A macrophyte is a plant that grows in or near water and is either emergent, submergent, or floating. In the body of water, macrophytes provide cover for fish, substrate for aquatic invertebrates, produce oxygen, and act as food for some fish and wildlife. Macrophytes are primary producers and are the basis of the food web for many organisms. They have a significant effect on soil chemistry and light levels as they slow down the flow of water and capture pollutants and trap sediments. Excess sediment will settle into the benthos aided by the reduction of flow rates caused by the presence of plant stems, leaves and roots. Some plants have the capability of absorbing pollutants into their tissue. Seaweeds are multicellular marine algae and, although their ecological impact is similar to other larger water plants, they are not typically referred to as macrophytes.

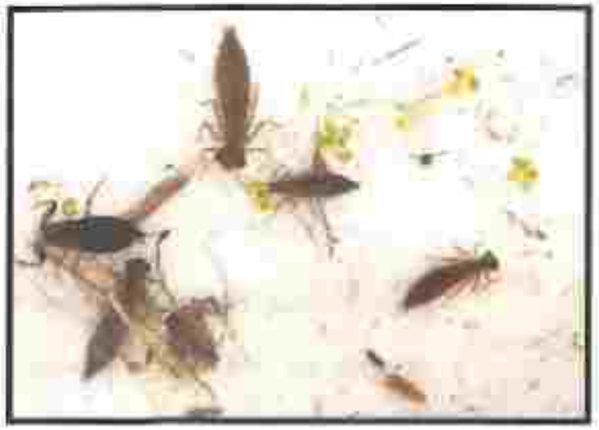
Pond Ecosystem Consumers

Zooplankton

Zooplanktons are animal component of the planktonic community. They are heterotrophic, meaning they cannot produce their own food and must consume instead other plants or animals as food. In particular, this means they eat phytoplankton.

Zooplanktons are generally larger than phytoplankton, mostly still microscopic but some can be seen with the naked eye. Many protozoans are zooplankton; among them zooflagellates, foraminifera, radiolarians, some dinoflagellates and aquatic micro animals are included. Macroscopic Zooplankton include pelagic cnidarians, ctenophores, molluses, arthropods and tunicates, as well as planktonic arrow worms and bristle worms. Through their consumption and processing of phytoplankton and other food sources, zooplankton play a role in aquatic food webs, as a resource for consumers on higher trophic levels (including fish), and as a conduit for packaging the organic material in the biological pump.

Aquatic invertebrates



Aquatic invertebrates are the invertebrates that live in any water habitats. Freshwater crustaceans include water fleas and are a food supply for fish. The larvae of some insects (including dragonflies) develop and grow in water but leave when they reach the adult stages of their life cycles. Many spiders live by ponds and build their webs close to the water's edge, where flies and other insects can be trapped. The water spider lives under water. Worms that live in ponds can find shelter in the soft mud that lies on the bottom. Mollusks, animals with soft bodies sometimes being protected by shells, found in ponds include freshwater snails and mussels. Snails, microcrustaceans, aquatic

mites, springtails, chironomids, and a high diversity of Hemiptera and Coleoptera are characteristic of these habitats. Pond-skaters, water snails, leeches and worms, water beetles, water boatmen, freshwater mussels, larvae (caddisfly, alderfly, dragonfly and damselfly to name a few) are some of more likely suspects that one might see in a body of water. The three main evolved strategies by which invertebrates survive in temporary ponds are physiological tolerance, life history modification, and migration.

Aquatic Vertebrates

Vertebrates are animals with backbones. In a pond, these might include fish, frogs, salamanders and turtles. Many types of fish, amphibians, birds, and mammals live in pond habitats. Fish spend their whole lives in water. Amphibians such as frogs, toads, and newts lay their eggs in water, where their larvae (tadpoles) develop and grow into adults. Water birds such as ducks, herons, and geese nest near to the water's edge and get food from the pond itself. Mammals like water voles and water shrews build burrows at the water's edge and are good swimmers.

Pond Ecosystem Decomposers

Animal waste and dead and decaying plants and animals form detritus on the bottom of the pond. Decomposers, also known as detritovores, are bacteria and other organisms that break down detritus into material that can be used by primary producers,

thus returning the detritus to the ecosystem. As this material decomposes it can serve as a food resource for microbes and invertebrates. During decay, microbes living on detritus can pull nutrients from the overlying water thus acting to improve water quality. In the process of breaking down detritus, decomposers produce water and carbon dioxide.

Pond Ecosystem Abiotic Components

Abiotic factors are non-living factors that can have an impact on the ecosystem The main factors of ponds include water quality, temperature, light, soil, and seasonal change. Water is an important abiotic factor. The quality of water is crucial for living organisms in the pond. The temperature could impact the ecosystem if they are at the extremes. Water that is too hot will not have as much oxygen for the fish and they will in return become weak and prone to parasites and diseases. Too low of a water temperature also puts the aquatic ecosystem under stress and the fish can die off in large amounts. pH is also taken into consideration because too low or too high of acidity in the water can clog a fish's gills and reproduction will be more challenging. The lay of the land and the soil is of importance as well. The soil needs to contain enough moisture to keep the surrounding plants alive. If the soil or ground is dry, it is less likely to sustain a live or growing plant in comparison to moist, fertile soil that will help the plant stay alive. Light is also an abiotic factor in this ecosystem. Plants need light for photosynthesis so they can produce oxygen not only above the water but below as well to sustain healthy oxygen levels for aquatic organisms. Fish also need light in the form of heat from the sun to keep the water at a regular temperature. The change of seasons has an impact on the pond. This is because the temperature and climate are not extreme enough to have

a great impact on the oxygen and nutrient level. In the winter time, because of the low temperatures, oxygen from the water can even disappear from in the water if it is too cold. In the summer, the temperature of the water can become too warm and again hold less oxygen for the aquatic organisms. Too much sunlight can impact the pond because the algae is growing too fast, therefore crowding space for the fish.

Observations and Data Collection

1. **Name of the Pond** : No particular name

2. **Position of The Pond** : Neighbourhood; Natunpara, Behala, Kolkata – 700 008

3. **Date of observation** : 10th May, 2022

4. **Plants growing around the pond** : Ipomoea Aquatica (Kalmi), Persicaria Orientale (Panimarich), Persicaria Hydropiper (Bihagoni), Rumex Dentatus (Jangli Palang), Elaeocharis Dulcis (Jalmotha), Fuirena Cilliaris (Bondakola), Scoenoplectus Articulates (Chatpati), Echinochloa Colona (Shyamaghash).

5. **Plants growing on the pond** : Monochoria Hastate (Nilopalam), Hydrilla Verticellata (Jhajhi), Vallisnaria Spiralis (Patascola), Ceratophyllam Demersum (Chotojhajhi), Nymphaea Pubescens (Shaluk), Nelumbo Nucifera (Padma), Lemna Minor (Kshudepana), Green And Blue-Green Algae.

6. **Animals inhabiting the pond** : Small Fish, Small Prawn, Lata Fish, Rohu Fish, Toad, Frog, Tadpole, Snail, Leech, Crab.

7. **Insects inhabiting the pond** : Water Spider, Water Beetles, Cyclops, Mosquito Larvae.

8. **Birds falling back on the pond** : Kingfisher, Duck, Cormorant, Crane.

Data Analysis

From the above data, it is evident that a food chain between the organisms living in the pond exists. An ecosystem has also been formed in the pond. The producers of this

ecosystem are the algae and the green plants. The primary consumers are the small insects like Water Spider, Cyclops, Mosquito Larvae etc. The secondary consumers are Toad, Frog, Duck and small Fishes. The tertiary consumers are large Fishes, Kingfishers etc.

Some information of few observed animals is noted in the following table.

Animal	Respiratory Organ	Locomotive Organ	Food	Primary Stage of Life Cycle
Small Fishes	Gills; intakes water dissolved oxygen	Fins and Tail	Water insects and algae	Eggs
Prawn	Gills; intakes water dissolved oxygen	Belly legs	Water insects and algae	Eggs
Toad	Lungs and Skin	Two pairs of webbed legs	Water insects	Eggs and tadpoles
Duck	Lungs	One pair of webbed legs	Water insects, molluses and small fishes	Eggs
Cormorant	Lungs	One pair webbed leg and wing	Molluses and small fishes	Eggs
Mosquito	Larvae and pupa stage respire through siphon tube	Larvae swim on water, adult flies with wings	Female sucks mammalian blood and male sucks plant sap	Eggs, larvae and pupa
Snail	Ctenidium and pulmonary sac	Body covered by a shell. Locomotory organ is muscular foot attached with operculum	Small aquatic organisms	Egg and larvae

Limitation of the Work

During observation I found that many zooplanktons are unknown to me. Their names are even not known to me. I could not identify them in spite of my sincere efforts. This is the main limitation of my work. Again, for the observation of ecosystem, it is essential to observe all the organisms, from the producers to the decomposers. But I could not examine any decomposers of the pond that I studied, mainly due to lack of infrastructures and other references. The decomposers are usually microscopic and it is difficult to identify them in naked eyes. I can only state that microscopic organisms act as decomposers in our ecosystem. This is also another limitation of my work. Moreover, I do not know swimming so that detailed active work by going down into the water could not be performed. This is another major limitation of the work.

Inference from the Work

From the above collected data it is evident that each and every organism of the pond are somehow inter-related with each other and they, together, form one or more ecosystem. The temperature of the upper layer of the pond is comparatively warmer than that of the lower layer. The producers of the pond ecosystem grow on littoral zone. Though the consumers live on the limnetic zone but they travel to the limnetic zone for their food. It may be mentioned that I observed some kind of pollution in the water of the concerned pond.

There are mainly four habitats in a pond ecosystem, namely shore, surface film, open water and bottom water habitats.

Shore Habitat: The organisms inhabiting this habitat vary depending upon whether the shore is rocky, sandy or muddy. In case of rocky shores, plants might not be able to grow, whereas in muddy or sandy or mixed type, plants like grasses, algae and rushes can be present along with organisms such as earthworms, protozoa, snails, insects, small fishes and microorganisms.

Surface Film Habitat: Surface film habitat, as the name suggests, implies to the surface of the pond. In general, insects like water striders and marsh traders, organisms that are free-floating and those that can walk on the surface of water inhabit the surface habitat. They nourish on the floating plants, dead insects and, sometimes, feed upon each other.

Open Water Habitat: Open water habitat is inhabited by fishes and the plankton (tiny organisms). Both phytoplankton (such as algae) and zooplankton (such as insect larvae, rotifers, tiny crustaceans and invertebrates) are present in this habitat. Fishes feed on different kinds on planktons.

Bottom Water Habitat: Depending upon whether the pond has shallow or deep water, the bottom habitat varies. For example, if a pond is shallow and has sandy bottom, organisms like earthworms, snails and insects inhabit the bottom, and whereas if the pond is deep and has muddy bottom, microorganisms, flatworm, rat-tailed maggot and nymphs of dragonflies mostly inhabit the bottom habitat.

Problems and importance of problems

Pond as a water body in an environment has great importance. Its water meets various demands of the rural area. The local people are dependent on pond for bathing and washing of utensils, clothes, etc. A pond water is even used as drinking water, but for the pond that I visited it is not the case. Unfortunately, due to lack of awareness the ecosystem of a pond is disturbed by the human activities. Pond can also be polluted due to cattle bathing, domestic wastes, and also by human excretions etc., though I did not observe such incidents during my visit. As the water body is the habitat of various organisms, the balance in ecosystem is disturbed, and even abolition of ecosystem is occurred owing to pollution of a pond. For this reason, the maintain of pond ecosystem is very important.

The biodiversity of pond ecosystems is currently threatened by a number of anthropogenic disturbances including well-known problems such as eutrophication, acidification and contamination from heavy metals and organochlorines.

These are a specific type of freshwater ecosystems that are largely based on the autotroph algae which provide the base trophic level for all life in the area. The largest predator in a pond ecosystem is generally fish, and in-between range smaller insects and microorganisms. It may have a scale of organisms from small bacteria to big creatures like water snakes, beetles, water bugs, frogs, tadpoles, and turtles. This is important for the environment.

Due to the pressure of increased population, everyday, somewhere, at least one natural water body or pond is soiled for the construction of housing complex. This is a burning problem now and its influence is long standing. People should be aware of soiling of natural body or pond. Ponds can support an economy through fishery, pearl culture etc. Ponds can resist flood by holding excess water in rainy season. It can also act as a natural refinery of dirty water. The dry part of the water body can be used for

grazing. Therefore, the importance of pond in environment is multipurpose; so the study of pond ecosystem and its preservation is important.

Aquatic ecosystems perform many important environmental functions. For example, they recycle nutrients, purify water, attenuate floods, recharge ground water and provide habitats for different organisms. Pond ecosystems are also used for human recreation and are very important to the tourism industry, too.

The health of an aquatic ecosystem is degraded when the ecosystem's ability to absorb a stress has been exceeded. A stress on an aquatic ecosystem can be a result of physical, chemical or biological alterations of the environment. Physical alterations include changes in water temperature, water flow and light availability. Chemical alterations include changes in the loading rates of bio-stimulatory nutrients, oxygen consuming materials, and toxins. Biological alterations include the introduction of exotic species. Human population can impose excessive stress on aquatic ecosystems.

Conclusion

Ponds provide not only environmental values, but practical benefits to society. One increasingly crucial benefit that ponds provide is their ability to act as greenhouse gas sinks. Most natural lakes and ponds are greenhouse gas sources and aid in the flux of these dissolved compounds. However, manmade farm ponds are becoming significant sinks for gas mitigation and the fight against climate change. These agriculture runoff ponds receive high pH level water from surrounding soils. Highly acidic drainage ponds act as catalysis for excess Carbon Dioxide to be converted into forms of carbon that can easily be stored in sediments. When these new drainage ponds are constructed, concentrations of bacteria that normally break down dead organic matter, such as algae, are low. As a result, breakdown and release of Nitrogen gasses from these organic materials such as N_2O does not occur and thus, not added to our atmosphere. This process is also used with regular denitrification in anoxic layer of ponds. However, not all ponds have the ability to become sinks for greenhouse gases. Most ponds

experience eutrophication were faced with excessive nutrient input from fertilizers and runoff. This over-nitrifies the pond water and results in mass algae blooms and local fish kills.

Some farm ponds are not used for runoff control but rather for livestock like cattle or buffalo as watering and bathing holes. Ponds are important hotspots for biodiversity. Sometimes this becomes an issue with invasive or introduced species that disrupt pond ecosystem dynamics such as food-web structure, niche partitioning, and guild assignments. This varies from introduced fish species such as the Common Carp that eat native water plants or Northern Snakeheads that attack breeding amphibians, aquatic snails that carry infectious parasites that kill other species, and even rapid spreading aquatic plants like Hydrilla and Duckweed that can restrict water flow and cause overbank flooding.

Ponds, depending on their orientation and size, can spread their wetland habitats into the local riparian zones or watershed boundaries. Gentle slopes of land into ponds provides an expanse of habitat for wetland plants and wet meadows to expand beyond the limitation of the pond. However, the construction of retaining walls, lawns, and other urbanized developments can severely degrade the range of pond habitats and the longevity of the pond itself. Roads and highways act in the same manner, but they also interfere with amphibians and turtles that migrate to and from ponds as part of their annual breeding cycle and should be kept as far away from established ponds as possible. Because of these factors, gently sloping shorelines with broad expanses of wetland plants not only provide the best conditions for wildlife, but they help protect water quality from sources in the surrounding landscapes. It is also beneficial to allow water levels to fall each year during drier periods in order to re-establish these gentile shorelines.

In landscapes where ponds are artificially constructed, they are done so to provide wildlife viewing and conservation opportunities, to treat wastewater, for sequestration and pollution containment, or for simply aesthetic purposes. For natural

pond conservation and development, one way to stimulate this is with general stream and river restoration. Many small rivers and streams feed into or from local ponds within the same watershed. When these rivers and streams flood and begin to meander, large numbers of natural ponds, including vernal pools and wetlands, develop.

With human activity impacting on the pond environment, toxins can affect the quality of the pond ecosystem. If toxins affect the water, plants can die. Without plants to add oxygen to the water, the creatures might perish. Without the smallest life forms in the food chain, the ripple effect can lead to other species dying out or leaving the pond environment.

Human activity on the pond ecosystem affects the quality and purity of its soil and water. Fertilizer, oil, introduced species, pollution, fishing – all can upset the delicate balance that exists in a healthy pond ecosystem. Maintaining the balance, keeping every species alive and in good number will ensure a healthy, vital pond ecosystem. Fresh water, climate, drought, humidity, rising salinity are all important factors that can affect the pond ecosystem beyond the initial impact of human activity.

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Samanta 25/05/2022

UNIVERSITY OF CALCUTTA

ENVIRONMENTAL STUDIES PROJECT

Environmental Justice

PARTICIPANT'S PROFILE

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SUBJECT : ENVIRONMENTAL STUDIES (ENVS)

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I am making this project, not only for marks, but to also increase my knowledge.

INTRODUCTION

Environment can be roughly defined as "the sum total of all conditions and influences that affect the life and development of organisms". Life originated and flourished on earth because of the environment. Every organism influences its environment and in turn, gets influenced by it. We are an integral part of the environment. Among all, man influences environment the most and can also modify the environment to some extent as per his needs. Changes in environment affects us. Rapid population growth, industrialization, faster modes of transport, urbanization and increasing human activities has contributed to the pollution of environment. Environmental pollution causes serious problems like global warming, depletion of ozone layer, extinction of biodiversity, etc. Large scale degradation not only causes degra but may jeopardise the very existence of human society. Deforestation, poaching and pollution upset the ecological balance and thus leads to environmental crisis. It is a catastrophic situation in which the normal pattern of life or ecosystem has been disrupted, which needs timely interventions to save and protect the environment. The causes can be manmade, accidents or negligence. However, not everyone gets affected by the degradation uniformly. The poor and marginalised tend to disproportionately bear the brunt of environmental degradation, due to three main reasons:-

- Firstly, they are more vulnerable to environmental hazards.
- Secondly, such people often lack the means to protect themselves from the pernicious impacts of environmental hazards.
- Thirdly, research shows that low-income households depend more on natural

resources for their income, compared to their richer counterparts. The lives of indigenous communities can be irreparably affected if the forests they depend on gets destroyed. Research showed that environmental factors such as air pollution erosion of natural capital and continued impact of natural hazards were significant factors that contributed to burgeoning income inequality within countries, since 1990s.

Limiting environmental degradation itself and protecting ecosystems is the first best solution. But we also have to ensure that the inequality be addressed. Recognizing and ensuring the right to healthy environment within constitutions would greatly bolster these policies to disrupt the link between environmental degradation and income inequality. For this, environmental justice is required.

ENVIRONMENTAL JUSTICE

Environmental justice (EJ) is the fair treatment and meaningful involvement of all people regardless of race, colour, national origin or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies.

Fair treatment means no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies.
Meaningful involvement means:-

- People have an opportunity to participate in decisions about activities that may affect their environment and/or health;
- The public's contribution can influence the regulatory agency's decision.
- Community concerns will be considered in the decision-making process; and
- Decision makers will seek out and facilitate the involvement of those potentially affected.

This definition was formulated by the United States Environmental Protection Agency.

HISTORY

The environmental justice movement was started by individuals, primarily people of colour, who sought to address the inequity of environmental protection in their communities. Professor Robert Bullard wrote, "Whether by conscious design or institutional neglect, communities of colour in urban ghettos, in rural poverty-pockets, or on economically impoverished Native-American reservations face some of the worst environmental devastation in the nation." The Civil Rights Movement of the 1960s sounded the alarm about the public health dangers for their families, their communities and themselves.

Many point to 1982, when North Carolina had announced a plan to move soil contaminated with PCBs (Polychlorinated Biphenyl) from alongside 240 miles of the state's roadsides to a landfill located in Warren County, one of only a few counties in the state with a majority black population. The decision triggered a wave of protest, one of which resulted in the arrest of a U.S. congressman and dozens of other activists who tried to block the PCB-laden trucks at the entrance to the landfill.
Environmental advocates lost that battle- North Carolina ultimately buried the PCBs in Warren County- but the controversy crystallized the idea that the nation's environmental problems disproportionately burden its low-income people of colour.
Other communities of colour had organized to oppose environmental threats before Warren County:-

- In the early 1960s, Latino farm workers led by Cesar Chavez fought for workplace rights, including protection from harmful pesticides in the farm fields of California's San Joaquin Valley.
- In 1967, African-American students took to the streets of Houston to oppose a city garbage dumps in their community that had claimed the life of a child.
- In 1968, residents of West Harlem, in New York City, fought unsuccessfully against a sewage treatment plant in their community. But, the Warren County protests marked the first instance of an environmental protest by people of colour garnering widespread national attention.

By 1990, leaders of the growing environmental justice movement began to look for allies among traditional, primarily white environmental organizations. These were groups that had fought long to protect wilderness, endangered species, clean air and water. But historically, they had little or no involvement in the environmental struggles of people of colour under constant assault from neighbouring hazardous waste, landfills, waste transfer stations,

incinerators, garbage dumps, diesel bus, and truck garages, auto body shops, smokestack industries, industrial hog and chicken processors, oil refineries, chemical manufacturers and radioactive waste storage areas.
That year, several environmental justice leaders signed a widely publicized letter to the 'Big 10' environmental groups, including NRDC (Natural Resources Defence Council), accusing them of racial bias in policy development, hiring and the makeup of their boards and challenging them to address toxic contamination in the communities and workplaces of people of colour and the poor. As a result, some mainstream environmental organizations developed their first environmental justice initiatives, added people of colour to staff and resolved to take environmental justice into account when making policy decisions.

PRINCIPLES OF ENVIRONMENTAL JUSTICE

Environmental justice is a social movement that originated from the need to ensure healthy environments for all communities, regardless of colour, income, place of origin or race. For this reason, 17 principles of environmental justice were drafted and adopted by delegates to the first National People of Colour Environment Leadership Summit held in October 1991, in Washington D.C. Since, these principles have served as the cornerstone for environmental justice. They are :-

1. Environmental Justice affirms the sacredness of Mother Earth, ecological unity and the interdependence of all species, and the right to be free from

ecological destruction.
2. Environmental Justice demands that public policy be based on mutual respect and justice for all peoples, free from any form of discrimination or bias.
3. Environmental Justice mandates the right to ethical, balanced and responsible uses of land and renewable resources in the interest of a sustainable planet for humans and other living things.
4. Environmental Justice calls for universal protection from nuclear testing, extraction, production and disposal of toxic/hazardous wastes and poisons and nuclear testing that threaten the fundamental right to clean air, land, water and food.
5. Environmental Justice affirms the fundamental right to political, economic, cultural and environmental self-determination of all peoples.
6. Environmental Justice demands the cessation of the production of all toxins, hazardous wastes and radioactive materials, and that all past and current producers be held strictly accountable to the people for detoxification and the restoration of the environment at the point of production.
7. Environmental Justice demands the right to participate as equal partners at every level of decision-making including needs assessment, planning, implementation, enforcement and evaluation.
8. Environmental Justice affirms the right of all workers to a safe and healthy work environment without being forced to choose between an unsafe livelihood and unemployment. It also affirms the right of those who work at home to be free from environmental hazards.
9. Environmental Justice protects the right of victims of environmental injustice to receive full compensation and reparation for damages as well as quality health care.
10. Environmental Justice considers government acts of environmental injustice a violation of International law, the Universal Declaration On Human Rights and the United Nations Convention on Genocide.

11. Environmental Justice must recognise a special legal and natural relationship of Native Peoples to the U.S. government through treaties, agreements, compacts and covenants affirming sovereignty and self-determination.
12. Environmental Justice affirms the need for urban and rural ecological policies to clean up and rebuild our cities and rural areas in balance with nature, honoring the cultural integrity of all our communities and provided fair access for all to the full range of resources.
13. Environmental Justice calls for strict enforcement of principles of informed consent and a halt to the testing of experimental reproductive and medical procedures and vaccinations on people of colour.
14. Environmental Justice opposes the destructive operations of multinational corporations.
15. Environmental Justice opposes military occupation, repression and exploitation of lands, peoples and cultures and other life forms.
16. Environmental Justice calls for the education of present and future generations which emphasizes social and environmental issues, based on our experience and an appreciation of our diverse cultural perspectives.
17. Environmental Justice requires that we, as individuals, make personal and consumer choices to consume as little of Mother Earth's resources and to produce as little waste as possible, and make the conscious decision to challenge and reprioritize our lifestyle to ensure the health of the natural world for present and future generations.

IMPORTANCE

1. It defines human relationship with the environment. The human relationship with the environment revolves around perception and value and the role that

these two play in our behaviour and lives. Those who are empowered on environmental issues understand that it protects humanity and other lives by protecting the environment.
2. It highlights the importance of conservation and fair usage of natural resources. People get to conserve natural resources when they follow environmental justice. Given that communities debate over justice when it comes to distributing available resources like water fairly, it ensures the resources are used wisely. For eg, unfair distribution and usage of natural resources can be dangerous especially in areas where they are scarce. E.J. therefore emphasizes on fair distribution and opposes wastage. When the principles are followed, injustices associated with natural resources are forgotten and things like waste and clashes over usage of natural resources are forgotten.
3. Sustainability can only be well comprehended through environmental justice. Sustainability revolves a lot around the indefinite time renewable resources can be harvested while population reduces & humanity can stop being overly dependent on non-renewable resources. Justice is about which rights are owed to what or who and assigning the right treatments appropriate to behaviour and circumstances. Sure, sustainability might be in a distant future, but the actions we take in the present through environmental justice initiatives take us a step forward towards it.
4. It defines the need for just distribution of resources (distributive justice). Because, it is not wrong for one person to have more resources than others, distributive justice is not about equally sharing resources. Just distribution of resources revolves around how the people involved are involved with one another. Justice applies not when one has more resources than another, but if one person takes resources from another person's environment. It also applies when one has more resource than they need while another is suffering for lacking any. This is injustice. E.J. thus emphasizes on the law of distribution.
5. It strengthens environmental laws, policies and regulations. Justice falls under two categories; procedural justice which revolves around how policies are decided on and consequentialist justice which is what comes off those

decisions and actions. For procedural justice, the rights of people have to be respected in making decisions. Since it redistributes benefits and burdens, environmental justice supports the policies about the environment. The principles of environmental justice supports and strengthens environmental laws through equal distribution of resources and laws regarding pollution.

ENVIRONMENTAL JUSTICE ISSUES

Issues of environmental burdens that may be considered under the umbrella of environmental justice covers many aspects of community life. These burdens can include any environmental pollutant, hazard or disadvantage that compromises the health of a community or its residents. For instance, one of the environmental justice end examples is inadequate access to healthy food. Certain communities, particularly lower-income or minority communities, often lack supermarkets or other sources of healthy and affordable foods.

Another issue is inadequate transportation. While public transportation may be available in urban areas, policies must be monitored to avoid cuts in service and fare hikes that make it difficult for community residents to pursue employment or an adequate living standard.

Air and water pollution are major environmental justice issues. Because many lower-income or minority communities are located near industrial plants or waste disposal sites, air and water quality can suffer if not properly monitored.

These communities may also contain older and unsafe homes. Older homes are more likely to have lead-based paint that can chip and find its way into the dust and soil surrounding the home, leading to illness. These homes may also be prone to structural problems, molds or other hazards that put

residents at higher risks of health problems.

EXAMPLES OF ENVIRONMENTAL JUSTICE

The following are examples of environmental justice over the years and cases where environmental justice was applied. According to Ejolt, only about 35% of cases in environmental justice cases reach any sort of conclusion compared to 17% of the global cases. As these numbers suggest, in most cases justice is not exactly served, but in some, environmental justice is followed.

1. 1972, Pittston Coal :- The case by workers against the Pittston Coal company is one of the successful environmental cases. It was after the workers strike following Pittston Company terminating health care benefits for retirees, widows and miners who are disabled and the displacement of thousands of people causing an environmental nightmare of epic proportions. The company's sludge by-products flowed from uphill creating sludge dams that were ignored by the company. In February, 1972, the dams gave way and ended up displacing so many people by turning the ground to marsh. It is for this reasons that Legal action was taken against the company to settle these people.

2. 1989, Exxon Valdez Disaster :- This is one of the most known environmental disasters and cases where environmental justice applied. An oil tanker, Exxon Valdez, containing

Thirty eight gallons of crude oil ran aground. This was at a Prince William Bligh reef, which is off-shore Alaska. It killed marine life for thousand of miles within the ocean and it continued for many years thereafter. Exxon Oil Company paid billions in fine and litigation in addition to taking care of clearing up.

3. 1993, Chevron Refining :- In 1993, Chevron Refining company wanted to expand its operations to Richmond in California. There was much opposition due to concerns for the health of the locals and environmental pollution. Chevron ignored these and went ahead with operations. Citizens, however formed coalitions called the county toxics coalitions. The coalitions formed a judicial pact with the company that allowed it to continue operations as long as they provided a five million dollar grant funding the city's future environmental programs. The coalitions are effective to this day.

4. 2010, B.P. :- B.P. is an oil company, that is known and operates internationally. In 2010, however, they caused the worst disaster ecologically speaking yet. While B.P. was pumping oil from the gulf of Mexico at the ocean floor, the rig exploded resulting in a rupture of the highly pressurized pipeline full of oil. Millions of gallons of oil spilled and since there was no known way to stop the spillage, there was massive leakage. The well head was eventually capped but the damage was done. Marine life was killed, ecological and even human fatalities were found. Despite the lawsuits, levies and clean up funds, the damages are still suffered up to date.

5. 2016, Fracking :- A new technology called fracking is highly booming in the United states. It pumps highly pressurized liquids to create fissures in the shale rock from which oil and natural gases can escape. Its advocates had managed to ease the storm around fracking

but a recent study by researchers from Duke Universities have stirred it up by presenting facts about the ecological impact of fracking. Facts show environmental pollution and direct impact on human lives around the areas of mining. Litigation and lawsuits are now gearing up, some successful while some still on ongoing.

ENVIRONMENTAL JUSTICE MOVEMENTS IN INDIA

March 2022 marked the 49th anniversary of the beginning of the Chipko Andolan, which is often credited as India's first environmental justice movement. However, the history of India's environmental justice movements can be traced much further back. Early grassroots resistances to British rule, such as the Bengal peasant revolt of 1859-63 against indigo plantations carried ecological undertones. Gandhi's freedom movement also rang with concerns for the ecosystem and its people, who inhabited seven hundred thousand villages by advocating a model of self-sufficiency and opposing industrialisation. After independance, there was a heavy boost to large infrastructure for nation building such as multipurpose dam projects and steel plants. This impetus on rapid industrialisation ushered in a wave of environmental justice movements that fought for the preservation of water, forests and land (Jal, jungle, zameen), such as the Narmada Bachao

Andolan, the Appiko Movement and the Silent Valley Protest. More recent movements include those against corporate giants such as Vedanta in Niyamgiri, Odisha or Thoothukudi, Tamil Nadu. These movements are often drawn out filled with uncertainty and involve multiple layers of injustices and inequalities. They also often include Adivasis, the indigenous population, at the forefront.

These environmental justice movements are movements against Ecological Distribution Conflicts (EDCs). These are struggles around environmental costs and benefits due to inequalities in power and income, and are embedded in the broader context of race, class, caste and gender asymmetries. In the last 5 decades they have evolved, and in recent years, are invading new spatial and symbolic spaces. EDCs are not limited to rural areas anymore, rather they are manifesting in different contexts and settings, such as conflicts against the expansion of the Mormugao Port for importing coal in Goa, or protests to save the Aarey forest in Mumbai against the creation of the metro car shed in the last green space of the city.

According to the Environmental Justice Atlas (EJAtlas), a worldwide inventory of environmental justice movements from across the globe, India has the largest number of E.J. Movements (at about 300 reported cases of conflicts). Out of these, more than 57% of the reported have Adivasi communities mobilising. Involvement of Adivasis in such movements gives rise to multiple kinds of oppression due to historical exclusion and marginalisation.

Despite that, they have continued to protect to safeguard the jal, jungle zameen, that sustain them. Due to these mobilisations, an important legislation was passed that asserts tribal land rights. This law, known as the The Forest Rights Act (FRA) or the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, is a key piece of legislation

that recognises the historical injustice meted out to scheduled tribes and other traditional forest dwellers. It seeks to secure traditional rights over forest land and community forest resources, and to establish democratic community-based forest governance.

ENVIRONMENTAL ACTS PASSED BY INDIAN LEGISLATURE

1. THE ENVIRONMENT (PROTECTION) ACT, 1986

Authorises the central government to protect and improve environmental quality, control and reduce pollution from all sources, and prohibit or restrict the setting and/or operation of any industrial facility on environmental grounds. It was enacted in 1986 with the objective of providing for the protection and improvement of the environment. It empowers the Central Government to establish authorities charged with the mandate of preventing environmental pollution in all its forms and to tackle specific environmental problems that are peculiar to different parts of the country.

2. THE PUBLIC LIABILITY INSURANCE ACT AND RULES 1991 AND AMENDMENT, 1992

These acts were drawn upon to provide for public liability insurance for the purpose of providing immediate relief to the persons affected by accident

while handling any hazardous substance.

3. THE NATIONAL ENVIRONMENTAL TRIBUNAL ACT, 1995, AMENDMENT, 2010. It has been created to award compensation for damages to persons, property, and the environment arising from any activity involving hazardous substances. The Amendment provides an equal opportunity to any citizen of India to approach the National Green Tribunal.

4. THE NATIONAL ENVIRONMENT APPELLATE AUTHORITY ACT, 1997
This act has been created to hear appeals with respect to restriction as of areas in which classes of industries, etc are carried out or prescribed subject to certain safeguards under the EPA.

5. THE BIOMEDICAL WASTE (MANAGEMENT AND HANDLING) RULES, 1998 It is a legal binding on the healthcare institutions to streamline the process of proper handling of hospital waste such as segregation, disposal, collection and treatment.

6. THE MUNICIPAL SOLID WASTES (MANAGEMENT AND HANDLING) RULES, 2000 The rules apply to every municipal authority responsible for the collection, segregation, storage, transportation, processing and disposal of municipal solid waste.

7. THE OZONE DEPLETING SUBSTANCES (REGULATION AND CONTROL) RULES, 2000 These rules have been laid down for the regulation of production and consumption of ozone depleting substances.

8. THE BATTERIES (MANAGEMENT AND HANDLING) RULES, 2001
These rules shall apply to every manufacturer, importer, re-conditioner

assembler, dealer, auctioneer, consumer and bulk consumer involved in the manufacture, processing, sale, purchase and use of batteries or components so as to regulate and ensure the environmentally safe disposal of used batteries.

9. THE NOISE POLLUTION (REGULATION AND CONTROL)(AMENDMENT) RULES, 2010 These rules lay down such terms and conditions as are necessary to reduce noise pollution, permit use of loudspeakers or public address systems during night hours (between 10:00 pm to 12:00 midnight) on or during any cultural or religious festive occasion.

and many more...

CONCLUSION

Environmental justice is a movement and a conceptual framework that arose from a particular set of historical circumstances — a growing environment — alism in the latter part of the 20th century, but one that failed to address issues of social injustice. When applied to the status quo, environmental justice finds that there is an inequitable distribution of environmental benefits and hazards, and that those who already suffer social, racial, economic and cultural discrimination bear disproportionate environmental disadvantage. In a world in which we are increasingly aware of environmental problems, the environmental justice framework provides another way of examining this set of issues and reminds us that our environmental decisions make significant impacts on people's lives, which need to be factored into any process that aspires to be truly just.

Rajendra 25/05/22

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GLOBAL WARMING

and

ITS EFFECTS

GLOBAL WARMING

CONTENTS

INTRODUCTION

Climate change refers to long-term shifts in temperatures and weather patterns. These shifts may be natural, but since the 1800s, human activities have been the main driver.

The Beginning of Global warming :

Since the Industrial Revolution, the global annual temperature has increased in total by a little more than 1 degree Celsius, or about 2 degrees Fahrenheit. Between 1880—the year that accurate recordkeeping began—and 1980, it rose on average by 0.07 degrees Celsius

Industrial emissions leading to global warming

Since 1981, however, the rate of increase has more than doubled: For the last 40 years, we've seen the global annual temperature rise by 0.18 degrees Celsius, or 0.32 degrees Fahrenheit, per decade.

Global warming:

Contemporary **climate change** includes both **global warming** and its impacts on Earth's weather patterns. There have been previous periods of climate change, but the current changes are distinctly more rapid and not due to natural causes Instead, they are caused by the emission of greenhouse gases, mostly carbon dioxide (CO_2) and methane. Burning fossil fuels for energy use creates most of these emissions. Certain agricultural practices, industrial processes, and forest loss are additional sources Greenhouse gases are transparent to sunlight, allowing it through to heat the Earth's surface. When the Earth emits that heat as infrared radiation the gases absorb it, trapping the heat near the Earth's surface. As the planet heats up it causes changes like the loss of sunlight-reflecting snow cover, amplifying global warming.

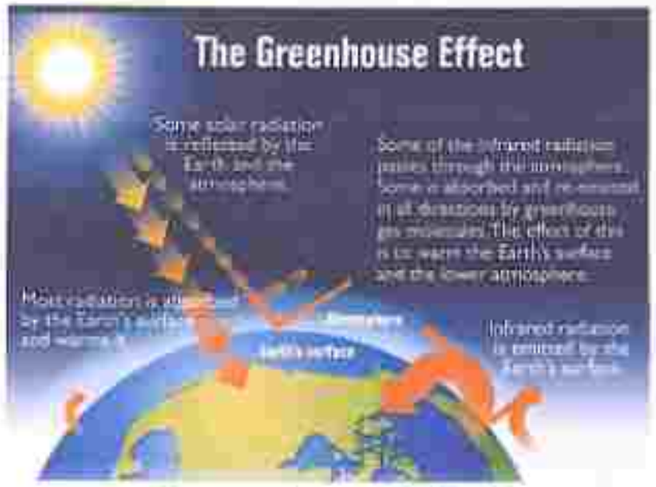
Global warming.

Global warming

Terminology:

Before the 1980s, it was unclear whether warming by increased greenhouse gases would dominate aerosol-induced cooling. Scientists then often used the term *inadvertent climate modification* to refer to the human impact on the climate. In the 1980s, the terms *global warming* and *climate change* were popularised. The former refers only to increased surface warming, the latter describes the full effect of greenhouse gases on the climate. *Global warming* became the most popular term after NASA climate scientist James Hansen used it in his 1988 testimony in the U.S. Senate. In the 2000s, the term *climate change* increased in popularity. *Global warming* usually refers to human-induced warming of the Earth system, whereas *climate change* can refer to natural or anthropogenic change. The two terms are often used interchangeably.

Green house Effect :



Green house Effect

Global warming occurs when carbon dioxide (CO_2) and other air pollutants 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. These heat-trapping pollutants—specifically carbon dioxide, methane, nitrous oxide, water vapor, and synthetic fluorinated gases—are known as greenhouse gases, and their impact is called the greenhouse effect.

Causes of Global warming :

- When we burn coal, oil and gases it largely adds to the climate problem.
- Deforestation is the clearance of woodland and forest, this is either done for the wood or to create space for farms or ranches.
- Humans create more waste now than ever before, because of the amount of packaging used and the short life cycle of products.
- Power plants burn fossil fuels to operate, due to this they produce a variety of different pollutants.
- Oil drilling is responsible for 30% of the methane population and around 8% carbon dioxide pollution.
- Burning fossil fuels releases carbon and other types of pollutants into the atmosphere.
- Farming takes up a lot of green space meaning local environments can be destroyed to create space for farming.

Result of Global warming:

In the past, scientists have been skeptical of blaming increasing temperatures on global warming. As we head into future ventures of technology and ingenuity, the science community has steadily stepped on board with the Environmental Protection Agency and other believers in global warming to do something about it. Like never before, scientists are seeing growth rates of increased climate change.

Result of Global warming.

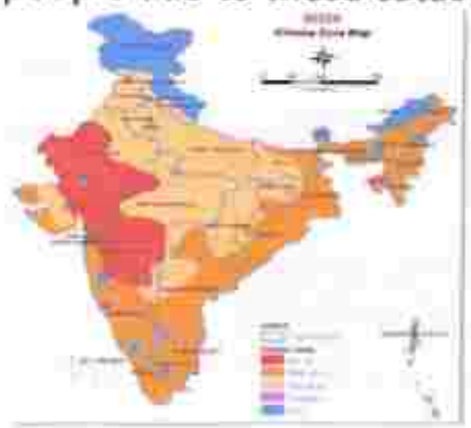
Melting polar ice-caps, the collapse of vegetation and wildlife, and violent surges of hurricanes more rampant in the past are all concerning reasons to understand how climate change can affect so many facets on planet earth.Global warming's massive impact on social, economic, and physical health are areas for great distress.

Effects of Global warming:

- Due to increased global warming, the level of the sea will rise which will lead to flooding.
- . Irregular weather patterns have already started showing results. Increased precipitation in the form of rain has already been noticed in polar and sub-polar regions.
- As temperatures warm, the presence of drought has increased in the western U.S.
- As the temperature becomes warmer, it can affect the health of humans and the diseases they are exposed to.
- As the temperature of the oceans rises, hurricanes and other storms are likely to become stronger.
- The melting of polar ice-caps and less water evaporating into the atmosphere are causing increased sea levels.
- Heat waves cause dangerously hot weather and in recent years
- While wildfires are a natural occurrence, with the added carbon dioxide in the air, and hotter summers.
- Global warming also creates conditions that can lead to more powerful hurricanes and summer storms.

Impacts of global warming on climate of India:

The effect of global warming on the climate of India has led to climate disasters as per some experts. India is a disaster prone area, with the statistics of 27 out of 35 states being disaster prone, with foods being the most frequent disasters. The process of global warming has led to an increase in the frequency and intensity of these climatic disasters.
According to surveys, in the year 2007-2008, India ranked the third highest in the world regarding the number of significant disasters, with 18 such events in one year, resulting in the death of 1103 people due to these catastrophes.The



Impact on Indian climate.

anticipated increase in precipitation, the melting of glaciers and expanding seas have the power to influence the Indian climate negatively.

CONCLUSION

Precautions of Global warming:

Change a light
Replacing one regular light bulb with a compact fluorescent light bulb will save 150 pounds of carbon dioxide a year.

Drive less
Walk, bike, carpool or take mass transit more often. You'll save one pound of carbon dioxide for every mile you don't drive!

Recycle more
You can save 2,400 pounds of carbon dioxide per year by recycling just half of your household waste.

Check your tires
Keeping your tires inflated properly can improve your gas mileage by more than 3 percent. Every gallon of gasoline saved keeps 20 pounds of CO_2 of the atmosphere.

Use less hot water
It takes a lot of energy to heat water. Use less hot water by taking shorter and cooler showers and washing your clothes in cold or warm instead of hot water.

Avoid products with a lot of packaging
You can save 1,200 pounds of carbon dioxide if you reduce your garbage by 10 percent.

Adjust your thermostat
Moving your thermostat down just 2 degrees in winter and up 2 degrees in summer could save about 2,000 pounds of carbon dioxide a year.

Plant a tree
A single tree will absorb one ton of carbon dioxide over its lifetime.

Prevention of Global Warming

Samanta
25/05/2022

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Page No: ??

Waste and Impact of Waste Accumulation

Waste is any material that is unused and rejected as worthless and unwanted. In modern times waste is generated at an alarming rate both in complexity and quantity.

The use and throw concept, i.e., the practice of discarding things after using them once, is responsible for it. One can see heaps of solid wastes accumulated in street corners, around hospitals, school backyards and even near water bodies. Dumping of solid wastes not only gives an ugly look and foul smell, but also causes serious health hazards. Sometimes, the outbreak of epidemics takes place due to the accumulation of wastes, particularly near water bodies.

Accumulated solid wastes when left uncared, start decomposing. A number of pathogenic (disease-causing) bacteria, virus, and fungi grow in these wastes. Flies, insects, rodents, etc. , live in the accumulated waste heaps and carry germs of various diseases to human habitations. Decomposition of wastes produces harmful gases that pollute the air around us.

During rains, rainwater may take the decomposed waste along with pathogens (disease causing germs) to our water bodies (rivers, ponds, wells, etc.) and cause water pollution. All this leads to outbreak of epidemics and other health hazards.

Spoilage Of Landscape

Much of the world's solid waste is simply dumped onto vacant land and left to decompose. Open dumps not only ruins the natural beauty of the land but also provide a home to rats and other disease carrying organisms. Both open dumps and landfills may contain poisonous substances that seep into the groundwater or flow into the streams and lakes.

Burning of coal, fuel wood or petroleum produces sulphur and nitrogen which react with oxygen and are converted into their respective oxides- sulphur oxide and nitrogen dioxide. These oxides react with water vapour present in the atmosphere to form acids like sulphuric acid and nitric acid. These acids precipitate with rain to form acid rain. A chemical reaction occurs between the acid of the acid rain and the buildings. It exerts a pressure on the monument surface leading to corrosion of its body. The gypsum and calcium sulphate are washed away by water causing damaging marks on statues and monuments. Limstone statues are also destroyed naturally because carbonic acid in rainwater converts limestone into bicarbonate which is water soluble and is washed away.

Many monuments are affected by acid rain. Examples are : The Parthenon of Athens, The Lincoln Memorial of Washington, Parliament Building of Ottawa, House of Parliaments in London, Cathedral of Cologne, The Leaning Tower of Pisa, The Tower of London, etc.

Pollution

The word 'pollute' means to degrade or to make dirty. Pollution is thus, an unfavourable modification of the natural world caused entirely or partly due to direct or indirect actions of human beings.

Accumulation of waste is probably the most visible form of pollution. Every year human beings dispose of billions of metric tonnes of domestic, commercial, industrial wastes. Agriculture and the food processing industry are considered to be the largest contributors to the total annual production of solid wastes.

The handling of solid wastes is a problem because most disposable methods cause harm to the environment. Both open dumps and landfills may contain toxins that seep into the soil and the water bodies and cause soil and water pollution respectively. The uncontrolled burning of accumulated waste creates smoke and other air pollutants that release toxic substances into the environment and cause air pollution. Scavengers and stray animals invade the open garbage dumps and spread the waste over large area, thereby, spreading germs and diseases as well as destroying the beauty of the place.

Industrial waste contains harmful chemicals, particulates (small particles) and toxic heavy metals such as lead and mercury. These toxic chemicals and heavy metals get deposited in animal tissues and harm living things along the food chain.

Eutrophication :-

It is the process of depletion of oxygen from water bodies occurring either naturally or due to human activities. The process of eutophication takes place due to introduction of nutrients and chemicals through discharge of domestic sewage, industrial effluents and fertilizers from agricultural fields. Algae and phytoplankton use carbon dioxide, inorganic nitrogen and phosphate from the water as food. They serve as food for microscopic animals (zooplankton). Small fish feed on these zooplanktons and large fish in turn consume these small fish. When nutrients become abundant due to waste accumulation, the growth of phytoplankton and algae increases. Consequently, the penetration of oxygen, light and heat into the water body is reduced. This causes death of most of the aquatic organisms, draining water of all its oxygen.

Health Hazards

Spread Of Disease Through Contamination

Several incidents around the world have demonstrated the potential harm of accumulation of waste on human health. Waste that is not properly managed is a serious health hazard. Unattended waste dump in the open attracts flies, rats and other creatures that act as vectors of the diseases and spread them among human beings. Domestic waste poses a serious threat since it is organic in nature, it undergoes fermentation and creates conditions favourable for the survival and growth of pathogens. Waste dumped near a water source percolates through the soil into the water bodies and contaminates the water. Direct dumping of untreated waste in rivers, seas and lakes results in the accumulation of toxic substances in the water bodies and further in the food chain through plants and animals that feed on it (biomagnifications). Choking of drains and gully pits by the solid wastes result in water logging, especially during the rainy season. The water logging results in breeding of mosquitoes in the stagnant water which spread diseases like malaria and chikungunya.

Hazardous wastes are toxic substances which cause an increase in death rate and serious irreversible or incapacitating reversible illness. Lead is a harmful toxin and it can affect the development of a child's brain. Asbestos can cause a respiratory disease known as asbestosis, as well as chest and lung cancer. Mercury is a highly toxic chemical which attacks the nervous system, causing brain damage and even death. Arsenic is another chemical that has been shown to cause cancer.

Radioactive waste produced by nuclear reactors and weapon factories causes a potentially serious environmental problem. Radioactive waste, although present in small quantities, remains extremely harmful to human health for many years.

Effect On Terrestrial Life

Terrestrial life includes all the organisms that live on land – human beings, plants and animals.

Effect on Human Beings : Accumulation of solid waste looks ugly, smells foul, attracts insects, rats and other animals that spread diseases. Burning of waste in the open dumpyards causes smoke and foul smelling air. In addition rainwater can drain through refuse and carry harmful substances to different places. Sanitary landfills are not fit for human settlements because methane and carbon dioxide gases start coming up in the first two years. These gases are produced when solid wastes start decomposing underground.

Effect on Plants : Waste accumulation has dangerous effect on plant life. Plant life is affected either by direct decomposition of harmful toxins from waste or indirectly through soil. The toxins cause :

- Different types of leaf injury
- Premature leaf fall
- Decrease in transpiration
- Reduction in the rate of photosynthesis

passage of infrared waves from the earth back into space. Concentration of solar radiation produces much heat, making the earth back into space. Concentration of solar radiation produces much heat, making the earth a very warm place. This

phenomenon is similar to that of a greenhouse in which the glass enclosed area gets heated up due to the insulation from the rest of the environment. The warming up of the atmosphere is due to the greenhouse effect. Hence, Global Warming is also known as Greenhouse Effect.

Greenhouse Gases Type equation here.

There are five gases which are mainly responsible for the Greenhouse effect and Global warming. These gases are known as Greenhouse Gases. They are :

(i) Carbon Dioxide (CO_2)
(ii) Methane (CH_4)
(iii) Nitrogen oxide (Nitrous oxide)
(iv) Chlorofluorocarbons (CFC)
(v) Water vapour

Human activities like burning of fossil fuels increase the carbon dioxide content in the atmosphere. The increased concentration of carbon dioxide may bring about drastic damages in the world climate in the near future in the form of increased temperature or global warming.

If the carbon dioxide content of the atmosphere increases steadily it will result in increase in the present world temperature by about $3.6°C$. It is estimated that if the earth continuous to warm up, all the glaciers will recede and the ice caps in the Antarctic and the Arctic will begin to melt. Then, the sea level will rise by a few meters and most of the cities on the seashore may be submerged and coastal eco-life will be adversely affected.

Our Future In Danger

Our future is in danger if we do not arrest global warming by controlling emissions into the atmosphere. The following are the effects of Global Warming :

1. Global temperature is likely to rise by $2°C$ *to* $5°C$ during the next century.
2. Due to rise in temperature by $2°C$ *to* 5°C, there is a chance of melting of ice caps on the Earth's poles. This melting of ice will result in the rise of the sea level. Large stretches of low lying areas will submerge and many islands countries will face deep encroachment by seawater. Some may disappear altogether.
3. As the increase in temperature will be uniform all over the surface of the world, there will be serious climatic changes. This will bring various changes in wind and rain pattern.
4. Higher temperature will cause rise in transpiration, which in turn, will affect the groundwater table.
5. Insects and pests will increase in the warmer climatic conditions. Thus, pathogenic diseases will multiply.

Depletion Of Ozone Layer

Significance of Ozone Layer in Atmosphere

The atmosphere is divided into four layers :

- Troposhere
- Stratosphere
- Ionosphere
- Exosphere.

In the second layer, i.e. , the Stratosphere which lies at the height of 20 km to 50 km from the Earth's Surface, lies the Ozone layer. In spite of its low destiny, the Ozone layer plays an important role in our life.

Due to the presence of Ozone layer, ultraviolet rays and infrared rays from the sun cannot reach the earth's surface directly. Ozone layer

absorbs the harmful ultraviolet rays from the sun and protects the life on the Earth from their harmful effects.

Causes Of Ozone Layer Depletion And Ozone Hole

It has been revealed from different researches that when the Oxides of Nitrogen (NO and NO_2) come in contact with Ozone (O_3), their chemical reaction destroys Ozone layer. Besides this, supersonic aeroplanes move through the stratosphere and emit huge amount of Nitrogen gas which depletes the Ozone layer. Another important causative factor of Ozone layer depletion is Chlorofluorocarbons (CFCs), which have strong power to damage the Ozone layer.

All the developed and developing countries are using CFCs – type of chemicals as refrigerants in aerosol, paints, plastics, foam and thermal insulating materials in spray and packaging industries. During the use of such materials, a lot of CFCs ultimately get dispersed into the atmosphere.

A hole has been observed in the Ozone layer in the Stratosphere near Antarctica. This hole allows the ultraviolet rays of the sun to reach the earth directly without any obstacle or filtration. These ultraviolet rays cause many disease like skin cancer and cataract. The ultraviolet rays causes genetic disorders which ultimately affect heredity. Increased concentration of ultraviolet rays disturb ecological balance in marine ecosystem. Green algae, fish and other animals on continental shelves get affected by ultraviolet rays. Young cells and larvae of organisms living in aquatic ecosystems get destroyed.

Vegetables are very sensitive to the ultraviolet rays. Ultraviolet rays can damage physical and chemical properties of any complex chemical substances. Plastic become brittle when they come in contact with ultraviolet rays.

Acid Rain :

Acid Rain means the presence of excessive acids in rainwater. Burning of coal, wood or petroleum produce sulphur and nitrogen. These two react with oxygen and are converted into their respective oxides- sulphur dioxide and nitrogen dioxide, which are soluble in water. During rain, these oxides react with large quantities of water vapour in the atmosphere to form acids like sulphuric acid, sulphurous acid, nitric acid and nitrous acid. These acids, when they precipitate together with rain or snow form acid rain.

Effects Of Acid Rain

1. Acid rain increases acidity in the soil and destroys forests and crops.
2. It corrodes buildings, monuments, statues, bridges, fences and railings. For example, acid rain produced by the pollutants from the Mathura oil refinery has been turning the white marble surface of the Taj Mahal into yellow.
3. It poses a serious threat to human health, since it contaminates air and water.
4. It affects the human nervous system by causing neurological diseases.
5. Aquatic species are affected due to acid rain.
6. Acid rain affects the plant growth. Plant leaves get burnt and dry.

Soil Health :

Soil is the foundation of a healthy biosphere. Precipitation from air as acid rain and dry deposition of pollutants on land surfaces contribute to soil pollution. Chemicals and minerals in the soil react with chemical pollutants. These pollutants combine with plant nutrients and the plants are consumed by animals. Polluted soils cause reduction in mineralization and decomposition processes. Transformation of sulphur, nitrogen, availability of phosphorous, biological nitrogen fixation in soil are affected by acid rain. Soil fertility and aeration are also reduced. Earthworms, nematodes, etc. , are destroyed by toxic chemicals. Destruction of the soil is synonymous with the destruction of the biosphere, it is of utmost importance to check the accumulation of waste and thereby reduce soil pollution and improve the health of the soil.

There is a need to manage the waste properly. Therefore, public awareness of the health hazards of waste is necessary. No doubt, waste disposal has become a big industry employing thousands of workers but the

options for its disposal are limited, the main disposal sites are the land, water or the air.

Method Of Safe Disposal Of Waste – Segregation, Dumping and Composting :

Segregation : In industrialized countries like Japan, the waste is segregated before it is disposed of. Even in colonies various types of dustbins are used to segregate glass, metals, paper, cloth, etc., and each type is handled separately by reusing it, recycling it or disposing it in any other accepted waste disposal method. It should be the duty of each household to segregate domestic waste into different dustbins like biodegradable and non-biodegradable and then convert biodegradable ones into other useful products like compost or gobar gas. Urban residential colonies should undertake collective efforts for safe disposal of domestic waste as well as sweepings from the gardens and public parks. These sweepings can be converted into compost and used for the maintenance of these gardens and parks.

Sorting out of the reusable material from heaps of waste may often involve much manual labour. In a country like India, the poor rag pickers make a living from discarded solids. In this way they do a good job by removing much of the waste from the garbage dumps. Pieces of metal, glass, rubber, plastics etc., are removed to be recycled to get finished products.

The products derived from recycling process are not of the same quality as original ones. Paper made from recycled materials is of a coarse quality and has to be used as a packaging material in cartons, in corrugated boards, etc.

Dumping :

Open Dumping : In this method, waste materials are dumped in open low lands far away from the city. This method is not environment friendly. However, this is the cheapest method and does not need much planning. The open pits spoil the sight of the area and become a breeding ground for mosquitoes, flies, insects, etc., that are the carriers of harmful diseases. They give out foul odour. The burning of waste material in the open dumps pollutes the air. Another danger of open dumping is that rainwater could carry the harmful substances to the nearby streams, ponds or lakes and if the water seeps down it could pollute the groundwater.

Sanitary Landfill : In this method, the waste is packed and dumped daily at the site and is covered with earth to prevent insects or rodents from entering into the landfill. The waste then is subjected to bacterial decomposition. Physical, chemical and biological reactions take place generating different gases like carbon dioxide, methane, ammonia and hydrogen sulphide.

Sanitary landfill is a way of disposing refuse on land without creating nuisance or hazards to public health or safety. The waste disposal is carried out with minimal environmental damage and in areas already spoiled or in need of restoration.

The sanitary landfill system of disposing of waste is essentially a biological method.

The waste undergoes the following five phases :

- During the first phase of operation, aerobic bacteria deplete the available oxygen and as a result the temperature increases.
- In the second phase, anaerobic conditions become established and hydrogen and carbon dioxide are evolved.
- Phase three establishes population of bacteria and the beginning of methanogenic activity, i.e., production of methane from the decomposition of organic matter.
- In the fourth phase the methanogenic activity becomes stabilized.
- The fifth phase depletes the organic matter, and the system returns to aerobic state.

The advantages of sanitary landfill as opposed to open dumping are :

- It is free from air pollution from burning.

- The health problems are minimized since flies, rats and other pests cannot breed in the landfill because of the convered wastes.
- It is mostly free from fire hazards.

Plantation At Landfill Site

A vegetative cover should be provided over the landfill site in accordance with the following specifications :

1. Locally adopted non-edible perennial plants that are resistant to drought and extreme temperatures should be planted.
2. The plants grown should be such that their roots do not penetrate more than 30 cms. This condition should apply till the landfill is stabilized.
3. Selected plants should have the ability to thrive on low- nutrient soil with minimum nutrient addition.
4. Plantation should be made in sufficient density to minimize soil erosion.

Composting :

Composting of waste is an aerobic (in the presence of air) method of decomposing solid wastes. The process involves decomposition of organic waste into humus known as compost which is a good fertilizer for plants. The composting process produces carbon dioxide and heat which can be used for various purposes like cooking. The organic waste from households are made to undergo decomposition in such a way that bacteria and other micro-organisms break them down and produce a safe, clean and soil-like material called compost.

The micro-organisms help to stablise the organic matter. For example, fungi starts working in the first week after dumping of the material. Actinomycetes help in the last stages of the breakdown while bacteria is present throughout the process.

Samanta
25/05/2022

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Table of Contents

1. Concept of Ecology & Ecosystem

What is Ecology?

Ecology is the study of the relationships between living organisms, including humans, and their physical environment; it seeks to understand the vital connections between plants and animals and the world around them. It also provides information about the benefits of ecosystems and how we can use Earth's resources in ways that leave the environment healthy for future generations.

Ecology overlaps with the closely related sciences of biogeography, evolutionary biology, genetics, ethology, and natural history. Ecology is a branch of biology, and it is not synonymous with environmentalism.

Among other things, ecology is the study of:

- Life processes, antifragility, interactions and adaptations.
- The movement of materials and energy through living communities.
- The successional development of ecosystems.
- Cooperation, competition, and predation within and between species.
- The abundance, biomass, and distribution of organisms in the context of the environment.
- Patterns of biodiversity and its effect on ecosystem processes.

2. Role of Ecology in Our Lives.

The many specialties within ecology, such as marine, vegetation, and statistical ecology, provides us with information to better understand the world around us. This information can also help us improve our environment, manage our natural resources, and protect human wealth.

Illustration: In the 1960s, ecological research identified two of the major causes of poor water quality in lakes and streams – phosphorus and nitrogen – which were found in large amounts in laundry detergents and fertilizers. Provided with this information, citizens were able to take the necessary steps to help restore their communities' lakes and streams – many of which are once again popular for fishing and swimming.

3. Types of Ecology

(i) Global Ecology –

Global ecology is the study of the interactions among the Earth's ecosystems, land, atmosphere and oceans. Global ecology is very important because it is used to understand large scale interactions and how they influence the behaviour of the entire planet, including the earth's responses to future changes.

(ii) Landscape Ecology –

It deals with the exchange of energy, materials, organisms ~~with~~ other products of ecosystems. Land-scape ecology throws light on the role of human impacts on the landscape structures and functions.

(iii) Ecosystem Ecology –

It deals with the entire ecosystem, including the study of living and non-living components and their relationship with the environment.

(iv) Organismal Ecology –

Organismal ecology is the study of an individual organism's behavior, morphology, physiology, etc. in response to environmental challenges. It looks at how individual organisms interact with biotic and abiotic components. Ecologists research how organisms are adapted to these non-living and living compon-ents of their surroundings.

Individual species are related to various adaptations like physiological adaptation, morphological adapta-tion, and behavioural adaptation.

(v) Molecular Ecology –

The study of ecology focuses on the production of proteins and how these proteins affect the organisms and their environment. This happens at the molecular level.

DNA forms the proteins that interact with each other and the environment. These interactions give rise to some complex organisms.

(vi) Population Ecology –

It deals with factors that alter and impact the genetic composition and size of the population of organisms. Ecologists are interested in fluctuations in the size of a population, the growth of a population and any other interactions with the population.

In biology, a population can be defined as a set of individuals of the same species living in a given place at a given time. Births and immigration are the main factors that decrease the population.

Population ecology examines the population distribution and density. Population density is the number of individuals in a given volume or area. This helps in determining whether a particular species is in endanger or its number is to be controlled and resources to be replenished.

(vii) Community Ecology –

Community ecology or synecology is the study of the interactions between species in communities on many spatial or temporal scales, including the distribution, structure, abundance, demography and interactions between coexisting populations.

4. Importance of Ecology

The study of ecology is important in ensuring people understand the impact of their actions on the life of the planet as well as on each other. Here are the reasons why ecology is important:

(i) It helps in environmental conservation –

Ecology allows us to understand the effects our actions have on our environment. With this information, it helps us to guide conservation efforts by first showing the primary means by which the problems we experience within our environment begin and by following this identification process, it shows us where our efforts would have the biggest effect.

Ecology also shows individuals the extent of the damage we cause to the environment and provides predictive models on how bad the damage can get. These indicators instil a sense of urgency among the population, pushing people to actively take part in conservation efforts and ensure the longevity of the planet.

(ii) Ensures proper Resource allocation —

Ecology equally allows us to see the purpose of each organism in the web of connectivity that makes up the ecosystem. With this knowledge, we are able to ascertain which resources are essential for the survival of the different organisms. This is very fundamental when it comes to assessing the needs of human beings who have the biggest effect on the ecosystem.

An example is human dependency on fossil fuels that has led to the increase of carbon footprint in the ecosystem. It is ecology that allows humans to see these problems which then calls for the need to make informed decisions on how to adjust our resource demands to ensure that we do not burden the environment with demands that are unsustainable.

(iii) Enhances energy conservation —

Energy conservation and ecology is connected in that, it aids in understanding the demands different energy sources have on the environment. Consequently, it is good for decision making in terms of

deciding resources for use as well as how to efficiently convert them into energy.

Without proper understanding of energy facts through ecology, humans can be wasteful in their use of allotted resources such as indiscriminate burning of fuels or the excessive cutting down of trees. Staying informed about the ecological costs allows people to be more frugal with their energy demands and adopt practices that promote conservation such as switching of lights during the day and investing in renewable energy.

(iv) Promotes eco-friendliness —

Ecology makes people aware of their environment and encourages the adoption of a lifestyle that protects the ecology of life owing to the understanding they have about it.

This means that in the long-term, people tend to live less selfishly and make strides towards protecting the interest of all living things with the realisation that survival and quality life depends on environment sustainability. Hence, it fosters a harmonious lifestyle and assures longevity for all organisms.

(v) Aids in disease and pest control —

A great number of diseases are spread by vectors. The study of ecology offers the world novel ways of understanding how pests and vectors behave thereby equipping humans with knowledge and techniques on how to manage pests and diseases.

For example, malaria which is one of the leading killer diseases is spread by the female Anopheles mosquito. In a bid to control malaria, humans must first understand how the insect interacts with its environment in terms of competition, sex and breeding preferences. The same applies to other diseases and pests. By understanding the life cycle and preferred methods of propagation of different organisms in the ecosystem, it has created impressive ways to devise controls measures.

5. EXAMPLES OF ECOLOGY

Examples of ecology are simply aspects that seek to study how the various types of ecology come about. For instance, the study of humans and their relationship with the environment gives us human ecology. Alternatively, studying a food chain in a wetland area gives wetland ecology while the study of how termites or other small organisms interact with their habitat brings about niche construction ecology. Here are two basic examples to elaborate examples of ecology in details.

(i) Human ecology —

This aspect of ecology looks at the relationship between humans and the ecosystem as a whole. It is centred on human beings, studying their behaviour and hypothesises the evolutionary reasons why we might have taken up some traits.

Emphasis is placed on this due to the impact human beings have on the environment and it also gives us knowledge about the shortcomings of the entire human population and how to better ourselves for our own sake and that of the environment.

(ii) Niche construction –

Niche construction is an example of ecology dealing with the study of how organisms are able to alter their environment for their benefit and also for the benefit of other living things. It is of particular interest of ecologists who desire to understand how some organisms overcome the challenges presented to them.

A prime example is how termites are well organised and equipped to erect mound and which stand over 6 feet tall while at the same time protecting and feeding their (nutrients to) entire pollution. In going about their niche, ants also recycle nutrients for plants. This presents a good example of ecology because it is all about evolution and other several aspects regarding population, community and ecosystem ecology.

6. STRUCTURE OF ECOSYSTEM

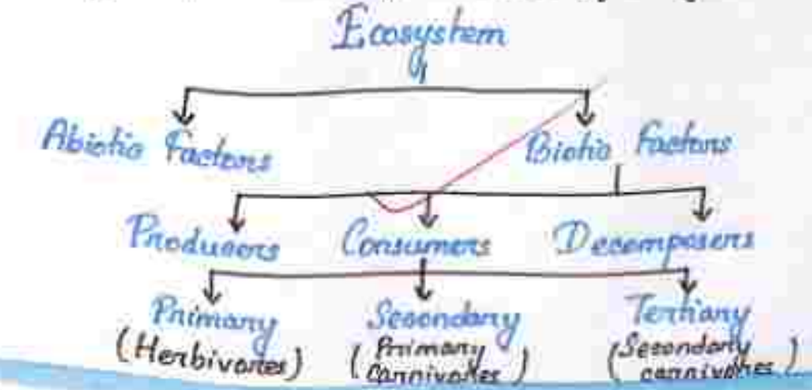
The structure of an ecosystem is characterised by the organisation of both biotic and abiotic components. This includes the distribution of energy in our environment. It also includes the climatic conditions prevailing in that particular environment.

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.

Fig: Representation of Structure of Ecosystem



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).

(a) 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.

(b) 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 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. They 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.

(c) 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.

7. TYPES OF ECOSYSTEM

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

- Terrestrial Ecosystem
- Aquatic Ecosystem

Terrestrial Ecosystem —

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

(i) FOREST ECOSYSTEM :

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.

(ii) 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.

(iii) 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 - a type of ecosystem is found in the Artic or mountain tops.

(iv) 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:

- Freshwater Ecosystem
- Marine Ecosystem.

(i) FRESHWATER ECOSYSTEM :

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

(ii) 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.

8. FUNCTIONS OF ECOSYSTEM

The functions of the ecosystem are as follows :

- It regulates the essential ecological processes, supports life systems and renders stability.
- It is also responsible for the cycling of nutrients between biotic and abiotic components.
- It maintains a balance among the various trophic levels in the ecosystem.
- It cycles the minerals through the biosphere.
- 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 :

- Productivity
- Energy flow
- Decomposition
- Nutrient cycling

9. Important Ecological Concepts

(i) Food Chain —

Transfer of food energy from green plants (produce-rs) through a series of organisms with repeated eating and being eaten is called a food chain. Each step in the food chain is called trophic level.

During this process of transfer of energy some energy (90 percent) is lost into the system as heat energy and is not available to the next trophic level. Therefore, the number of steps are limited in a chain to 4 or 5.

Participants in any food chain consists of :

(a) AUTOTROPHS - They are the producers of food for all other organisms of the ecosystem. They are largely green plants and convert inorganic material in the presence of solar energy by the process of photosynthesis into the chemical energy (food).

PRODUCTIVITY :

It refers to the rate of biomass production.

ENERGY FLOW :

It is the sequential process through which energy flows from one trophic level to another. The energy captur-ed from the sun flows from producers to consumers and then to decomposers and finally back to the environment.

DECOMPOSITION :

It is the process of breakdown of dead organic material. The top soil is the major site for decomposition.

NUTRIENT CYCLING :

In an ecosystem nutrients are consumed and recycled back in various forms for the utilisation by various organisms.

(b) HERBIVORES – The animals which eat the plants directly are called primary consumers or herbivores eg- insects, birds, rodents and ruminants.

(c) CARNIVORES – They are secondary consumers.

(d) OMNIVORES – Animals that eat both plants and animals. eg- pig, bear and man.

(e) DECOMPOSERS – They take care of the dead remains of organisms at each trophic level and help in recycling the nutrients. eg – bacteria and fungi.

There are two types of food chains :

(a) Grazing Food chains – which starts from the green plants that make food for herbivores and herbivores in turn for the carnivores.

(b) Detritus Food chains – start from the dead organic matter to the detrivore organisms which in turn make food for protozoan to carnivores etc.

In an ecosystem the two chains are interconnected and make y-shaped food chain. These two types of chains are:

(a) Producers → Herbivores → Carnivores

(b) Producers → Detritus Feeders → Carnivores

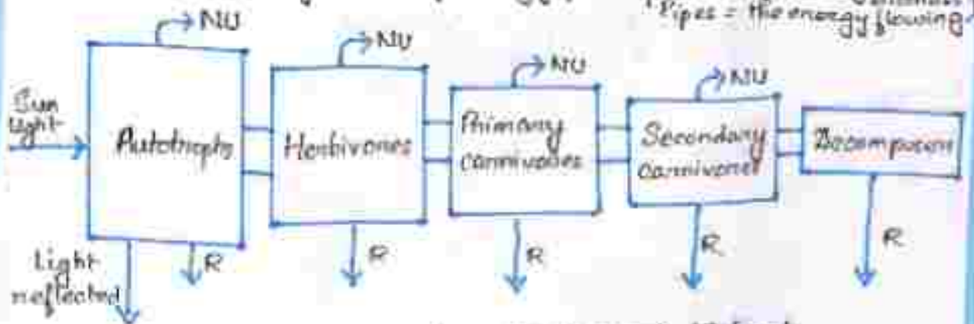
(ii) Food web –

Trophic levels in an ecosystem are not linear rather they are interconnected and make a food web. Thus food web is a network interconnected food chains existing in an ecosystem.

(iii) Flow of energy in an ecosystem –

The flow of energy in an ecosystem is always linear or one way (unidirectional). The quantity of energy flowing through the successive trophic levels decreases as shown by the reduced sizes of boxes in figure below. At every step in a food chain or web the energy received by the organism is used to sustain itself and left over is passed on to the next trophic level.

Fig: Model of energy flow {Boxes = standing crop biomass; Pipes = the energy flowing}



{NU = Not Utilised, R = Respiration}

Significance of studying food chains :

- It helps in understanding the feeding relations and interactions among different organisms of an eco-system.
- It explains the flow of energy and circulation of materials in ecosystems.
- It help in understanding the concept of biomagnification in ecosystems.

(iv) Ecological pyramid —

Ecological pyramids are the graphic representations of trophic levels in an ecosystem. They are pyramidal in shape and they are of three types. The producers make the base of the pyramid and the subsequent tiers of the pyramid represent herbivore, carnivore and top carnivore levels.

Pyramid of biomass: This represents the total standing crop biomass at each trophic level.

Pyramid of number: This represents the number of organisms at each trophic level.

Pyramid of energy: This pyramid represents the total amount of energy at each trophic level.

10. BIOGEOCHEMICAL CYCLES

Recycling of the nutrients is called biogeochemical or nutrient cycle (Bio = living, geo = rock, chemical = element).

In ecosystems flow of energy is linear but that of nutrients is cyclical. The nutrients cycle from dead remains of organisms released back into the soil by detritivores which are absorbed again, i.e. nutrient absorbed from soil by the root of green plants are passed on to herbivores and then carnivores. The nutrients locked in the dead remains of organisms and released back into the soil by detritivores and decomposers.

There are two important components of a biogeochemical cycle —

(a) **Reservoir pool** : atmosphere or rock, which stores large amounts of minerals.

(b) **Cycling pool or compartments of cycle** : They are relatively short storages of carbon in the form of plants and animals.

Let us illustrate two biogeochemical cycles :

(i) Carbon cycle —

Carbon cycle is the process where carbon compounds are interchanged among the biosphere, geosphere, pedo-sphere, hydrosphere and atmosphere of the earth.

Following are the major steps involved in the process of the carbon cycle :

(a) Carbon present in the atmosphere is absorbed by plants for photosynthesis.

(b) These plants are then consumed by animals and carbon gets bioaccumulated into their bodies.

(c) These animals and plants eventually die, and upon decomposing, carbon is released back into the atmosphere.

(d) Some of the carbon that is not released back into the atmosphere eventually become fossil fuels.

(e) These fossil fuels are then used for man-made activities, which pumps more carbon back into the atmosphere.

(ii) Nitrogen cycle —

The nitrogen cycle is the biogeochemical cycle by which nitrogen is converted into multiple chemical forms as it circulates among atmosphere, terrestrial, and marine ecosystems. The conversion of nitrogen can be carried out through both biological and physical processes.

Following are the major steps involved in the process of the nitrogen cycle :

(a) Nitrogen Fixation : This process involves conversion of gaseous nitrogen into Ammonia, a form in which it can be used by plants. Atmospheric nitrogen can be fixed by the following three methods —

(1) Atmospheric fixation – Lightening, combustion and volcanic activity help in the fixation of nitrogen.

(2) Industrial fixation – At high temperature (400°C) and high pressure (200 atm.), molecular nitrogen is broken into atomic nitrogen which then combines with hydrogen to form ammonia.

(3) Bacterial fixation – • Symbiotic bacteria, eg- Rhizobium
• Free living, eg- Nostoc, Azotobacter and Cyanobacteria can combine atmospheric nitrogen with hydrogen to form NH_3.

(b) Nitrification : It is a process by which ammonia (NH_3) is converted into nitrates or nitrites by Nitrosomonas and Nitrococcus bacteria respectively. Another soil bacteria Nitrobacter can convert nitrate into nitrite.

(c) Assimilation : In this process nitrogen fixed by plants is converted into organic molecules such as proteins, DNA, RNA, etc. These molecules make the plant and animal tissue.

(d) Ammonification : Living organisms produce nitrog-enous waste products such as urea and uric acid. These waste products as well as dead remains of organisms are converted back into inorganic ammon-ia by the bacteria. This process is called ammonifi-cation. Ammonifying bacteria help in this process.

(e) Denitrification : Conversion of nitrates back into gaseous nitrogen is called denitrification. Denitrifying bacteria live deep in soil near the water table as they like to live in oxygen free medium. Denitrifica-tion is reverse of nitrogen fixation.

11. CONCLUSION

We are now able to understand that :

- Ecology is a scientific approach to the study of the biosphere.
- Ecosystems are created by the interrelationships between living organisms and the physical environments they inhabit (land, water, air). Ecosystems require a source of energy to make them work and for most, although not all, this is light from the sun.
- To study ecosystems we have to start to identify the components involved and the interrelation-ships between them. We can list the living organisms by identifying the species involved.
- Food chains and food webs are a way of mapp-ing one type of interrelationship between the organisms in an ecosystem.
- Human beings are part of ecosystems, as well as manipulators of ecosystems. As such we are dependent on, as well as responsible for, the ecological health of the ecosystems we inhabit.

Samantha
25/05/2021

RIVER GANGES: HOLY OR POLLUTED?

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Session- 2021-2022

Acknowledgement

To begin with, I am thankful to our Principal Dr. Atashi Karpha and professor Santanu Samanta for assigning me this topic. Their proffered encouragement was of great aid. Additionally, working on this project has helpedme to obtain knowledge and experience.

Following I would like to express my sincerest of gratituded to the owners of those sources that I have utilized. This paper has been augmented in its value because of all the details I was able to gather from these websites. It has succoured with the understanding of facts and explanation broached and its credits are to their owners.

Thank You

Shreya Nath

Samanta
23/05/2022

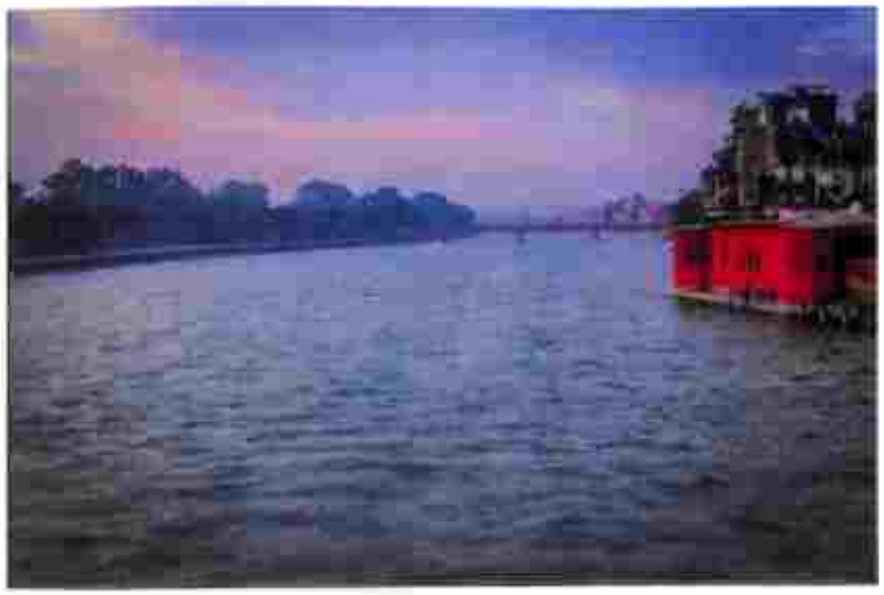
Teacher Signature

Student Signature

Index

Abstract

On November 4, 2008, the Indian government declared the holy river Ganges a "national river". This river gained the status of a national river for the first time in Indian history. From Nepal and India across the Great Plains of India to the largest deltas in the world, including West Bengal and Bangladesh. She is worshipped in different places such as Haridwar, Allahabad and Varanasi, because people believe that the Ganges goddess brings happiness and washes away our sins. As well as praying for the River Ganga brings peace, wealth and prosperity. Due to rapid urbanization, industrialization and agricultural growth, more and more sewage, industrial sewage and other pollutants are being disposed of seriously threatening it. The competitive demand for river water from irrigation, households, industry and energy use exacerbates this problem. Due to the complexity of the problems faced by the Ganges, it has inadvertently become the source of fierce disputes about the interests, ownership, and even far-reaching rights of the Ganges. The blurring line between use and abuse.



Introduction

The Ganges has always been the cradle of Indian civilization. This river occupies a unique place not only in India, but also in the cultural and spiritual lives of millions of people around the world. Most Indians regard the river as a "mother" and give the status of a goddess. There are many examples of the vitality and scale of the Ganges in ancient Indian mythology. Due to various reasons, the reliance on the Ganges River system is increasing, including: the population growth and high concentration of the Ganges River Basin, the improvement of living standards, and the exponential growth of industrialization and urbanization. The river basin height, climate, land use and farming patterns of the Ganges are unusual.

The source of the Ganges is the Uttarakand state of Gomukh at the endof the Gangotri Glacier. When the ice on this glacier melted, it formed the clear water of the Bhagirathi River. When the Bhagirathi River flows through the Himalayas, it merges into the Alaknanda River at Devprayaga. There it is officially recognized as the Ganges River, and the river flows into Bay of Bengal, where it converges to form the Ganges Delta, the largest river delta in the world. With a total length of 2,510 kilometers, the Ganges is the longest river in India.

The reason Ganga is considered holy. The Ganges is famous for its healing and regenerative nourishment of body and mind. It occupies an important sacred position in Hinduism and is mentioned in many ancient religious books in India, such as the Vedas, Purana, Ramayana and Mahabharata. The Ganges is mentioned in the oldest Hindu classic "Rigveda". It is mentioned in Nadistuti, which lists the rivers from east to west. The Ganges has many names and is related to many legends and myths. Hindus worship the Ganges River. They believe that bathing in the river can forgive sins and promote liberation from the cycle of life and death. People travel long

distances to sink the ashes of their loved ones into the Ganges water to carry their souls. Closer to Nirvana (salvation). In Hindu mythology, the river is the essence of purity and the purifying power of everything it touches. Her entire journey is a pilgrimage of millions of Hindu followers, who visited the famous Tirtha that states her presence. The emotional bond with the river and the pilgrimage centres (Rishikesh, Haridwar, Allahabad, Varanasi and Patna) is India's deep and long history. The holy bath in the Ganges River which is known as 'Ganga Snan' is seen as eliminating all the sins committed. It is considered the gate to heaven.

A study commissioned via means of the Union Water Resources Ministry to probe the "precise properties" of the Ganga discovered that the river water carries an appreciably better percentage of organisms with antibacterial properties. Other Indian rivers additionally include those organisms however the Ganga specifically in its top Himalayan stretches has greater of them, those assist to lose itself from different dangerous bacteria. Ganga additionally decomposes natural waste 15 instances quicker than some other rivers on this world. Ganga has 25 times greater oxygen than different rivers, the water is going via the procedure of natural purification.

Apparently today, the Ganges is taken into consideration to be the fifth-most polluted river in the world. The fundamental reasons of

water **pollutants in the** Ganga River are the disposal of human sewage and animal waste, **growing populace** density, and disposal of **commercial** waste into the river. This river flows through more than 100 cities with a population of more than 100,000; 97 cities and approximately 48 cities with populations between 50,000 and 100,000. Most of the wastewater with the most serious organic pollution in the Ganges comes from the domestic water of this group of people.

The establishment of numerous industrial cities along the Ganges such as Kanpur, Prayagraj, Varanasi and Patna, as well as the countless tanneries, chemical plants, textile factories, wineries, slaughterhouses, and Hospitals have all contributed to the development of industry. Of all the wastewater flowing into the Ganges, about 12% of sewage pollution is relatively low, but because it is usually toxic and non-biodegradable, it is a major problem. Sewage from factories along the Ganges is another source of pollution. During the festival, more than 70 million people bathed in the Ganges to wash the sins they have committed in the past. Some substances remain in the Ganges, such as food, garbage or leaves, andthey are also the cause of pollution in the Ganges. Traditional beliefs claim that cremation on its shore and sailing along the Ganges can purify the souls of the dead and lead them directly to salvation.

Objectives

The Ganges River is a holy land for Hindus. It flows through some countries and has a certain influence. For thousands of years, people have been engaged in spiritual practice and worshiped the goddess of Ganges. Places like Haridwar, Rishikesh, and Varanasi worship the Ganges. During Covid-19 Pandemic, the bodies of Covid-19 victims were found in some rivers in India.

The water before the Ganges is different today, because the water we drink today is in the dam. But now, entering the 21st century, the Ganges River is becoming a trash can for Indians, instead of people worshiping and using the reservoir to wash clothes, throw garbage and pollute the beautiful river. The Ganges is the livelihood of the indigenous people, and their agriculture and irrigation plants depend on the river. Agriculture is themain activity of most of the rural population in the Ganges River Basin, and therefore is the main water user in the basin area. With the rapid population growth, the improvement of living standards, and theexponential growth of industrialization and urbanization, which have led to shocking pollution, unsustainable development, fisheries and poaching, the biological resources of the Ganges are threatened. Therefore, the demand and competition for natural resources, especially domestic water and irrigation water, are very fierce, andmost of the tributaries of the river basin are regulated by dams. The Ganges Action Plan was initiated by Shri Rajiv Gandhi, then Prime Minister of India, on January 14, 1986. The main goal is to reduce pollution and improve by collecting, diverting and treating domestic wastewater and existing industrial and toxic substances. Water quality. Chemical residues from identified extreme pollutants entering the river. The ultimate goal of BPA is an integrated approach

to watershed management that takes into account the various dynamic interactions between non-living and biological ecosystems.

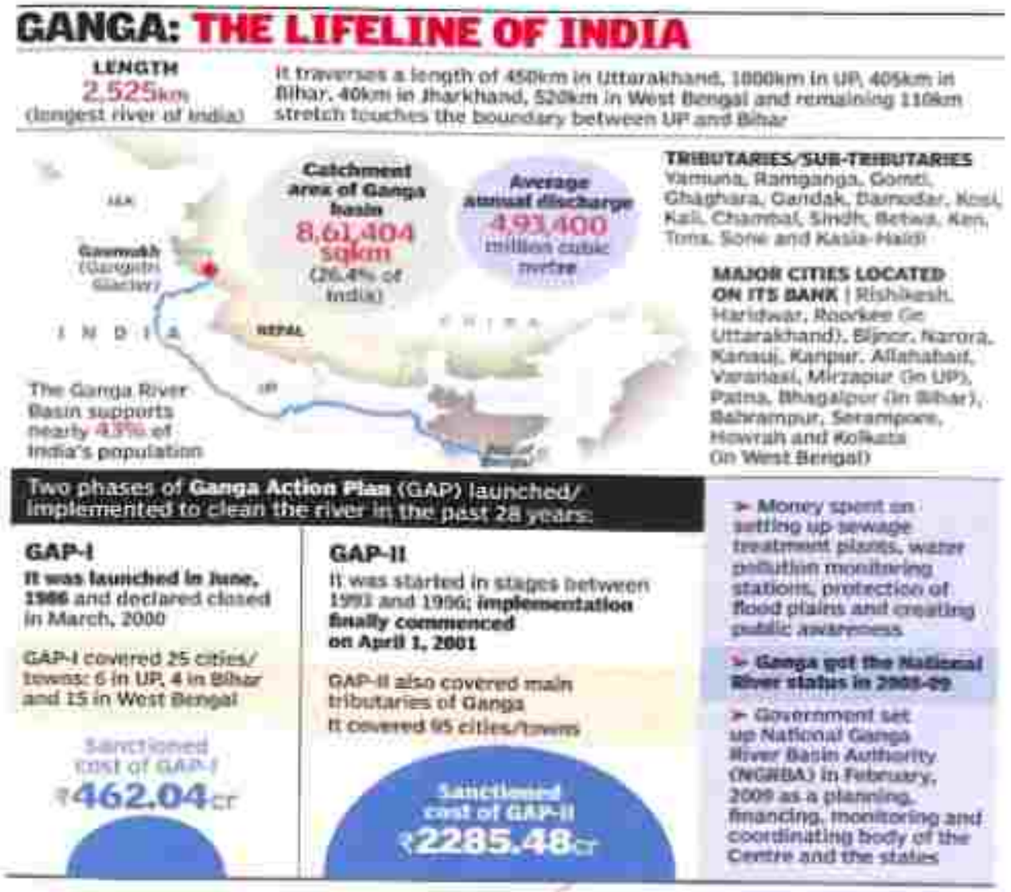
Study Area

The source of the Ganges water is the Himalayan snowmelt and monsoon rains. According to mythology, Gaumukh (the mouth of a cow) at an approximate altitude of 4000 meters is the source of the Ganges, although the Ganges actually rises in various streams at an altitude of 6000 meters and higher.

The Ganges Basin is located between 73°30 to 89°0 east longitude and 22°30 to 31°30 north latitude. It covers an area of 1.086 million square kilometres and straddles India, China, Nepal and Bangladesh. Its drainage area in India is 8, 62,769 square kilometres, which means that about 80% of the drainage area is in India. India's watershed area accounts for 26% of the country's area and is home to approximately 43% of the population (448.3 million according to the 2001 census). Among the many watersheds in India (12 watersheds and 14 small watersheds and desert watersheds), the Ganges River Basin is considered part of the integrated Ganga-Brahmaputra-Meghna watershed, the largest watershed in India and the world's fifth largest watershed. The most populated and oldest inhabited plain in the world, agriculture supports this population. The average population density of the basin exceeds 550 people per square kilometre, while in the delta region- more than 900 people per square kilometre.

The Northern mountains, Indo-Gangetic Plains and Central Highlands collectively shape the Ganga river basin that's bounded at the north with the aid of using the Himalaya mountain ranges; in the west the Ganga basin borders the

Indus basin after which the Aravalli ridge; at the south it's far bounded by the Vindhyas and Chhotanagpur plateaus and at the east with the aid of using the Brahmaputra ridge. The Ganga basin includes hilly terrains of the Himalaya with dense forest, carefully forested Shiwalik hills and the fertile Ganga plains. The Ganga is the predominant river of the Indian subcontinent and maximum vital Perennial River. During its 2,525 km course, gouging a distance of approximately 220 km withinside the Himalayas, it enters the obvious at Haridwar and flows southeast via the Indian states of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal in the long run becoming a member of the ocean on the Bay of Bengal.



Importance of the project

The Ganges is the maximum sacred river of Hindus. It is an existence saver to a big quantity of Indians who lived alongside its path and depend upon it for each day requirements. It is worshipped because the goddess Ganga in Hinduism. It has moreover been critical verifiably, with many preceding not unusual place or imperial capitals (like Pataliputra, Kannauj, Kara, Kashi, Patna what is greater, Kolkata located on its banks or the banks of feeders and related streams. The most important stem of the Ganges starts on the city of Devprayag, at conversion of the Alaknanda, that is the supply move in hydrology due to its greater noteworthy length, and the Bhagirathi, that is taken into consideration the supply move in Hindu folklore. The Ganges is undermined with the aid of using intense contamination. This represents a peril now no longer solely to humans but moreover to creatures, the Ganges is domestic to approx. 140 sorts of fish and 90 sorts of creatures of land and water.

Figure 3: Ganga Arti Ritual

The river moreover carries reptiles and nicely developed creatures, counting essentially imperilled species which includes the gharial and South Asian River dolphin. The stages of faecal coliform microscopic organisms from human waste in the river near Varanasi are greater than more than one instances the Indian government's reputable breaking point. The Ganga Action Plan, an herbal initiative to tidy up the river, has been considered as a unhappiness that is otherwise ascribed to corruption, a loss of will in the government, helpless specialised expertise, natural arranging and a loss of assist from local spiritual authorities.

Methodology

The Ganga is a vast river each from a socio monetary and non-secular factor of view. However, the river Ganga is being drastically getting polluted through home and business waste alongside its banks. The Ganga Action Plan became initiated in 1986 to smooth up the river and guard it from similarly pollution. This paper discusses the, "Ganga Action Plan" its implementation, impacts, successes and failures. Generally, the initiatives methodologies are precise, strict and commonly incorporates a sequence of steps for every factors of the project. The method is a set of methods, practice, strategies manufacturers and rules. This paper describes the plan. The challenges, successes and issues and the plans for different river basins in India.

Personally, I have not visited the location. I used second-hand data from websites, books and the help of various research papers.

Result and Discussion

Water management is not really knowledge-based practice. The Ganga's management group sponsored by government lacks cross-basin integration, and the states are not well coordinated. In addition, the bigger challenge is to improve the water supply and sewage treatment infrastructure of certain smart cities, and to provide drinking water for all rural households by 2024.

Although the Ganges River has religious and daily significance to the Indians, it has been polluted day by day and has become a polluted river in the world. Due to India's rapid growth and religious reasons, the pollution of the Ganges is caused by human and industrial waste. Activities such as idols throwing flowers and garlands into the water, submerged in the river and littering. Therefore, in order not to pollute the Ganges, these unethical activities must be interrupted.

India currently has a population of more than 1 billion, of which 400 million live in the Ganges Basin. As a result, most of the waste, including untreated sewage, was dumped in the river. In addition, many people bathe and wash clothes in the river.

Conclusion

The Ganges is called a sacred river, but it is not treated like that, and it is not respected. Today, the condition of the Ganges has deteriorated, and this respected river is dying due to pollution and waste. Worshipping is good, but we must treat it well, which is impossible before people realize it. Clean the Ganges, but there is still much work to be done. People must have enough responsibility to take care of the rivers that provide them with food, water, etc. in order to survive. People hold sacrificial rituals in front of the Ganges. Except for throwing rubbish into the same waters where they worship, the rivers regarded as goddesses are not treated like this, so all citizens should take the pollution of the Ganges seriously. Should be regarded as the goddess of Ganges.

Figure 6: Statue of Goddess Ganga

Human wishes and greed not to mention rapid visible experience have disturbed the touchy ecological balance. Not handiest this, human beings are depleting and degrading the essential life supporting structures along air, water and land that belong to the entire residing world. Individual actions of a big form of humans at huge will substantially have an impact at the environment. So, we were given to apprehend and talk environmental issues and solutions, we have to seriously consider them. Like any social and political movement, environmentalism (a shape of ethical codes directed for carrying out better environmental management) gives an in depth form of approaches.

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While doing the project I received immense knowledge. The sources of information to do this project are given below-:

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Samanta
25/05/2022

DISASTER MANAGEMENT

-floods, earthquake, cyclones and landslides.

ENVS PROJECT (AECC2)

Presented by:-

YAMINI

SEMESTER 2

ECONOMICS DEPARTMENT (HONS)

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INTRODUCTION

A disaster refers to sudden serious disruption of normal functioning of a society, involving large damages to life, property and environment, beyond its ability to cope with its own resources. It can be natural or man-made or a combination of both.

Disaster management is defined as the organization and management of resources and responsibilities for dealing with all the humanitarian aspects of emergencies, in particular preparedness, response and recovery in order to lessen the impact of disasters.

PHASES OF DISASTER MANAGEMENT:

There are four phases of disaster management;

1. **Mitigation:**

Preventing future emergencies or minimizing their effects;

- **Includes any activities that can prevent or reduce the chance of occurrence of an emergency, or reduce the damaging effects of unavoidable emergencies.**
- **Mitigation activities take place before and after emergencies.**
- **This can be done by revised zoning, land use management, etc.**

2. <u>Preparedness</u>:

Preparing to handle an emergency;

- Includes plans or preparations for disaster and to help response and rescue operations.
- Evacuation plans and stocking food and water are both examples of preparedness.
- Preparedness activities take place before an emergency occurs.

3. <u>Response</u>:

Responding safely to an emergency;

- Includes actions which are to be taken to save lives and prevent further property damage. Response is putting your preparedness plans into action.
- Seeking shelter from a tornado or turning off gas valves in an earthquake are both response activities.
- Response activities take place during an emergency.

4. Recovery:

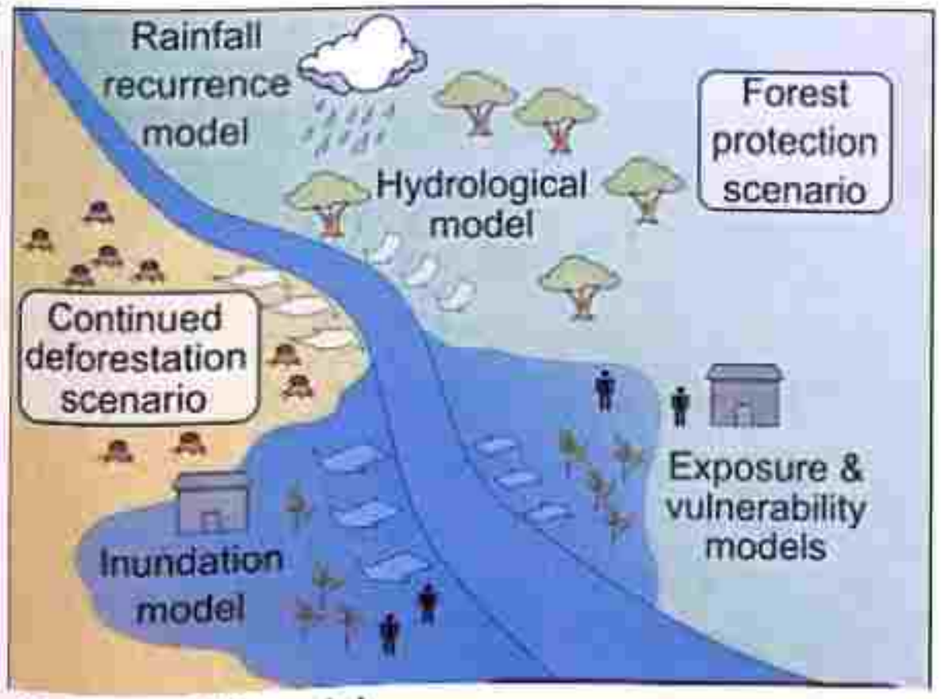
Recovering from an emergency;

- Includes actions need to be taken to return to a normal or an even safer situation following an emergency and one should also consider things which would mitigate the effects of future disasters.
- Recovery includes getting financial assistance to help pay for the repairs.
- Recovery activities take place after a disaster.

FLOODS:-

Floods occur when land that is usually dry is submerged by large amounts of water. Sudden submergence or inundation of land area with water is called as flood.

The occurrence of floods can be due to both Natural and human causes. Anthropogenic causes of floods include: Clearing of forests; Urban development; Improper farming and other land use practices; Enhanced Green house effect. Natural causes of floods: Excessive rainfall; Storm Surges; Melting Snow; Global Atmospheric processes; Earthquakes.



(Causes of floods)

Impact of floods: Loss of life; Damage to infrastructure and property; Spread of Diseases; Loss of natural habitat.

Management and mitigation of floods:-

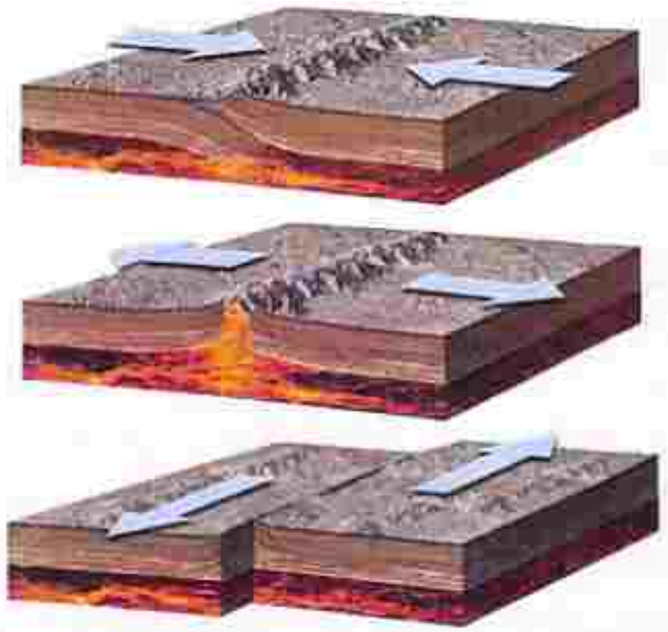
Floods can be mitigated by:

- **Structural methods include building dams, reservoirs, and retarding basins, channel management and embankments.**
- **Water control methods: include increasing forest and vegetation cover, watershed management, flood proofing and catchment modifications. Schemes of drainage and flood protection.**
- **Non-structural methods: flood forecasting, flood warning and emergency preparedness systems, flood insurance, public information and education, and flood relief.**

EARTHQUAKE:-

An earthquake is the shaking of the surface of the Earth, with sudden release of energy in the form of seismic waves on the surface of the earth.

Causes of earthquake: According to the theory of plate tectonics, plates do not always move smoothly against each other and sometimes get stuck. This builds up pressure. When this pressure is eventually released, an earthquake tends to occur from the movement of tectonic plates.



(Movement of plate tectonics causing Earthquakes)

Effects of earthquake: Soil Liquefaction; Landslides and avalanche; Tsunamis; Floods; Fires; Destabilization; *Loss of life and property.*

Management and mitigation methods:-

Earthquakes cannot be stopped or predicted accurately but certain management techniques could be followed to minimize its effect:

- Construction of buildings which can tolerate earthquakes.
- Soil testing should be done so that stability of building is assured.
- Seismic retrofitting is the modification of existing structures to make them more resistant to seismic activity, ground motion, or soil failure due to earthquakes.
- Preparedness and safe building construction can reduce extent of damage and loss.
- Establishment of GPS station in the earthquake prone region to assess future crustal movements.

CYCLONES:-

Cyclone refers to any spinning storm that rotates around a low-pressure center.

Formation of cyclone: The warm moist air over the ocean rises from the surface in the upward direction, resulting in the formation of the low-pressure zone over the surface. Air from the surrounding region, with higher pressure, pushes into the low-pressure area. The cool air becomes warm and moist and rises again, thus the cycle continues. As the warm air rises, the moisture in the air cools thus leading to the formation of cloud. The whole system grows gradually and becomes fast with time. As a result of this, an eye is created in the center, as shown in the figure, which is the low-pressure center into which the high-pressure air flows from above, thus creating a cyclone.

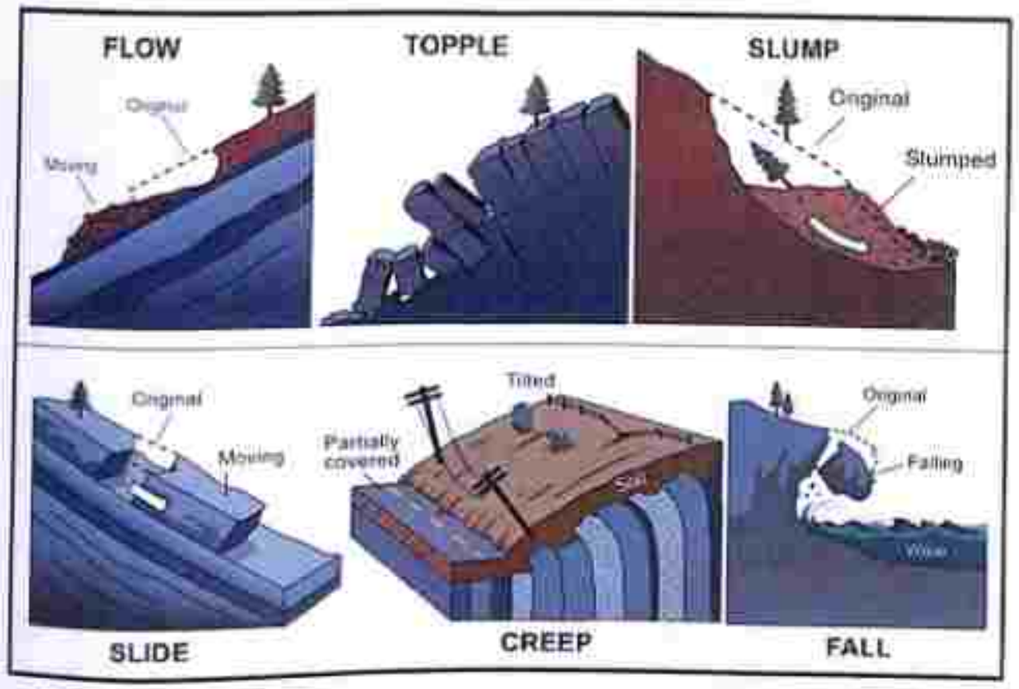
There should be maintenance of river embankments. Communication lines should be drawn underground. Construction of strong halls in vulnerable areas.

- Coastal Regulation Zone norms: They should be strictly enforced.
- Insurance cover: Comprehensive state insurance cover needs to be provided for persons, their properties and cattle.
- Preparedness: Coastal areas should have adequate preparedness against cyclones. Wide roads for quick evacuation, disaster resilient buildings, shelter houses etc.
- Awareness: Focused awareness activities are required to increase public awareness of storm surge, flooding and rainfall related to cyclone.

LANDSLIDES:-

A landslide/landslip is primarily a combination of several geological processes that include earth movements like extensive slope failure, rocks falling, and debris flow under the action of gravity.

Causes of landslides: Extensive Rainfall, Melting of Snow, Rivers, particularly during the floods triggering a landslide; Seismic Shaking and volcanic eruption; Deforestation; Developmental activities such as Excavation for minerals, tunnels etc. and road construction.



(Landslides)

Effects of landslides: blocking of streams leading to overflowing; disrupting vehicular movement; damages vegetation, roads, communication networks and buildings. It also results in accidents. Overall it acts as a risk to life.

Management and mitigation methods:

- Afforestation: It consolidates the slope thus checking slope instability. Degraded areas should be afforested and existing patches should be preserved.
- Wired stone blocks: Stone ridge is strapped with wire mesh to protect against landslides.
- Retaining wall: Construction of concrete retaining walls to prevent slippage from slope.
- Landslide hazard zonation mapping: Zonation mapping will help in preventing settlements in hazard prone area and also developing and continuously updating the inventory of landslide incidences affecting a country.
- Surface drainage: Draining of surface and subsurface rivers to allow smooth flow of water.

Management and mitigation methods:

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- Surface drainage: Draining of surface and subsurface rivers to allow smooth flow of water.
- Landslide Warning Techniques: Sensors have been developed which are used for the landslide warning and detection Early warning systems can disseminate information to masses on time, hereby saving many lives.
- Managing of catchment: Excess water in catchments areas should be stored to reduce the effect of flash floods, this will also recharge the ground water level.

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25/05/2022

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CLIMATE CHANGE AND ITS EFFECTS

-

GLOBAL WARMING, ACID RAIN & OZONE LAYER DEPLETION

CONTENTS

INTRODUCTION

The average temperature in many regions has been increasing in recent decades. The global average surface temperature has increased by 0.6° + 0.2° C over the last century. Globally, 1998 was the warmest year and the 1990s the warmest decade on record. Many countries have experienced increases in rainfall, particularly in the countries situated in the mid to high latitudes.

In some regions, such as parts of Asia and Africa, the frequency and intensity of droughts have been observed to increase in recent decades. Episodes of El Niño, which creates great storms, have been more frequent, persistent and intense since mid-1970s compared with the previous 100 years. All these are signs that the earth is sick. Its climate is changing, making it more difficult for mankind to survive. The earth is losing its ability to balance itself due to the imbalances created by human activities.

Nowadays, climate changes are very usual all throughout the world. It is among the most discussed topics by the scientists and researchers, the variations in the climatic conditions have emerged as an important topic of discussion.

Climate change refers to long-term shifts in temperatures and weather patterns. These shifts may be natural, such as through variations in the solar cycle. These changes have become rapid and adverse, posing a threat to the society. Earlier these changes were due to natural causes and sustainable. However, in the past few years these changes are not so natural but are caused due to human activities. Several human activities have impacted the Government in a negative way thus causing such adverse climate shifts.

There have been previous periods of climate change, but the current changes are distinctly more rapid and not due to natural causes which therefore lead to numerous issues .Nowadays, climate changes are caused by the emission of carbon dioxide (CO_2)

and methane. Burning fossil fuels for energy use creates most of these emissions. Certain agricultural practices, industrial processes, and forest loss are additional sources.[3] Greenhouse gases are transparent to sunlight, allowing it through to heat the Earth's surface. When the Earth emits that heat as infrared radiation the gases absorb it, trapping the heat near the Earth's surface. As the planet heats up it causes changes like the loss of sunlight-reflecting snow cover, amplifying global warming.

EFFECTS

Human societies will be seriously affected by extremes of climate such as droughts and floods. A changing climate would bring about changes in the frequency and/or intensity of these extremes. This is a major concern for human health. To a large extent, public health depends on safe drinking water, sufficient food, secure shelter, and good social conditions. All these factors are affected by climate change. Fresh water supplies may be seriously

affected, reducing the availability of clean water for drinking and washing during drought as well as floods. Water can be contaminated and sewage systems may be damaged. The risk of spread of infectious diseases such as diarrhoeal diseases will increase. Food production will be seriously reduced in vulnerable regions directly and also indirectly through an increase in pests and plant or animal diseases.

The local reduction in food production would lead to starvation and malnutrition with long-term health consequences, especially for children. Food and water shortages may lead to conflicts in vulnerable regions, with serious implications for public health.

Climate change related impacts on human health could lead to displacement of a large number of people, creating environmental refugees and lead to further health issues.

Changes in climate may affect the distribution of vector species, such as mosquitoes, which in turn will increase the spread of disease, such as malaria and filariasis, to new areas which lack a strong public health infrastructure. The seasonal transmission and distribution of many that are transmitted by mosquitoes (dengue, yellow fever) and by ticks (Lyme disease, tickborne encephalitis) may spread due to climate change.

CAUSES

The various causes of climate change can be categorised mainly into three types- Global warming, Acid rain and the Ozone layer depletion. These are tremendously affecting the earth, posing a threat to the human and animal living. We shall discuss the effects, causes and remedies of all the three above-mentioned phenomena in detail.

❖ Global Warming

Always hearing about global warming everywhere, but do we know what it really is? The evil of the worst form, global warming is a phenomenon that can affect life more fatally. Global warming refers to the increase in earth's temperature as a result of various human activities. The planet is gradually getting hotter and threatening the existence of lifeforms on it. Despite being relentlessly studied and researched upon, global warming for the majority of the population remains an abstract concept of science. It is this concept which over the years has culminated in making global warming a stark reality and not a concept covered in books.

Since the Industrial Revolution, the global annual temperature has increased in total by a little more than 1 degree Celsius, or about 2 degrees Fahrenheit. Between 1880—1980, it rose on average by 0.07 degrees Celsius (0.13 degrees Fahrenheit) every 10 years. Since 1981, however, the rate of increase has more than doubled.

For the last 40 years, we've seen the global annual temperature rise by 0.18 degrees Celsius, or 0.32 degrees Fahrenheit, per decade. The result? A planet that has never been hotter. Nine of the 10 warmest years since 1880 have occurred since 2005—and the 5 warmest years on record have all occurred since 2015. Climate change deniers have argued that there has been a "pause" or a "slowdown" in rising global temperatures, but numerous studies, including a 2018 paper published in the journal *Environmental Research Letters*, have disproved this claim. The impacts of global warming are already harming people around the world.

CAUSES

Global warming occurs when carbon dioxide (CO_2) and other air pollutants 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.

Though natural cycles and fluctuations have caused the earth's climate to change several times over the last 800,000 years, our current era of global warming is

directly attributable to human activity—specifically to our burning of fossil fuels such as coal, oil, gasoline, and natural gas, which results in the greenhouse effect. In the United States, the largest source of greenhouse gases is transportation (29 percent), followed closely by electricity production (28 percent) and industrial activity (22 percent).

Global warming is not caused by one sole reason that can be curbed. There are multifarious factors that cause global warming most of which are a part of an individual's daily existence. Burning of fuels for cooking, in vehicles, and for other

conventional uses, a large amount of greenhouse gases like carbon dioxide, methane amongst many others is produced which accelerates global warming. Rampant deforestation also results in global warming as lesser green cover results in an increased presence of carbon dioxide in the atmosphere which is a greenhouse gas.

EFFECTS

a) Extreme Temperatures- As global average temperatures warm, weather patterns are changing. An immediate consequence of global warming is extreme weather. These extremes come in a lot of different flavours. Paradoxically, one effect of climate change can be colder-than-normal winters in some areas. Changes in climate can cause the polar jet stream -the boundary between the cold North Pole air and the warm equatorial air-to migrate south, bringing with it cold, Arctic air. This is why some states can have a sudden cold snap or colder-than-normal winter, even during the long-term trend of global warming.

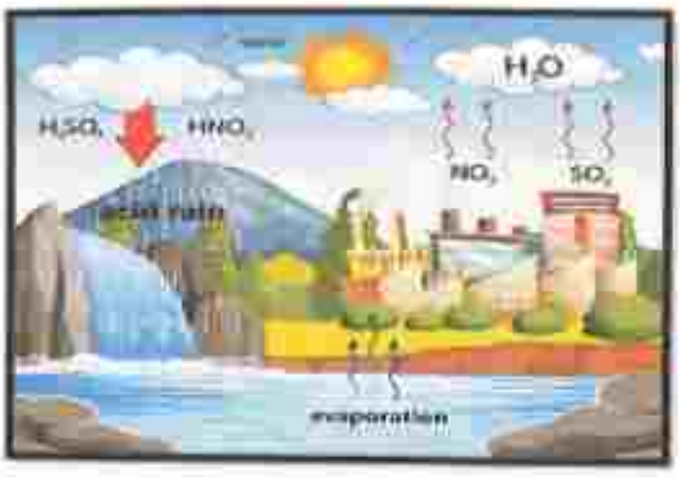
b) Storms and Cyclones- Global warming is also changing other extreme weather. According to the scientists, cyclones and hurricanes are likely to become more intense, on average, in a warming world. Most computer models suggest that hurricane frequency will stay about the same (or even decrease), but those storms that do form will have the capacity to drop more rain due to the fact that warmer air holds more moisture. Moreover, hurricanes of the future will be hitting shorelines that are already prone to flooding due to the sea-level rise caused by climate change. This means that any given storm will likely cause more damage than it would have in a world without global warming.

c) Melting of Ice- One of the most dramatic effects of global warming is the reduction in Arctic Sea ice. Sea ice hit record-low extents in both the fall and winter of 2015 and 2016, meaning that at the time when the ice is supposed to be at its peak, it

was lagging. The melt means there is less thick sea ice that persists for multiple years. That means less heat is reflected back into the atmosphere by the shiny surface of the ice and more is absorbed by the comparatively darker ocean, creating a feedback loop that causes even more melt.

d) Plants and Animals- The effects of global warming on the Earth's ecosystems are expected to be profound and widespread. Many species of plants and animals are already moving their range northward or to higher altitudes as a result of warming temperatures. Warmer temperatures will also expand the range of many disease-causing pathogens that were once confined to tropical and subtropical areas, killing off plant and animal species that formerly were protected from disease.

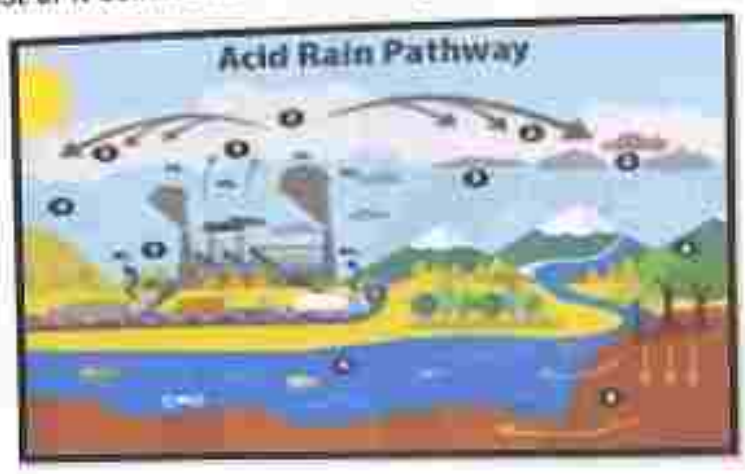
❖ Acid Rain



When fossil fuels such as coal, oil and natural gas are burned, chemicals like sulphur dioxide and nitrogen oxides are produced. These chemicals react with water and other chemicals in the air to form sulfuric acid, nitric acid and other harmful pollutants like sulphates and nitrates. These acid pollutants spread upwards into the atmosphere, and are carried by air currents, to finally return to the ground in the form of acid rain, fog or snow. The corrosive nature of acid rain causes many forms of environmental damage. Acid pollutants also occur as dry particles and gases, which when washed from the ground by rain, add to the acids in the rain to form a more corrosive solution. This is called acid deposition.

CAUSES

Acid rain results when sulphur dioxide (SO_2) and nitrogen oxides (NO_x) are emitted into the atmosphere and transported by wind and air currents. The SO_2 and NO_x react with water, oxygen and other chemicals to form sulfuric and nitric acids. These then mix with water and other materials before falling to the ground. While a small portion of the SO_2 and NO_x that cause acid rain is from natural sources such as volcanoes, most of it comes from the burning of fossil fuels.



The major sources of SO_2 and NO_x in the atmosphere are:

- Burning of fossil fuels to generate electricity. Two thirds of SO_2 and one fourth of NO_x in the atmosphere come from electric power generators.
- Vehicles and heavy equipment.
- Manufacturing, oil refineries and other industries.

FORMS OF ACID RAIN

WET DEPOSITION Wet deposition is what we most commonly think of as acid rain. The sulfuric and nitric acids formed in the atmosphere fall to the ground mixed with rain, snow, fog, or hail.

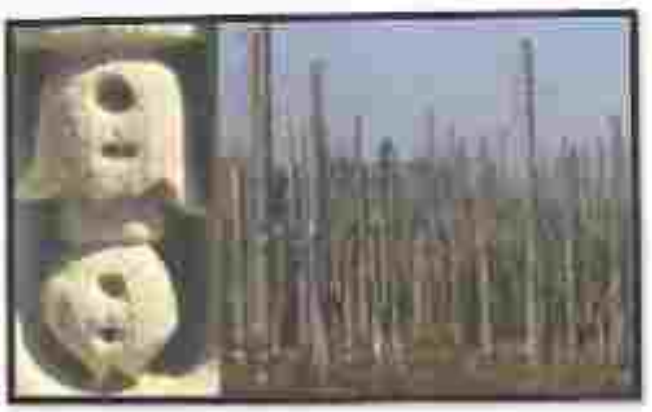
DRY DEPOSITION Acidic particles and gases can also deposit from the atmosphere in the absence of moisture as *dry deposition*. The acidic particles and gases may deposit to surfaces (water bodies, vegetation, buildings) quickly or may react during atmospheric transport to form

larger particles that can be harmful to human health. When the accumulated acids are washed off a surface by the next rain, this acidic water flows over and through the ground, and can harm plants and wildlife, such as insects and fish.

EFFECTS

Acid rain dissolves and washes away nutrients in the soil which are needed by plants. It can also dissolve naturally occurring toxic substances like aluminium and mercury, freeing them to pollute water or poison plants.

Acid rain indirectly affects plants by removing nutrients from the soil in which they grow. It affects trees more directly by creating holes in the waxy coating of leaves, causing brown dead spots which affect the plant's photosynthesis. Such trees are also more vulnerable to insect infestations, drought and cold.



Spruce and fir forests at higher elevations seem to be most at risk. Farm crops are less affected by acid rain than forests. Acid rain that falls or flows as ground water to reach rivers, lakes and wetlands, causes the water in them to become acidic. This affects plant and animal life in aquatic ecosystems.

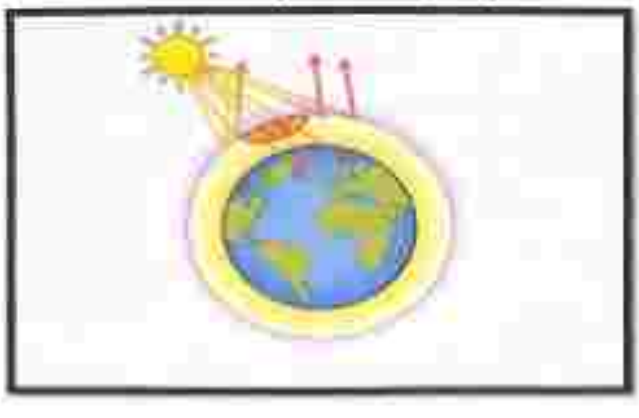
Acid rain also has far reached effects on wildlife. By adversely affecting one species, the entire food chain is disrupted, ultimately endangering the entire ecosystem. Different aquatic species can tolerate different levels of acidity. For instance, clams and mayflies have a high mortality when water has a pH of 6.0, while frogs can tolerate more acidic water, although with the decline in supply of mayflies, frog populations may also decline.

❖ Ozone layer Depletion

The ozone layer is mainly found in the lower portion of the earth's atmosphere. It has

the potential to absorb around 97-99% of the harmful ultraviolet radiations coming from the sun that can damage life on earth. If the ozone layer was absent, millions of people would develop skin diseases and may have weakened immune systems. However, scientists have discovered a hole in the ozone layer over Antarctica. This has focussed their concern on various environmental issues and steps to control them. The main reasons for the ozone hole are chlorofluorocarbons, carbon tetrachloride, methyl bromide and hydrochlorofluorocarbons.

Ozone layer depletion is the thinning of the ozone layer present in the upper atmosphere. This happens when the chlorine and bromine atoms in the atmosphere come in contact with ozone and destroy the ozone molecules. One chlorine can destroy 100,000 molecules of ozone. It is destroyed more quickly than it is created. Some compounds release chlorine



and bromine on exposure to high ultraviolet light, which then contributes to ozone layer depletion. Such compounds are known as Ozone Depleting Substances (ODS).

The ozone-depleting substances that contain chlorine include chlorofluorocarbon, hydrochlorofluorocarbons, and methyl chloroform. Whereas, the ozone-depleting substances that contain bromine are halons, methyl bromide, and hydro Bromo

fluorocarbons. Chlorofluorocarbons are the most abundant ozone-depleting substance. It is only when the chlorine atom reacts with some other molecule, it does not react with ozone.

CAUSES

Ozone layer depletion is a major concern and is associated with a number of factors. The main causes responsible for the depletion of the ozone layer are listed below:

Chlorofluorocarbons

Chlorofluorocarbons or CFCs are the main cause of ozone layer depletion. These are released by solvents, spray aerosols, refrigerators, air-conditioners, etc. The molecules of chlorofluorocarbons in the stratosphere are broken down by ultraviolet radiations and release chlorine atoms. These atoms react with ozone and destroy it.

Unregulated Rocket Launches

Researchers say that the unregulated launching of rockets results in much more depletion of the ozone layer than the CFCs do. If not controlled, this might result in a huge loss of the ozone layer by the year 2050.

Nitrogenous Compounds

The nitrogenous compounds such as NO_2, NO, N_2O are highly responsible for the depletion of the ozone layer.

Natural Causes

The ozone layer has been found to be depleted by certain natural processes such as Sun-spots and stratospheric winds. But it does not cause more than 1-2% of the ozone layer depletion.

EFFECTS

The depletion of the ozone layer has harmful effects on the environment. Let us see the major effects of ozone layer depletion on man and environment. Humans will be directly exposed to the harmful ultraviolet radiation of the sun due to the depletion of the ozone layer. This might result in serious health issues among humans, such as skin diseases, cancer, sunburns, cataract, quick ageing and weak immune system. Direct exposure to ultraviolet radiations leads to skin and eye cancer in animals.

Strong ultraviolet rays may lead to minimal growth, flowering and photosynthesis in

plants. The forests also have to bear the harmful effects of the ultraviolet rays. Planktons are greatly affected by the exposure to harmful ultraviolet rays. These are higher in the aquatic food chain. If the planktons are destroyed, the organisms present in the food chain are also affected.

Thus, Climate change is happening now, and it's the most serious threat to life on our planet. We need to work hard to keep this in control to save ourselves from worse situations. Core to all climate change solutions is reducing greenhouse gas emissions, which must get to zero as soon as possible. Because both forests and oceans play vitally important roles in regulating our climate, increasing the natural ability of forests and oceans to absorb carbon dioxide can also help stop global warming.

All countries need to move their economies away from fossil fuels as soon as possible. Petrol and diesel vehicles, planes and ships use fossil fuels. Reducing car use, switching to electric vehicles and minimising plane travel will not only help stop climate change, it will reduce air pollution too. Forests are crucial in the fight against climate change, and protecting them is an important climate solution. Cutting down forests on an industrial scale destroys giant trees which could be sucking up huge amounts of carbon. Thus, we have to be cautious towards the above given points for a better future.

Chamanth
26/05/2022

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YEAR: 2021-2022

TOPIC NAME: **OCEAN ACIDIFICATION**

ENVS PROJECT (AECC-2)

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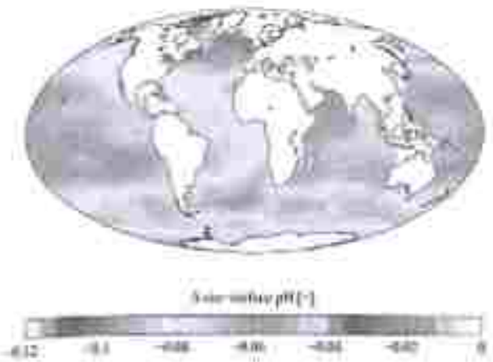
OCEAN ACIDIFICATION

INTRODUCTION

Ocean acidification is the ongoing decrease in the pH value of the Earth's oceans, caused by the uptake of carbon dioxide (CO_2) from the atmosphere. The main cause of ocean acidification is human burning of fossil fuels. As the amount of carbon dioxide in the atmosphere increases, the amount of carbon dioxide absorbed by the ocean also increases. This leads to a series of chemical reactions in the seawater which has a negative spillover on the ocean and species living below water. When carbon dioxide dissolves into seawater, it forms carbonic acid (H_2CO_3). Some of the carbonic acid molecules dissociate into a bicarbonate ion and a hydrogen ion, thus increasing ocean acidity (H^+ ion concentration). Between 1751 and 1996, the pH value of the ocean surface is estimated to have decreased from approximately 8.25 to 8.14, representing an increase of almost 30% in H^+ ion concentration in the world's oceans (the pH scale is logarithmic, so a change of one in pH unit is equivalent to a tenfold change in H^+ ion concentration).



Increasing acidity is thought to have a range of potentially harmful consequences for marine organisms such as depressing metabolic rates and immune responses in some organisms and causing coral bleaching. Ocean acidification is impacting on the ecosystems of marine environments that provide food, livelihoods, and other ecosystem services for a large proportion of

oceans, terrestrial biosphere, lithosphere, and atmosphere. The carbon cycle involves both organic compounds such as cellulose and inorganic carbon compounds such as carbon dioxide, carbonate ion, and bicarbonate ion. The inorganic compounds are particularly relevant when discussing ocean acidification for they include many forms of dissolved CO2 present in the earths oceans.

When CO2 dissolves, it reacts with water to form a balance of ionic and non-ionic chemical species: dissolved free carbon dioxide ($CO_{2(aq)}$, Carbonic acid (H_2CO_3),bicarbonate (HCO_3^-), Carbonate(CO_3^-). The ratio of these species depends on factors such as seawater temperature, pressure and salinity (as shown in a Bjerrum plot). These different forms of dissolved inorganic carbon are transferred from an ocean's surface to its interior by the ocean's solubility pump.

The resistance of an area of ocean to absorbing atmospheric CO_2 is known as the Revelle factor.

Ocean acidification has been compared to anthropogenic climate change and called the "evil twin of global warming" and "the other CO_2 problem". Increased ocean temperatures and oxygen loss act concurrently with ocean acidification and constitute the "deadly trio" of climate change pressures on the marine environment. Freshwater bodies also appear to be acidifying, although this is a more complex and less obvious phenomenon.

An estimated 30–40% of the carbon dioxide from human activity released into the atmosphere dissolves into oceans, rivers and lakes.

MECHANISM OF ACIDFICATION

Dissolving CO_2 in seawater increases the hydrogen ion (H^+)concentration in the ocean, and thus decreases ocean pH, as follows:

$CO_{2\,(aq)} + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons HCO_3^- + H^+ \rightleftharpoons CO_3^{2-} + 2\,H^+$.

Approximately one-third of the carbon dioxide released into the atmosphere by human activity is dissolved into oceans, rivers, and lakes, resulting in increasing

In shallow coastal and shelf regions, a number of factors interplay to affect pH change in addition to atmospheric CO_2. h These include biological processes, such as photosynthesis and respiration, and water upwelling onto the coast can

Also, ecosystem metabolism in freshwater sources reaching coastal waters can lead to large pH changes there, with the rates of biologically induced pH change dependent on local water temperature.

EFFECTS ON CALCIFICATION

Changes in ocean chemistry can have extensive direct and indirect effects on organisms and their habitats. One of the most important repercussions of increasing ocean acidity relates to the production of shells and plates out of calcium carbonate ($CaCO_3$ This process is called calcification and is important to the biology and survival of a wide range of marine organisms. Calcification involves the precipitation of dissolved ions into solid $CaCO_3$ as coccoliths. After they are formed, such structures are vulnerable to dissolution unless the surrounding seawater contains saturating concentrations of carbonate ions (CO_3^{2-}).

MECHANISM

Of the extra carbon dioxide added into the oceans, some remains as dissolved carbon dioxide, while the rest contributes towards making additional bicarbonate (and additional carbonic acid). This also increases the concentration of hydrogen ions, and the percentage increase in hydrogen is larger than the percentage increase in bicarbonate, creating an imbalance in the reaction $HCO_3^- \rightleftharpoons CO_3^{2-} + H^+$. To maintain chemical equilibrium, some of the carbonate ions already in the ocean combine with some of the hydrogen ions to make further bicarbonate. Thus the ocean's concentration of carbonate ions is reduced, creating an imbalance in the reaction $Ca^{2+} + CO_3^{2-} \rightleftharpoons CaCO_3$, and making the dissolution of formed CaCO
$_3$ structures more likely.

The increase in concentrations of dissolved carbon dioxide and bicarbonate, and reduction in carbonate, are shown in a Bjerrum plot.

SATURATION STATE

The saturation state (known as Ω) of seawater for a mineral is a measure of

cause calcareous species to perform more poorly than noncalcareous species in years with low pH and predicts consequences forshore benthic ecosystems.

Current rates of ocean acidification have been compared with the greenhouse event at the Paleocene–Eocene boundary (about 55 million years ago) when surface ocean temperatures rose by 5–6 degrees Celsius. No catastrophe was seen in surface ecosystems, yet bottom-dwelling organisms in the deep ocean experienced a major extinction. The current acidification is on a path to reach levels higher than any seen in the last 65 million years and the rate of increase is about ten times the rate that preceded the Paleocene–Eocene mass extinction. The current and projected acidification has been described as an almost unprecedented geological event. A National Research Council study released in April 2010 likewise concluded that "the level of acid in the oceans is increasing at an unprecedented rate". A 2012 paper in the journal *Science* examined the geological record in an attempt to find a historical analog for current global conditions as well as those of the future. The researchers determined that the current rate of ocean acidification is faster than at any time in the past 300 million years.

A review by climate scientists at the RealClimate blog, of a 2005 report by the Royal Society of the UK similarly highlighted the centrality of the *rates* of change in the present anthropogenic acidification process, writing

"The natural pH of the ocean is determined by a a need to balance the deposition and burial of $CaCO_3$ on the sea floor against the influx of Ca^{2+} and CO_3^{2-} into the ocean from dissolving rocks on land, called weathering. These processes stabilize the pH of the ocean, by a mechanism called $CaCO_3$ compensation...The point of bringing it up again is to note that if the CO_2 concentration of the atmosphere changes more slowly than this, as it always has throughout the Vostok record, the pH of the ocean will be relatively unaffected because $CaCO_3$ compensation can keep up. The [present] fossil fuel acidification is much faster than natural changes, and so the acid spike will be more intense than the earth has seen in at least 800,000 years."

IMPACT

Increasing acidity has possibly harmful consequences, such as depressing metabolic rates in **jumbo squid**, depressing the immune responses of blue mussels, and coral bleaching.

The reports "Ocean Acidification Summary for Policymakers 2013" and the IPCC approved "Special Report on the Ocean and Cryosphere in a Changing Climate" from 2019 describe research findings and possible impacts.

CORAL BLEACHING

The phenomenon of coral bleaching or coral whitening and the degeneration of coralline reef ecosystems is one consequence of increasing ocean acidity. The tropical and sub-tropical environments, including areas such as the Caribbean and surrounding regions, tropical Asia (e.g. Indonesia, Philippines, Thailand, Maldives) and the tropical Pacific (e.g. Australian Barrier Reef, Pacific Islands, Papua New Guinea) are mostly affected by coral bleaching, as these are the regions of the world that contain the largest and most extensive coral reef systems.

IMPACTS ON OCEANIC CALCIFYING ORGANISMS

Increasing ocean acidification makes it more difficult for shell-accreting organisms to access carbonate ions, essential for the production of their hard

When exposed in experiments to pH reduced by 0.2 to 0.4, larvae of a temperate brittlestar, a relative of the common sea star, fewer than 0.1 percent survived more than eight days. There is also a suggestion that a decline in the coccolithophores may have secondary effects on climate, contributing to global warming by decreasing the Earth's albedo via their effects on oceanic cloud cover.[115] All marine ecosystems on Earth will be exposed to changes in acidification and several other ocean biogeochemical changes.

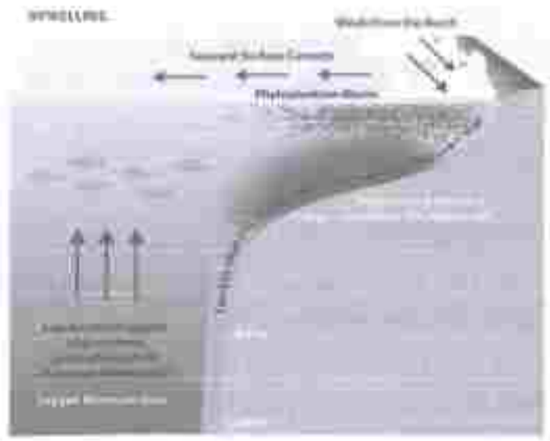
The fluid in the internal compartments (the coelenteron) where corals grow their exoskeleton is also extremely important for calcification growth. When the saturation rate of aragonite in the external seawater is at ambient levels, the corals will grow their aragonite crystals rapidly in their internal compartments, hence their exoskeleton grows rapidly. If the level of aragonite in the external seawater is lower than the ambient level, the corals have to work harder to maintain the right balance in the internal compartment. When that happens, the process of growing the crystals slows down, and this slows down the rate of how much their exoskeleton is growing. Depending on how much aragonite is in the surrounding water, the corals may even stop growing because the levels of aragonite are too low to pump into the internal compartment. They could even dissolve faster than they can make the crystals to their skeleton, depending on the aragonite levels in the surrounding water Under the current progression of carbon emissions, around 70% of North Atlantic cold-water corals will be living in corrosive waters by 2050–60.

A study conducted by the Woods Hole Oceanographic Institution in January 2018 showed that the skeletal growth of corals under acidified conditions is primarily affected by a reduced capacity to build dense exoskeletons, rather than affecting the linear extension of the exoskeleton. Using Global Climate Models, they show that the density of some species of corals could be reduced by over 20% by the end of this century.

An *in situ* experiment on a 400 m^2 patch of the Great Barrier Reef to decrease seawater CO_2 level (raise pH) to close to the preindustrial value showed a 7% increase in net calcification. A similar experiment to raise *in situ* seawater CO_2 level (lower pH) to a level expected soon after the middle of this century found that net calcification decreased 34%.

Ocean acidification may f force some organisms to reallocate resources away from productive endpoints such as growth in order to maintain calcification.

web, i.e. that the increases in consumption from thermal stress more than negates any primary producer to herbivore increase from elevated CO_2.



Thus, ecosystem impacts amplified by ocean warming and deoxygenation.

NONBIOLOGICAL IMPACTS

Leaving aside direct biological effects, it is expected that ocean acidification in the future will lead to a significant decrease in the burial of carbonate sediments for several centuries, and even the dissolution of existing carbonate sediments. This will cause an elevation of ocean alkalinity, leading to the enhancement of the ocean as a reservoir for CO_2 with implications for climate change as more CO_2 leaves the atmosphere for the ocean.

IMPACTS ON HUMAN INDUSTRY

The threat of acidification includes a decline in commercial fisheries and in the Arctic tourism industry and economy. Commercial fisheries are threatened because acidification harms calcifying organisms which form the base of the Arctic food webs.

Pteropods and brittle stars both form the base of the Arctic food webs and are both seriously damaged from acidification. Pteropods shells dissolve with increasing acidification and the brittle stars lose muscle mass when re-growing appendages. For pteropods to create shells they require aragonite which is produced through carbonate ions and dissolved calcium. Pteropods are severely affected because increasing acidification levels have steadily decreased the amount of water supersaturated with carbonate which is needed for aragonite

POSSIBLE RESPONSES

REDUCING GREENHOUSE GAS EMISSIONS

Members of the InterAcademy Panel recommended that by 2050, global anthropogenic CO_2 emissions be reduced less than 50% of the 1990 level. The 2009 statement also called on world leaders to:

- Acknowledge that ocean acidification is a direct and real consequence of increasing atmospheric CO_2 concentrations, is already having an effect at current concentrations, and is likely to cause grave harm to important marine ecosystems as CO_2 concentrations reach 450 [parts-per-million (ppm)] and above;
- ... Recognize that reducing the build up of CO_2 in the atmosphere is the only practicable solution to mitigating ocean acidification;
- ... Reinvigorate action to reduce stressors, such as overfishing and pollution, on marine ecosystems to increase resilience to ocean acidification.

Stabilizing atmospheric CO_2 concentrations at 450 ppm would require near-term emissions reductions, with steeper reductions over time.

The German Advisory Council on Global Change stated:

In order to prevent disruption of the calcification of marine organisms and the resultant risk of fundamentally altering marine food webs, the following guard rail should be obeyed: the pH of near surface waters should not drop more than 0.2 units below the pre-industrial average value in any larger ocean region (nor in the global mean).

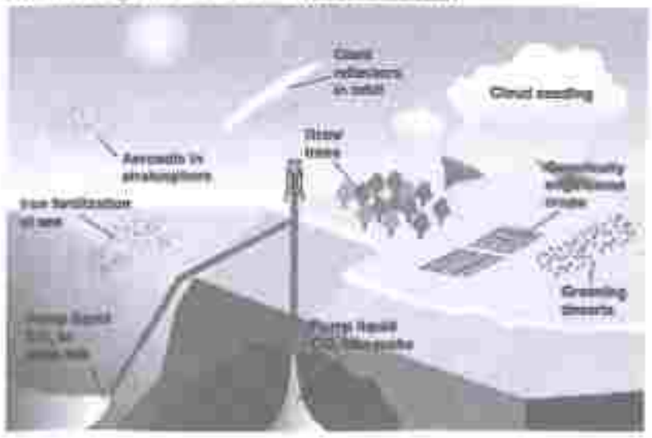
One policy target related to ocean acidity is the magnitude of future global warming. Parties to the United Nations Framework Convention on Climate Change (UNFCCC) adopted a target of limiting warming to below 2 °C, relative to the pre-industrial level. Meeting this target would require substantial reductions in anthropogenic CO_2 emissions. Limiting global warming to below 2 °C would imply a reduction in surface ocean pH of 0.16 from pre-industrial levels. This would represent a substantial decline in surface ocean pH.

Reports by the WGBU (2006, the UK's Royal Society (2009), and the US National Research Council (2011) warned of the potential risks and difficulties associated with climate engineering.

IRON FERTILIZATION

Iron fertilization of the ocean could stimulate photosynthesis in phytoplankton (see Iron hypothesis). The phytoplankton would convert the ocean's dissolved carbon dioxide into carbohydrate and oxygen gas, some of which would sink into the deeper ocean before oxidizing. More than a dozen open-sea experiments confirmed that adding iron to the ocean increases photosynthesis in phytoplankton by up to 30 times. While this approach has been proposed as a potential solution to the ocean acidification problem, mitigation of surface ocean acidification might increase acidification in the less-inhabited deep ocean.

A report by the UK's Royal Society (2009) reviewed the approach for effectiveness, affordability, timeliness and safety. The rating for affordability was "medium", or "not expected to be very cost-effective". For the other three criteria, the ratings ranged from "low" to "very low" (i.e., not good). For example, in regards to safety, the report found a "[high] potential for undesirable ecological side effects", and that ocean fertilization "may increase anoxic regions of ocean ('dead zones')



GLOBAL GOALS

The problem of ocean acidification is included in one of the targets of the

The end-Triassic biotic crisis is still the most well-established example of a marine mass extinction due to ocean acidification, because (a) volcanic activity, changes in carbon isotopes, decrease of carbonate sedimentation, and marine extinction coincided precisely in the stratigraphic record and (b) there was pronounced selectivity of the extinction against organisms with thick aragonitic skeletons, which is predicted from experimental studies. Ocean acidification has also been suggested as a cause of the end-Permian mass extinction and the end-Cretaceous crisis.

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25/05/202

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SUBJECT: ECONOMICS

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CU ROLL NO: 213013-11-0036

REGISTRATION NO: 013-1211-0172-21

COLLEGE: GOKHALE MEMORIAL GIRL'S COLLEGE

TOPIC: CLIMATE CHANGE AND ITS IMPACT

YEAR: 2022

SIGNATURE OF EXTERNAL EXAMINER

SIGNATURE OF INTERNAL EXAMINER

INTRODUCTION TO CLIMATE CHANGE

Climate change refers to long-term shifts in temperatures and weather patterns. These shifts may be natural, such as through variations in the solar cycle. But since the 1800s, human activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil, and gas.

Burning fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun's heat, and raising temperatures.

Greenhouse gas refers to any gas that has the property of absorbing infrared radiation (net heat energy) emitted from Earth's surface and reradiating it back to Earth's surface, thus contributing to the greenhouse effect. Carbon dioxide, methane, and water vapour are the most important greenhouse gases. (To a lesser extent, surface-level ozone, nitrous oxides, and fluorinated gases also trap infrared radiation.) Greenhouse gases have a profound effect on the energy budget of the Earth system despite making up only a fraction of all atmospheric gases. Concentrations of greenhouse gases have varied substantially during Earth's history, and these variations have driven substantial climate changes at a wide range of timescales. In general, greenhouse gas concentrations have been particularly high during warm periods and low during cold periods.

Examples of greenhouse gas emissions that are causing climate change include carbon dioxide and methane. These come from using gasoline for driving a car or coal for heating a building, for example. Clearing land and forests can also release carbon dioxide. Landfills for garbage are a major source of methane emissions. Energy, industry, transport, buildings, agriculture, and land use are among the main emitters.

DIAGRAM: Electricity generation plant

DIAGRAM: Cutting down of forest

DIAGRAM: Transportation causing pollution

WHAT CAUSES CLIMATE CHANGE?

1. Generating power

Generating electricity and heat by burning fossil fuels causes a large chunk of global emissions. Most electricity is still generated by burning coal, oil, or gas, which produces carbon dioxide and nitrous oxide – powerful greenhouse gases that blanket the Earth and trap the sun's heat. Globally, a bit more than a quarter of electricity comes from wind, solar and other renewable sources which, as opposed to fossil fuels, emit little to no greenhouse gases or pollutants into the air.

2. Cutting down forests

Cutting down forests to create farms or pastures, or for other reasons, causes emissions, since trees, when they are cut, release the carbon they have been storing. Each year approximately 12 million hectares of forest are destroyed. Since forests absorb carbon dioxide, destroying them also limits nature's ability to keep emissions out of the atmosphere. Deforestation, together with agriculture and other land use changes, is responsible for roughly a quarter of global greenhouse gas emissions.

3. Using transportation

Most cars, trucks, ships, and planes run on fossil fuels. That makes transportation a major contributor of greenhouse gases, especially carbon-dioxide emissions. Road vehicles account for the largest part, due to the combustion of petroleum-based products, like gasoline, in internal combustion engines. But emissions from ships and planes continue to grow. Transport accounts for nearly one quarter of global energy-related carbon-dioxide emissions. And trends point to a significant increase in energy use for transport over the coming years.

DIAGRAM: Commercial Power Generation plant

DIAGRAM: Manufacturing goods (coal mining)

4. Powering buildings

Globally, residential, and commercial buildings consume over half of all electricity. As they continue to draw on coal, oil, and natural gas for heating and cooling, they emit significant quantities of greenhouse gas emissions. Growing energy demand for heating and cooling, with rising air-conditioner ownership, as well as increased electricity consumption for lighting, appliances, and connected devices, has contributed to a rise in energy-related carbon dioxide emissions from buildings in recent years.

5. Manufacturing goods

Manufacturing and industry produce emissions, mostly from burning fossil fuels to produce energy for making things like cement, iron, steel, electronics, plastics, clothes, and other goods. Mining and other industrial processes also release gases, as does the construction industry. Machines used in the manufacturing process often run on coal, oil, or gas; and some materials, like plastics, are made from chemicals sourced from fossil fuels. The manufacturing industry is one of the largest contributors to greenhouse gas emissions worldwide.

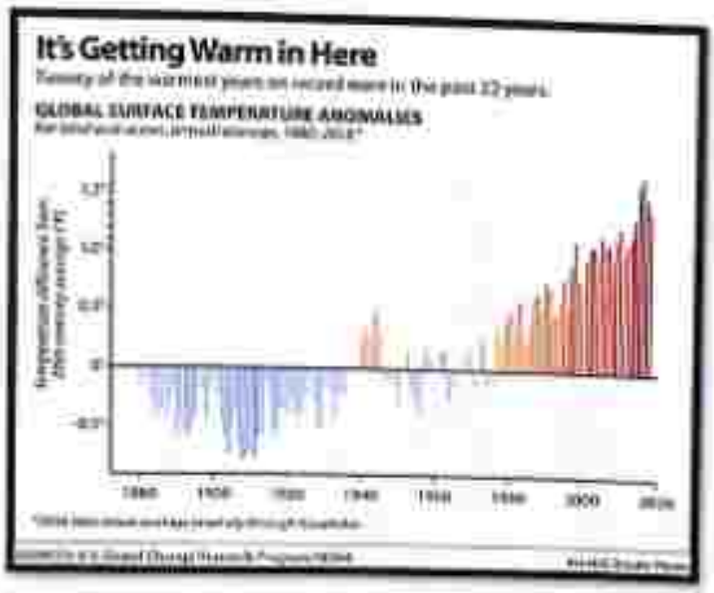

DIAGRAM: A graph showing the increase of temperature over the years

DIAGRAM: Draught

WHAT ARE ITS EFFECTS?

1.Hotter temperatures

As greenhouse gas concentrations rise, so does the global surface temperature. The last decade, 2011-2020, is the warmest on record. Since the 1980s, each decade has been warmer than the previous one. Nearly all land areas are seeing more hot days and heat waves. Higher temperatures increase heat-related illnesses and make working outdoors more difficult. Wildfires start more easily and spread more rapidly when conditions are hotter. Temperatures in the Arctic have warmed at least twice as fast as the global average.

2.Increased drought

Climate change is changing water availability, making it scarcer in more regions. Global warming exacerbates water shortages in already water-stressed regions and is leading to an increased risk of agricultural droughts affecting crops, and ecological droughts increasing the vulnerability of ecosystems. Droughts can also stir destructive sand and dust storms that can move billions of tons of sand across continents. Deserts are expanding, reducing land for growing food. Many people now face the threat of not having enough water on a regular basis.

3. Not enough food

Changes in the climate and increases in extreme weather events are among the reasons behind a global rise in hunger and poor nutrition. Fisheries, crops, and livestock may be destroyed or become less productive. With the ocean becoming more acidic, marine resources that feed billions of people are at risk. Changes in snow and ice cover in many Arctic regions have disrupted food supplies from herding, hunting, and fishing. Heat stress can diminish water and grasslands for grazing, causing declining crop yields and affecting livestock.

DIAGRAM: A slum being destroyed by a flood in Jakarta

DIAGRAM: Impact of climate change on human health

4. Poverty and displacement

Climate change increases the factors that put and keep people in poverty. Floods may sweep away urban slums, destroying homes and livelihoods. Heat can make it difficult to work in outdoor jobs. Water scarcity may affect crops. Over the past decade (2010–2019), weather-related events displaced an estimated 23.1 million people on average each year, leaving many more vulnerable to poverty. Most refugees come from countries that are most vulnerable and least ready to adapt to the impacts of climate change.

5. More health risks

Climate change is the single biggest health threat facing humanity. Climate impacts are already harming health, through air pollution, disease, extreme weather events, forced displacement, pressures on mental health, and increased hunger and poor nutrition in places where people cannot grow or find sufficient food. Every year, environmental factors take the lives of around 13 million people. Changing weather patterns are expanding diseases, and extreme weather events increase deaths and make it difficult for health care systems to keep up.

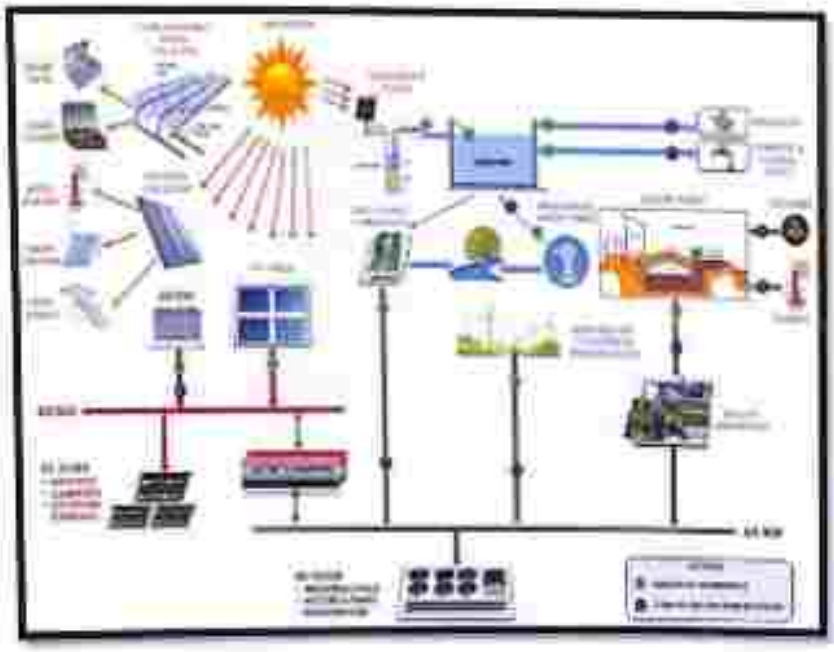

DIAGRAM: Smart integrated renewable energy system

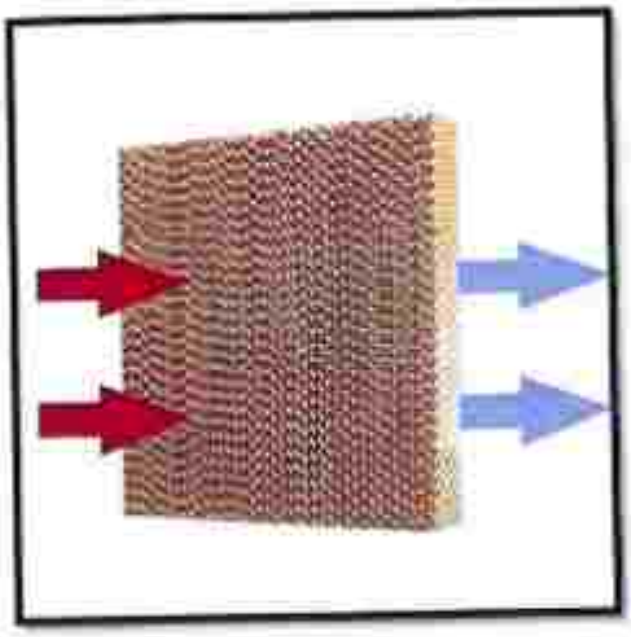

DIAGRAM: Cooling paper

ACTIONS TO CONTROL CLIMATE CHANGE

Governments, businesses, and civil society members are connecting in climate initiatives to speed the pace of climate action. Initiated at the 2019 Climate Action Summit held at the United Nations, the initiatives are reducing emissions, tackling critical concerns such as jobs and gender equality, unlocking finance, building sustainable infrastructure, using nature-based solutions, and advancing adaptation and climate resilience.

The United Nations' role as a convener is needed more than ever to encourage people to collaborate, be ambitious and take actions required to limit global temperature rise to no more than 1.5 degrees Celsius. The United Nations also stands behind a transition to a sustainable, low-carbon economy that is just and beneficial for all people.

Such initiatives include:

1. **In the energy sector:**
    - Accelerating Renewable Energy Transition in SIDS: Thirty-six small island developing States and their partners have come together to share strategies and galvanize momentum in the transition to renewable and resilient energy systems.

    - Climate Action for Jobs: This initiative has developed a roadmap and regional strategies for climate action that puts people's jobs and well-being at the heart of the transition to a green economy.

    - Cool Coalition: See how the world is coming together to deliver efficient, climate-friendly cooling for all, including through enhanced national climate plans. The coalition highlights promising innovations such as "cooling paper" that keeps temperatures down in buildings

DIAGRAM: A part of the Campaign for nature initiative

DIAGRAM: Active participation encouraged by ORRAA

2. Nature based solutions:

- Campaign for Nature: This growing coalition of more than 100 conservation organizations calls on policymakers to commit to a science-driven, ambitious new deal for nature. It hinges on protecting at least 30 per cent of the planet by 2030, backed by sufficient financial resources and the full realization of indigenous leadership and rights

- Ocean Risk and Resilience Action Alliance: ORRAA connects governments, financial institutions, the insurance industry, environmental organizations, and actors from the Global South to build resilience to ocean risk. It pioneers finance and insurance products aimed at incentivizing $500 million in investment in nature-based solutions by 2030.

DIAGRAM: A few ways to reduce co2 emissions by transport

DIAGRAM: Zero carbon fuel for shipping

3. the industry and transport sector:

- Action towards Climate-Friendly Transport: Over 100 organizations have forged the largest coalition ever dedicated to shifting all forms of transport to zero emissions. It researches issues like rural access and making the economics of decarbonization work. An online course helps urban leaders develop sustainable urban mobility solutions.

- Decarbonizing Shipping: Getting to Zero Coalition: A powerful alliance of more than 150 maritime, energy, infrastructure and finance companies, the coalition has a moon-shot ambition: commercially viable, deep sea zero-emission vessels operating by 2030. The Sea Cargo Charter defines benchmarks to decarbonize the transport of bulk shipping containers. Under the Poseidon Principles, 15 banks have disclosed how well shipping industry loan portfolios align with climate goals.

- Leadership Group for Industry Transition: Aimed at net-zero carbon emissions from industry by 2050, the initiative has established industry groups and developed road maps for heavy industries where carbon emissions are difficult to abate. A transition tracker profiles industries in various countries.

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POLLUTION

Pollution is the introduction of contaminants into the natural environment that causes adverse change. Pollution can take the form of any substance (solid, liquid, or gas) or energy (such as radioactivity, heat, sound, or light). Pollutants, the components of pollution, can be either foreign substances/energies or naturally occurring contaminants. Although environmental pollution can be caused by natural events, the word pollution generally implies that the contaminants have an anthropogenic source – that is, a source created by human activities. Pollution is often classed as point source or nonpoint source pollution. In 2015, pollution killed 9 million people worldwide.

Major forms of pollution include air pollution, light pollution, litter, noise pollution, plastic pollution, soil contamination, radioactive contamination, thermal pollution, visual pollution, and water pollution.

DEFINTION & TYPES

Any substances in water, soil, or air that degrade the natural quality of the environment, offend the senses of sight, taste, or smell, or cause a health hazard is known as pollution. The usefulness of the natural resource is usually impaired by the presence of pollutants and contaminants. In contrast, the United Nations considers pollution to be the "presence of substances and heat in environmental media (air, water, land) whose nature, location, or quantity produces undesirable environmental effects."

The major forms of pollution are listed below along with the particular contaminants relevant to each of them:

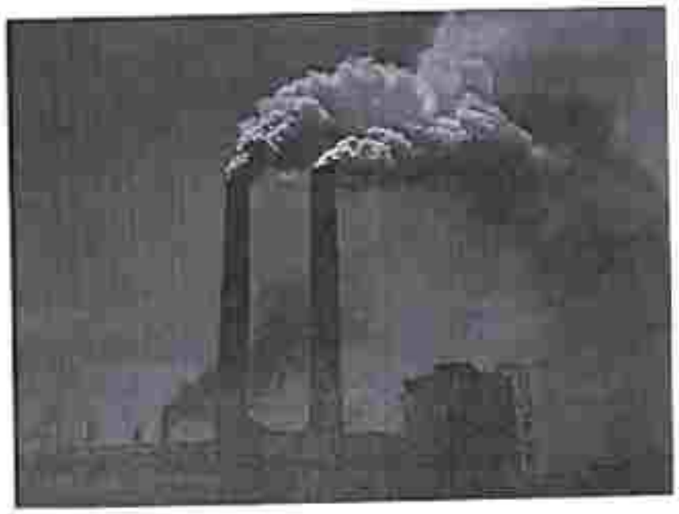
AIR POLLUTION

Air pollution can be defined as an alteration of air quality that can be characterized by measurements of chemical, biological or physical pollutants in the air. Therefore, air pollution means the undesirable presence of impurities or the abnormal rise in the proportion of some constituents of the atmosphere. It can be classified in 2 sections: **visible** and **invisible** air pollution.

Local : This concerns the quality of ambient air within a radius of a few kilometers

Regional : Pollution like acid rain, photochemical reactions and degradation of water quality at distances of a few kilometers to a thousand kilometres .

Global : Depletion of the ozone layer and global warming caused by the emission of greenhouse gases, mainly carbon dioxide (CO2).



Air Pollution Causes :

Air pollution is caused by the presence in the atmosphere of toxic substances, mainly produced by human activities, even though sometimes it can result from natural phenomena such as volcanic eruptions, dust storms and wildfires, also depleting the air quality.

Anthropogenic air pollution sources are :

1. Combustion of fossil fuels, like coal and oil for electricity and road transport, producing air pollutants like nitrogen and sulfur dioxide.

2. Emissions from industries and factories, releasing large amount of carbon monoxide, hydrocarbon, chemicals and organic compounds into the air

3. Agricultural activities, due to the use of pesticides, insecticides, and fertilizers that emit harmful chemicals

4. Waste production, mostly because of methane generation in landfills.

Effects of Air Pollution :

It is impossible to describe the whole extent of potential and actual damage caused by all forms of air pollution. But here are the main consequences -

ON THE ENVIRONMENT

Air pollution has a major impact on the process of plant evolution by preventing photosynthesis in many cases, with serious consequences for the purification of the air we breathe. It also contributes to the formation of acid rain, atmospheric precipitations in the form of rain, frost, snow or fog, which are released during the combustion of fossil fuels and transformed by contact with water steam in the atmosphere.

GLOBAL WARMING

On top of that, air pollution is a major contributor to **global warming and climate change**. In fact, the abundance of carbon dioxide in the air is one of the causes of the greenhouse effect. Normally, the presence of greenhouse gases should be beneficial for the planet because they absorb the infra-red radiation produced by the surface of the earth. But the excessive concentration of these gases in the atmosphere is the cause of the recent climate change.

ON HUMAN HEALTH

Our continual exposure to air pollutants is responsible for the deterioration of human health. Air pollution is indeed a significant risk factor for human health conditions, causing allergies, respiratory and cardiovascular diseases as well as lung damage.

WATER POLLUTION

Water pollution can be defined as the contamination of a stream, river, lake, ocean or any other stretch of water, depleting water quality and making it toxic for the environment and humans.

There are two types of water pollution:

1. Organic pollution due to microorganisms - bacteria and viruses - present in the water, generated by excrement, animal and vegetable waste

2.Chemical pollution generated by the nitrates and phosphates of pesticides, human and animal drugs, household products, heavy metals, acids and hydrocarbons used in industries.

Water Pollution Causes:

SEWAGE AND WASTEWATER

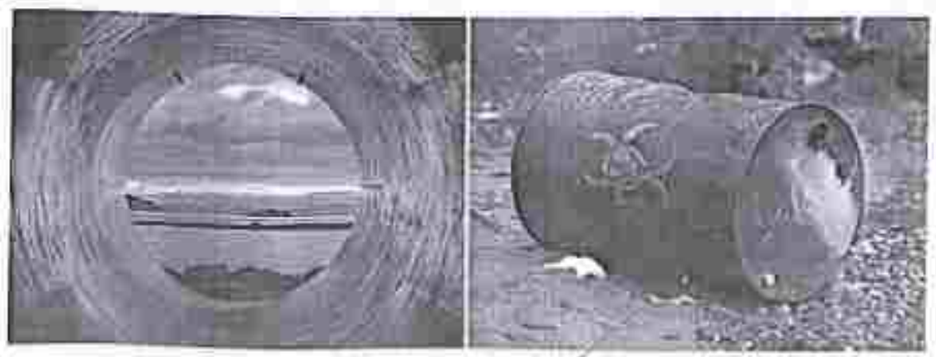
Inadequate sewage collection and treatment are sources of water pollution. According to the United Nations, more than 80% of the worldwide wastewater goes back in the environment without being treated or reused.

AGRICULTURE

Agriculture has an impact on water pollution due to the use of chemicals such as fertilizers, pesticides, fungicides, herbicides or insecticides running off in the water, as well as livestock excrement, manure and methane (greenhouse effect). Regarding aquaculture, pollution is directly in the water, as excess food and fertilizers are causing dystrophication.

RADIOACTIVE WASTE

Generated - among others - by power plants and uranium mining, radioactive waste can linger in the environment for thousands of years. When these substances are released accidentally or disposed improperly, they threaten groundwater, surface water, as well as marine resources.



Water Pollution Effects :

ON THE ENVIRONMENT

Water pollution truly harms biodiversity and aquatic ecosystems. The toxic chemicals can change the color of water and increase the amount of minerals - also known as eutrophication - which has a bad impact on life in water. Thermal pollution, defined by a rise in the temperature of water bodies, contributes to **global warming** and causes serious hazard to water organisms.

ON HUMAN HEALTH

Water pollution has very negative effects on public health. A lot of diseases result from drinking or being in contact with contaminated water, such as diarrhea, cholera, typhoid, dysentery or skin infections. In zones where there is no available drinking water, the main risk is dehydration obviously.

NOISE POLLUTION

Noise pollution is generally defined as regular exposure to elevated sound levels that may lead to adverse effects in humans or other living organisms. According to the World Health Organization, sound levels less than 70 dB are not damaging to living organisms, regardless of how long or consistent the exposure is. Exposure for more than 8 hours to constant noise beyond 85 dB may be hazardous. If you work for 8 hours daily in close proximity to a busy road or highway, you are very likely exposed to traffic noise pollution around 85dB.

Causes of Noise Pollution:

There are many sources of noise pollution, but here are some of the main ones:

Traffic noise : Traffic noise accounts for most polluting noise in cities. For example, a car horn produces 90 dB and a bus produces 100 dB.

Air traffic noise : There are fewer aircraft flying over cities than there are cars on the roads, but the impact is greater: a single aircraft produces 130 dB.

Construction sites : Building and car park construction and road and pavement resurfacing works are very noisy. For example, a pneumatic drill produces 110 dB.

Effects of Noise Pollution:

Human Diseases Caused by Noise Pollution-

Whether we realize we are subjected to it or not, noise pollution can be hazardous to our health in various ways.

Hypertension is, in this case, a direct result of noise pollution caused elevated blood levels for a longer period of time.

Hearing loss can be directly caused by noise pollution, whether listening to loud music in your headphones or being exposed to loud drilling noises at work, heavy air or land traffic, or separate incidents in which noise levels reach dangerous intervals, such as around140 dB for adult or 120 dB for children.

Sleep disturbances are usually caused by constant air or land traffic at night, and they are a serious condition in that they can affect everyday performance and lead to serious diseases.

Effects of Noise Pollution on Wildlife and Marine Life -

Our oceans are no longer quiet. Thousands of oil drills, sonars, seismic survey devices, coastal recreational watercraft and shipping vessels are now populating our waters, and that is a serious cause of noise pollution for marine life. Whales are among the most affected, as their hearing helps them orient themselves, feed and communicate. Noise pollution thus interferes with cetaceans' (whales and dolphins) feeding habits, reproductive patterns and migration routes, and can even cause hemorrhage and death.

Other than marine life, land animals are also affected by noise pollution in the form of traffic, firecrackers etc., and birds are especially affected by the increased air traffic.

WAYS TO REDUCE POLLUTION

In this era of globalization, our mother earth is facing serious pollution resulted from inconsiderable deeds of mankind. Therefore, there are four ways to reduce pollution on earth such as, practicing the 3Rs concept, reduce the usage of vehicles on road, creating awareness among citizens, and enforcing the laws.

The first way to reduce pollution is to practice the 3Rs concept namely reduce, reuse and recycle. Citizens should reduce the usage of air-conditioners as it will release harmful gases, for instant ozone-depleting chlorofluorocarbons which will result in reducing air pollution. One may make no difference, but when carried out together, massive changes can be made. Moving on, reuse reusable items like plastic bags, bottles, boxes and more is also one of the way to reduce pollution, For example, instead of throwing away a worn out tire, it can be used as a plantation plot. The next way to reduce pollution is to recycle recyclable items such as glass, cans, and newspapers. The recycled newspapers can be reproduced as toilet papers which will reduce extra waste on earth indirectly contributing in reducing land pollutions. Therefore, practicing the 3Rs is one of the most effective ways to reduce pollution on earth.

Reducing the usage of vehicles on road will also help in reducing air pollution on earth. The more the usage of vehicles, the more the harmful gases released into the air such as hydrocarbons, nitrogen oxides, carbon monoxides, and sulfur dioxides which will cause serious air pollutions. The usage of cars, lorries and motorbikes should be drastically reduced as the gases released by these vehicles can also contribute in green house effect. However, these pollutions can be reduced when citizens practice the habit of car-pooling and the usage of public transport like bus, trains, monorails and many more. In addition, citizens can walk or cycle to near destinations instead of driving which will lead to lesser air pollution. Therefore, reducing the usage of vehicles by no doubt can reduce air and soumd pollutions.

Another way to reduce pollution on earth is to create awareness among the citizens. Awareness about the importance on reducing pollution on earth can be created through campaigns for example, the "Go Green" campaign which encourages the citizens to plant more trees and to use recyclable items in their daily lives. The "Earth Hour" is also one of the activity conducted world widely which requires everyone to turn off every lights for one hour so as to create awareness on the importance of reducing pollution on earth by reducing the usage of electronic items. Awareness can be implanted through education for example, advertisements on televisions and articles in newspapers which are related to topics like "How to reduce pollutions", "The consequences of pollutions" and so on. Therefore, pollution can be reduced by creating awareness among the citizens.

CONCLUSION

Concluding all, environmental pollution is an issue that requires to be resolved as soon as possible so that we can assume a healthy life on the planet. People should do their part to curb this problem. And the Government should also take some bold steps to rectify the situation.

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25/05/2022

UNIVERSITY OF CALCUTTA

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I, Satavisa Majumdar I, a student of Semester 2 Economics department of Gokhale Memorial Girls' College would like to express my special thanks of gratitude to our principal Dr. Atashi Karpha and our ENVS Prof. Santanu Samanta who guided me and provided me the golden opportunity to do this wonderful project on the topic 'Waste Management'. This project helped me in doing a lot of research and I came to know about so many new things. I would also like to thank my parents and friends for their constant support and aid to finalise my assignment within the specified time limit.

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Introduction

The term waste management refers to all the processes that are involved to manage the waste from its outset till its disposal. The processes that are included in waste management are collection of waste, transportation of waste and treatment and disposal of waste. All these processes together constitute the term waste management. The waste is collected from multiple sources and then disposed of. The entire process is monitored and regulated as well to ensure that all the waste related laws are abided by and all the guidelines are strictly followed.

There are several sources of wastes and different sources generate different kinds of waste. Wastes could be solid, liquid as well as gaseous. The methods that are employed to manage these three types of waste are not the same. The waste is managed and disposed using different methods for different types of waste. The term waste management deals with all types of wastes that are generated like the biological, municipal, industrial, organic and many more. It is essential to manage the waste so that it does not become a threat to human life as well as to the environment.

Well, the process of waste management varies throughout the world. All the countries do not follow the same processes to manage the waste the process of waste management even differs for the rural and urban areas as well as for the residential and industrial places.

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Well, the process of waste management varies throughout the world. All the countries do not follow the same processes to manage the waste the process of waste management even differs for the rural and urban areas as well as for the residential and industrial places.

The process of waste management varies from place to place. In most places, the waste is collected by the trucks at regular intervals and then transferred into the disposal site. This process is referred to as curb side collection which is one of the most common methods of collecting the waste in the European Countries like Canada, New Zealand, United States and many more. Then, waste segregation takes place. The waste us segregated into dry wate and wet waste so that the dry waste can be recycled and the wet waste can be used as compost. Once the waste gets segregated, the amount of waste that would be landfilled reduces considerably and it reduces, air pollution and water pollution. Also, the segregated waste is usually cheaper to dispose then the unsegregated waste.

Waste management in Japan

Japan has made a huge progress in waste management since the 1990s. Not only have they efficient collection and treatment of the waste that is produced but, they have also tried to reduce the total waste produced and they have been quite successful in doing this. They have tried to recycle the waste produced as much as it is possible. As we know, that Japan is a mountainous country and therefore it is quite obvious that there would be very less space available for landfills so the methods that are mostly used here to manage the waste consists of incineration and recycling. Landfills and land reclamation are also used but comparatively to as smaller extent. The garbage is brought to the transportation centre by the small garbage trucks that run on the narrow road of the urban areas to collect the garbage. From the transportation site, the garbage is transferred into a big truck which carries to the disposal area. Several methods are used for disposal as stated above but the method that is mainly used in Japan to dispose the waste is Incineration.

Waste management in USA

When it comes to the production of waste, The United States definitely tops the list as it is one of the largest producers of waste all over the world. Due to this, the waste management industry there is one of the major industries in the United States. The largest waste management companies in the world like the Waste Management Inc are based in the United States. The different types of wastes that are managed in the United States are municipal solid waste, industrial waste am hazardous waste. The Environment Protection Agency (EPA) under the 1976 Resource Conservation Recovery Act is responsible for managing the waste

that is produced in the United States. The types of Wastes that are produced in the United States are hazardous wastes, industrial wastes, animal wastes, agricultural wastes, fossil fuel combustion waste, mining waste, medical wastes and radioactive waste. The United States is one of the largest generators of municipal solid waste per person which is around 2 kgs per person on a daily basis. An ever-growing problem in the United States is the Electronic Waste. 3.2 million tons if electronic waste is generated every year and is sunned into the landfills. Most of the electronic waste contains the hazardous metal Lead which is openly disposed into the landfills. This causes health issues like blood and brain disorder. In certain severe cases, it might lead to the death of a person who is exposed to lead for a prolonged time period. 80 percent of the total waste produced in the United States is disposed into the landfills and most of this waste is electronic waste.

Waste Management in Turkey

The annual amount of per capita waste that is generated in Turkey is around 390 kilograms. The collection coverage rate of the waste that is generated in Turkey is around 77 percent and the unsound waste disposal is around 69 percent. The country has implemented several waste management methods like sanitary landfills, composting, sterilization and incineration. Some of the advanced methods that are used for waste management in Turkey are pyrolysis, gasification and plasma. Landfilling is one of the most common techniques that is used in Turkey for waste management, especially for the municipal waste that is collected regularly. The powers as well as the duties have been distributed and several institutions are assigned to efficiently carry out the process of waste management efficiently. The metropolitan municipality and several other municipalities are responsible for waste management in Turkey. The processes include collection, transportation, separation, recycling, disposal and storage of waste services.

Waste Management in India

The Union Ministry of Environment, Forests and Climate Change is responsible for the waste management in India. The ministry released some rules pertaining to solid waste management (SWM) in the year 2016. The Solid Waste Management (SWM) rules was replaced by the Municipal Solid Waste (Management and Handling) Rules. 62 million tonnes wastes are generated every year. 70 percent of the waste which constitutes 43 million tonnes of waste are collected. 12 million tonnes of this wastes are treated and 31 million tonnes of this wastes are dumped in the landfill sites. It is estimated that by the year 2030, 165 million tonnes municipal solid wastes could be possibly generated in the urban areas. One of the major problems of the urban areas in India, is Solid Waste Management. With the advent of modernisation, urbanisation, industrialization and rapid economic growth, the amount of municipal solid wastes generated has increased day by day. Well, effective solid waste management is one of the major challenges that is faced in the urban areas. India is a diverse country with different cultures and religious groups and it is extremely difficult in such a country to achieve the aim of sustainable development. There has been development in the social, economic and environmental areas but the techniques that are used for solid waste management have not changed at all. 90 percent of the total waste is dumped openly and not properly landfilled. The waste is segregated from the source. Waste generators are used in hotels and hospitals to treat the organic waste.

Case study in my Neighbourhood

I live in Thakurpukur, Kolkata, West Bengal. The wastes that are generated in this area is managed and controlled by Municipal Corporation. There are several types of wastes that are generated here.

Types of wastes that are produced:

- Biomedical waste
- Household waste- the household wastes can be further classified into biodegradable and non- biodegradable waste.
- Organic waste which basically includes the leafy vegetables, fruits and the wastes produced in the kitchen.
- Recyclable wastes which mainly include plastic, paper and glass materials.
- E waste

Methods that are employed to manage the waste:

The Kolkata Municipal Corporation is clearly responsible for the waste management in my area. There are several methods that are used to manage the waste.

- Firstly, the wastes are collected from the household every morning. Apart from the households, waste collection also takes place from commercial and institutional areas.
- Then this waste this transferred to the landfill sites and it is ensured that the landfill sites are maintains well.
- The streets are sweeped and the drains are washed so that the drainage waste is also cleared.
- The carcass from the roads is also removed.
- Trucks are provided by the Kolkata municipal corporation and they come in the morning to transfer the waste into the landfills.

How to minimize the waste that is produced?

It is essential to minimise the total amount of waste produced if we want to protect the environment as they can cause severe damage to our environment. It pollutes the environment as well as it uses up all the finite resources. The population is growing at a rapid rate and long with that the number of landfills is also increasing day by day. The landfills release the dangerous gas methane into the air as well as contaminates the water too. Though some part of the waste is recyclable, we should focus on reducing the amount of waste that is generated day by day in order to improve the quality of the environment we live in. given below are some techniques that would help to minimize the total amount of waste that is produced.

- Usage of items that are compostable: well, it is essential to use items that are compostable so that you can easily compost them in your home without even sending them to the landfills. Composting is basically a process in which the

organic waste decomposes naturally under oxygen rich conditions. Certain items are considered to be compostable though most of the types of waste material eventually decompose. The materials that are regarded as compostable should only be put into containers. Some of the items that are easy to compost are the food items like the eggshells and the banana peels and the vegetable peels. Meat products on the other hand should not be added to compost. The leaves and grass clippings can be contained to the compost containers

- One should purchase products that are reusable: If you want to live a waste free lifestyle, then you need to choose those products that are reusable. If you want to fight pollution and enjoy all the amazing benefits, then all you need to do is choose those products that are reusable.

- Buying in Bulk- one of the most interesting ways in which you can actually reduce the total amount of waste that is generated in your home is by buying in bulk whatever you need. When you buy tiny packages, you need to actually pay more as you pay for the good as well as for the packaging too. But the packaging for which you pay money ultimately ends up in the landfills. Bulk purchases create less waste in comparison to small purchases.

- Make products that are eco-friendly- often most of us get convinced or impressed by the marketing of products and end up buying tings. What we cab do to save our environment is start using eco friendly products or start using products that we can make in out home so that the amount of waste generated reduces. For example, we can make our own toiletries in our home by using some basic inexpensive and natural ingredients.

- Second hand items should be brought- al of us like to buy brand new items and products that are of high quality. But we can definitely buy second hand items to reduce the amount of waste. This can actually avoid creation of packaging waste and you even end up getting the material in quite a cheap price too.

- Recycle electronics- the electronics are made up of materials that are reusable. So, in order to minimise the amount of waste produced, we can recycle the electronic goods.

Conclusion

Waste management basically refers to the process of collecting, treating and disposing the waste in a proper manner. It is an essential process and it should be carried out in a proper manner as if the waste is dumped on open grounds and adequate care is not taken, then that waste or garbage is likely to cause harm to the environment and the people living in the environment. It is essential to recycle the waste as much as it is possible. Improper disposal of waste mainly leads to environmental pollution which degrades the quality of the people living in that environment. Waste material that is openly dumped into the ground can lead to severe diseases like brain cancer and brain damage. It may even lead to death. Waste that is left untreated causes environment pollution and releases some harmful substances into the environment. The space for proper disposal of garbage is gradually declining with the advent of urbanisation and modernisation as the cities have become overcrowded. The radioactive type pf waste is very dangerous for the human life as well as for the marine life. Several developed countries have tried to manage the waste produced by adopting effectives techniques of waste management and also by reducing the total amount of the waste produced. People in the developed countries are quite aware of the harm that untreated waste can cause to human health. But in the developing nations like India, waste management is a huge problem owing to the diverse cultures that exists together as well as the rapid population growth. But what all of us should try is to ensure that the waste that is generated is disposed correctly so that we are able to achieve the goal of sustainable development in the near future.

Samanta
26/05/2022

QUESTIONNAIRE - I

1) How many members are there in the family?

Ans: There are four members in the family

2) How do you dispose your waste?

Ans) The waste is disposed in garbage bins

3) Is their any appropriate place to dispose the household waste in your neighbourhood?

Ans) Yes.

4) Do people in your locality dispose the waste in an improper manner?

Ans) No.

5) Do you classify the waste into dry waste and wet waste?

Ans) Yes.

6) Do you think that the quantity of waste sent for disposal to landfill should be minimised?

Ans) Yes.

7) Do you recycle the waste?

Ans) Sometimes

8) Are you satisfied with the way municipality manages the waste?

Ans) Yes

QUESTIONNAIRE - II

1) How many members are there in the family?

Ans) There are three members.

2) How do you dispose the waste?

Ans) Collect the garbage in plastic bags

3) Is there any appropriate place to dispose the household waste in your neighbourhood?

Ans) Yes.

4) Do people in your locality dispose the waste in an improper manner?

Ans) Yes.

5) Do you classify the waste into dry waste and wet waste?

Ans) No.

6) Do you think that the quantity of waste sent for disposal to landfill should be minimised?

Ans) Yes

7) Do you recycle the waste?

Ans) No.

8) Are you satisfied with the way municipality manages the waste?

Ans) Yes

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TOPIC: ENVIRONMENTAL ISSUES

Samanta 21/06/22

SIGNATURE OF EXAMINER

Index

Acknowledgement

I, Anuska Ghosh, a first year student of Economics (major) department of the eminent GOKHALE MEMORIAL GIRLS' COLLEGE would like express my special thanks of gratitude to our honourable principal Dr. Arachi Karpha and our beloved ENVS professor Santanu Samanta who gave me the golden opportunity to come up with this informative project on ENVIRONMENTAL ISSUES. It also helped me in doing a lot of research and I came to know many unknown facts.

Lastly, I would also like to give a heartfelt thanks to my parents for their kind help and participation in making this project a success within the limited time assigned.

By thanking all of them, I would like to begin with my project on Environmental Issues.

Environmental Issues

Environmental issues are effects of human activity on the biophysical environment, most often of which are harmful effects that cause environmental degradation.

Environmental protection is a practice of protecting the natural environment on the individual, organisational or governmental levels, for the benefit of both the environmental and humans. Environmentalism, a social and environmental movement, addresses environmental issues through advocacy, legislation education and activism.

Environment destruction caused by humans is a global, ongoing problem. Most scholars think that the project peak global world population of between 9-10 billion people, could live sustainably within the earth's ecosystems if human society worked to live sustainably within planetary boundaries. The bulk of environmental impacts are caused by the most wealthy populations in the globe consuming too much industrial goods. The UN Environmental Program, in it's "Making Peace With Nature" Report in 2021, found adressing key planetary crises, like pollution, climate change and biodiversity loss, was achievable if parties work to address the Sustainable development Goals.

Types of issues

Major current environmental issues may include -

1. Ozone Depletion, Greenhouse Effect and Global Warming
2. Desertification
3. Deforestation
4. Loss of Biodiversity
5. Disposal of Wastes

The conservation movement lobbies for protection of endangered species and protection of any ecologically valuable natural areas, genetically modified foods and global warming. International frameworks for environmental issues focus on three key issues as the "triple planetary crises": climate change, pollution and biodiversity loss.

1. Ozone Depletion, Green House Effect And Global Warming :

All the three physical phenomena are related to one another to a great extent. To understand their effect on environment, we must first of all know what their meaning, interrelationship and working is.

Ozone is a form of oxygen, which is away from the earth's surface at a height of about 20 to 30 km in the atmosphere. It is scattered in the stratosphere in the form of a layer of about three millimeter thick. This layer works as a shield to protect the earth against the ultraviolet

radiation that comes from sun. Near the earth's surface, ozone is an increasingly troublesome pollutant but it is also an important to life as oxygen itself. If this layer disappears or thins, all terrestrial life will be annihilated. The thinning and depletion of the ozone layer has generated global concern during the last few years. This is due to several chemical pollutants discharged by industries and produced through other chemical reactions. The main cause of the ozone depletion is generally attributed to the chlorofluorocarbons (CFCs) which are mostly produced by highly industrialized developed countries. CFCs is a source of energy which is needed mostly in the modern life. When released into the air, it accumulates in the upper atmosphere which destroys the ozone layer. The depletion of ozone layer is linked to both 'greenhouse effect' and the phenomenon of 'global warming'. The phenomenon commonly known as 'greenhouse effect' occurs due to emission of certain gaseous pollutants (methane, CFCs, water vapour, and carbon dioxide are known as greenhouse gases) in the air which after the heating of the atmosphere causes the average global temperature to rise. This is known as 'global warming'. The increase in ozone layer depletion will invite the lethal ultraviolet rays from the sun which will increase cancer (especially skin cancer), eye damage (increase in cataracts of the eye), injure plants and animals and marine life. It reduces human immunity to many diseases. It has the effect on the earth's climate by adding to the greenhouse effect which ultimately results in global warming.

2. DESERTIFICATION:

There is no environmental problem in the world that affects people, especially poor people, as extensively as land degradation or desertification. UNCCD defines desertification as "the diminution or destruction of biological potential of land, which can ultimately lead to the desert-like conditions? The causes of desertification are numerous.

However, the important ones include climate change, overgrazing, deforestation, and expansion of agriculture. About 35 percent of the earth's area (about 6.1 billion hectares) and 900 million people are affected by the problem of desertification. Desertification leads to loss of vegetation which forces men to migrate for their livelihood while the women are left behind to struggle on.

Q. How does climate change affect desertification?

Desertification is land degradation in drylands. Climate change and desertification have strong interactions. Desertification affects climate change through loss of fertile soil and vegetation. Soils contain large amounts of carbon, some of which could be released to the atmosphere due to desertification, with important repercussions for the global climate system. The impacts of climate change on desertification are complex and knowledge on the subject is still insufficient. On the other hand, some dryland regions will receive less rainfall and increases in temperatures can reduce soil moisture, harming plant growth. On the other hand, the increase of carbon dioxide (CO_2) in the atmosphere can enhance plant growth if there are enough waters and soil nutrients available.

Q. How can climate change induced desertification be avoided, reduced or reversed?

Managing land sustainably can help avoid, reduce or reverse desertification and contribute to climate change mitigation and adaptation. Such sustainable land management practices include reducing soil tillage and maintaining plant residues to keep soils covered, planting trees on degraded lands, growing a wider variety of crops, applying efficient irrigation methods, improving rangeland grazing by livestock and many others.

Q. How do sustainable land management practices affect ecosystem services and biodiversity?

Sustainable land management practices help improve ecosystems services and protect biodiversity. For example, conservation agriculture and better rangeland management can increase the production of food and fibres. Planting trees on degraded lands can improve soil fertility and fix carbon in soils. Sustainable land management practices also support biodiversity through habitat protection. Biodiversity protection allows for the safeguarding of precious genetic resources, thus contributing to human well-being.

3. DEFORESTATION:

Deforestation is one of the most important issues of environmental change and degradation of soil. About 30 percent of earth's surface is covered by forests. South America, Brazil, West central Africa and South-East Asia, are home to regions of dense forests. Loss of trees in order to make space for residential, industrial or commercial projects means that less oxygen is produced, and temperature and rainfall are affected.

The human pressure on forests has significantly increased in recent decades. The need for agricultural land, increased demand for fuel and commercial wood, more and more dam construction, large-scale ranching and mining along with growing industrialization and urbanization have ruthlessly exploited the forests and have in turn created chaotic conditions and severe environmental disease and imbalances.

Deforestation has generally altered landscapes around the world. About 2,000 years ago, 80 percent of Western Europe was forested; today the figure has reduced to as low as 34 percent. In North America, about half of the forests in the eastern part of the continent were cut down from the 1600s to the 1870s for timber and agriculture. Most of Earth's farmland was once forests.

Today, the greatest amount of deforestation is occurring in tropical rainforests, aided by extensive road construction into regions that were once almost inaccessible. Building or upgrading roads into forests makes them more accessible for exploitation. Slash-and-burn agriculture is a big contributor to deforestation in the tropics. With this agricultural

method, farmers burn large swaths of forest, allowing the ash to fertilize the land for crops. The land is only fertile for a few years, however, after which the farmers move on to repeat the process elsewhere. Tropical forests are also cleared to make way for logging, cattle ranching, oil palm and rubber tree plantations.

Deforestation can result in more carbon dioxide being released into the atmosphere. That is because trees take in carbon dioxide from the air for photosynthesis and carbon is locked chemically in their wood. When trees are burned, this carbon returns to the atmosphere as carbon dioxide. With fewer trees around to take in the carbon dioxide, this greenhouse gas accumulates in the atmosphere and accelerates global warming.

Deforestation also threatens the world's biodiversity. Tropical forests are home to great numbers of animal and plant species. When forests are logged or burned, it can drive many of those species into extinction. Some scientists say we are already in the midst of a mass-extinction episode.

There has been a growing concern among professional foresters along with social workers about the rate of deforestation everywhere. FAO, UNDP, World Bank and other government and non-governmental organisations (NGOs) have expressed their opinion about deforestation and suggest plans to protect and renewal of forests. In India, the Chipko Andolan and Narmada Bachao Andolan are the two popular movements which have developed consciousness among the people to raise voice against the ruthless destruction of forests.

- Over exploitation of resources
- chemical fertilizers, pesticides and oil pollution.
- climate change
- Pollution
- Invasive species
- Habitat destruction
- Deforestation
- Extinction
- wild life trade.

5. DISPOSAL OF WASTES:

The high energy consumption and high population densities of the urban regions give rise to large quantities of waste water and sewage as well as household rubbish. Industrialization and urbanization are the main causes of domestic, industrial and nuclear wastes.

The contaminated waters supplies cause many diseases of epidemic nature. The industrial waste consists of chemicals, detergents, metals and synthetic compounds besides the solid waste and garbage. Thousands of tonnes of mercury, nitrogen, phosphorus, cadmium, lead, zinc and other waste is dumped every day in the rivers and sea waters.

The increased nuclear fuel is becoming as one of the sources of non-conventional energy. The nuclear waste contains radioactive isotopes which generate large quantities of heat. The domestic, industrial and nuclear wastes are serious health hazards and may endanger

the biosphere as well.

Industrial waste, pesticides, herbicides enter the waterways through dumping as well as run off from farms and homes. Many rivers of India including the long seashore are the victims of the disposal of waste, because of dumping of heavy waste, this now very difficult to get a cup of totally uncontaminated water from the so-called sacred rivers like Ganga and Yamuna. Inadequate system of solid waste disposal causes adverse impact of health, infant mortality and the birth rate.

Methods of Waste Disposal –

The various methods of waste disposal are as follows:

- LANDFILL: In this process the waste type involves non-reusable and non-recyclable substances which are spread in a thin layer in specific low-lying lands or areas. The areas are dug deep where waste is disposed inside. Then a layer of soil will be used to cover it back. These areas are declared unfit for activities like construction of building for the next 20 years.

- INCINERATION: Incineration is the treatment of waste or waste disposal by the means of burning where the garbage turns into the incombustible matter like gases and ashes. Incinerators are believed to be environmentally very dangerous as the residuals are heavy metals, which are placed in landfills ultimately making air, water and soil polluted.

- **GENERATION OF BIOGAS:** Food items, animal waste, municipal waste, vegetable or fruit peels and organic industrial wastes are biodegradable waste which means they can be decomposed by bacteria or other organisms. Using these wastes, biogas is produced at small as well as large scale. Where bacteria, fungi, other microbes easily degrade the substances. The organic biodegradable matter that is broken down or has to be decomposed serves as food for microorganisms. Biogas is a mixture of gases primarily methane and carbon dioxide.

- **WASTE COMPACTION:** Waste compaction involves a proper technique that includes shredding the waste into smaller pieces, pushing the mix properly and placing it in such a way to fill voids. Waste compaction results in reducing the amount and size of waste that ultimately results in less pollution of the environment.

- **COMPOSTING:** Composting is one of the waste disposal methods that begin from our kitchen. It deals with all organic materials including food scraps, garden waste, fruit and vegetables peel. When these substances are buried and left under the soil for some days, they decay under the soil due to bacterial action. As a result decomposition takes place and humus like substance named compost is formed. One such famous method is known as vermicomposting.

Environmental issues affecting Agriculture

Agriculture contributes to a large number of environmental issues that cause environmental degradation including: climate change, deforestation, biodiversity loss, dead zones, genetic engineering, irrigation problems, pollutants, soil degradation and waste.
The major types of Environmental Issues that affects agriculture are as follows—

1. Global Warming

"Global Warming is the extraordinary increase in Earth's surface temperature due to increase of greenhouse gases concentration on the atmosphere." Greenhouse gases are the heat-trapping gases in the atmosphere (carbon dioxide, methane, nitrous oxide, CFC)

⇒ Causes of Global Warming

(i) Rapid use of fossil fuel
(ii) Rapid use of fossil fuel will emit large amount of greenhouse gases especially carbon dioxide.
(iii) Deforestation / clearing of forests and land.

⇒ Signs of Global Warming

(i) The receding of ice formations on Earth (removes at mountain-tops, glaciers, Antarctic and Arctic ice)

(ii) The increase of shrubbery in Arctic.

(iii) Thinner clouds over the sky that decreases the ability to reflect heat from the sun.

(iv) The discovery of the decrease of Earth's albino (The amount of sunlight reflection by the Earth surface to the moon) by 2.8 percent, which means the Earth has loosen some levels of capability to reflect sunlight to the moon.

(v) change in wind directions

⇒ Impacts of Global Warming

(i) Stormy weather (more chances for hurricanes, floods, cyclone, storms to happen)

(ii) Increased severity for drought, hunger and spread of diseases, especially in poor countries.

(iii) Declines of amphibians, caused by altered precipitation patterns resulted in lower levels of pond and lake waters, where amphibians survive.

(iv) Damages to coral reef.

(v) Marine diseases.

(vi) Rising ocean temperature

(vii) Ecosystem degradation

(viii) Decline of biodiversity.

2. Ozone Depletion

Ozone layer is a protection to our atmosphere. It's about 19 to 30 km in distance from the Earth surface. It plays an important role of blocking the harmful ultraviolet rays (UV) that come from the sun, which, if there was no ozone layer even cancer, would dominate and even no life would be on Earth. The concentration of the layer is usually under 10 parts ozone per million. The ozone layer is made up by the action of sunlight to oxygen, and the amount is stabled by the existence of nitrogen.

⇒ Effects of Ozone depletion

(i) More ultraviolet (UV) rays come to Earth that is harmful for human skin and can cause deadly disease like skin cancer.

(ii) More heat thus increasing the risk of global warming.

3. Acid Rain

Acid Rain is the kind of precipitation that contains larger amounts of acid than normal. Rainwater is usually slightly acidic, with pH level between 5 and 6. Water that evaporates from earth is neutral (pH level 7) and it becomes weak acid when mixed with carbon dioxide in the atmosphere. This is caused by the presence of air pollutants like sulphur dioxide and nitrogen oxides. They produce acids if combined with water. Acid rain is considered as the wet deposits of air pollutants, whose ill combined with moisture before falling to the ground.

⇒ Impact of Acid Rain

(i) Deteriorated building that is made of rock or marbel.
(ii) Acidification of soil and lakes.
(iii) Deteriorates trees and forests.
(iv) Separation of poisonous minerals such as aluminium and mercury from the surrounding ground increasing the risk of contamination to lakes or water sources.

Environmental issues in India

India's environmental problems are due to the negative problems and effects of the process of development that is poverty and underemployment and underdevelopment. Poorly planned development projects cause damage to the environment, associated with plans for rapid economic growth and development. The second group is related with the impacts on health, land, soils, water, forests, wildlife as result of poverty.

The greatest challenge is the rapid growth of population. Population, poverty and environment are interrelated. The nexus between poverty and environmental degradation is a major issue as vast majority of people depends on the natural resources of country for their basic needs. About 40 percent are below poverty line.

The environmental degration has adversely affected the poor who depend upon natural resources. Henceforth, both poverty and environmental degradation are two facets of same challenge and it is widely recognised that population growth is a function of poverty.

The mountainous terrains of the Himalayas and North-East States are rapidly losing their forests and trees, which in turn enhances the removal of top soils and result in landslides and floods.

India has a rich flora. The Botanical Survey of India has reported nearly 49,000 species of plants after surveying about 70 percent of India's geographical area. But due to deforestation about 1336 plant species are considered as endangered. The main causes for loss of flora and fauna are pollution, over exploitation, habitat destruction and toxic substances in waters, floods, cyclones, etc.

In the last two decades India has seen a rampant rise in environmental challenges being faced by cities and countries globally. In India, the challenges related to air pollution, waste management, scarcity of water, contamination of natural resources and loss of biodiversity, amongst others have been increasing.

Conclusion

Environmental degradation is the deterioration of the environment through depletion of resources such as quality of air, water and soil; the destruction of ecosystems, habitat destruction; the extinction of wildlife and pollution. It is defined as any change or disturbance to the environment perceived to be deleterious or undesirable.

Environmental degradation is one of the ten threats officially cautioned by the high-level Panel on Threats, Challenges and Change of the United Nations. The United Nations International Strategy for Disaster Reduction defines environmental degradation as "the reduction of the capacity of the environment to meet social and ecological objectives and needs." Environmental degradation comes in many types. When natural habitats are destroyed or natural resources are depleted, the environment is degraded. Efforts to counteract this problem include environment protection and environmental resources management. Mismanagement that leads to degradation can also lead to environmental conflict, where communities organise in opposition to the forces that mismanaged the environment.

Chamanta
21/06/22

ENVIRONMENTAL SCIENCE PROJECT

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COLLEGE ROLL NO. :- 21/BSCH/0156
TOPIC :- ECO SYSTEM

Registration No.- 013-1911-0177-21

CONTENTS

UNDERSTANDING ECOSYSTEM

An ecosystem (or ecological system) consists of all the organisms and the physical environment with which they interact. These biotic and abiotic components are linked together through nutrient cycles and energy flows. Energy enters the system through photosynthesis and is incorporated into plant tissue. By feeding on plants and on one another, animals play an important role in the movement of matter and energy through the system. They also influence the quantity of plant and microbial biomass present. By breaking down dead organic matter, decomposers release carbon back to the atmosphere and facilitate nutrient cycling by converting nutrients stored in dead biomass back to a form that can be readily used by plants and microbes.

Ecosystems are controlled by external and internal factors. External factors such as climate, parent material which forms the soil and topography, control the overall structure of an ecosystem but are not themselves influenced by the ecosystem. Internal factors are controlled, for example, by decomposition, root competition, shading, disturbance, succession, and the types of species present. While the resource inputs are generally controlled by external processes, the availability of these resources within the ecosystem is controlled by internal factors. Therefore, internal factors not only control ecosystem processes but are also controlled by them.

ECOSYSTEM DEGRADATION

In generalficial functions provided by such systems. These include: sustaining biodiversity, storage of sediment, flood defence and storm buffering, maintenance of water quality, and support of commercial coastal and marine food chains. Many of the processes and functioning of estuarine systems have been described in previous chapters of this volume, so we will focus on some of the direct management implications of maintaining and restoring intertidal systems.

Environmental degradation is the deterioration of the environment through depletion of resources such as quality of air, water and soil; the destruction of ecosystems; habitat destruction; the extinction of wildlife; and pollution.
Food shortage as the lands become barren and the oceans become fishless. Loss of biodiversity as whole species of living things disappear due to deforestation. Pollution will eventually become unmanageable and affect our health. Rising temperatures may be too much for all living things on the planet.
When ecosystems are degraded, their capacity to provide services decreases.Ecosystem services are a central issue in sustainable management. Spatial evaluation of ecosystem services is crucial for management decision making.

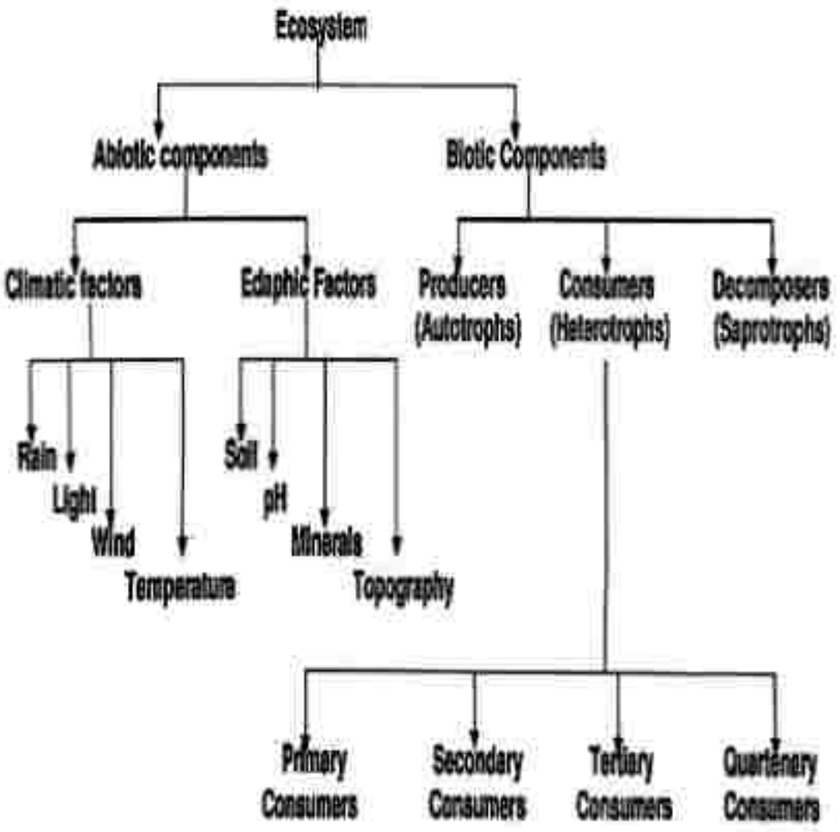
RESOURCE UTILIZATION

Resource utilization is the measure of how much of your available resources you are currently using. It can help you to plan how to utilize your resources more effectively to ensure that your organization is being as productive as possible.

While there are multiple ways to measure resource utilization, the simplest and most common method is by taking the actual number of hours worked by a resource, and dividing it by the total number of hours that the resource could have worked.Resource utilization defines the procedure of making the "MOST" out of the resources, which are accessible to you in sort to achieve the your purpose. This is an efficient and effective procedure for an organization.

A resource utilization example is checking if a certain employee is being maximized in between projects. While allocation organizes your project, it's utilization that makes your project successful. Both processes are key to achieving project success, however resource utilization is often undervalued.

Components of Ecosystem



Functions of Ecosystem :

1. Habitat functions : ecosystems provide habitat to wild plants and animals and thus conserve biological and genetic diversity. It supports different food chains and food chains.

Production function : production of wide range of goods ranging from food to raw materials.

Importance of Ecosystem :

1. Life cannot sustain without ecosystem services.
2. Ecosystem services are the goods and services derived from natural and managed ecosystems upon which human welfare depends, and include everything from clean air and water to food and fuel.

PRODUCERS:-

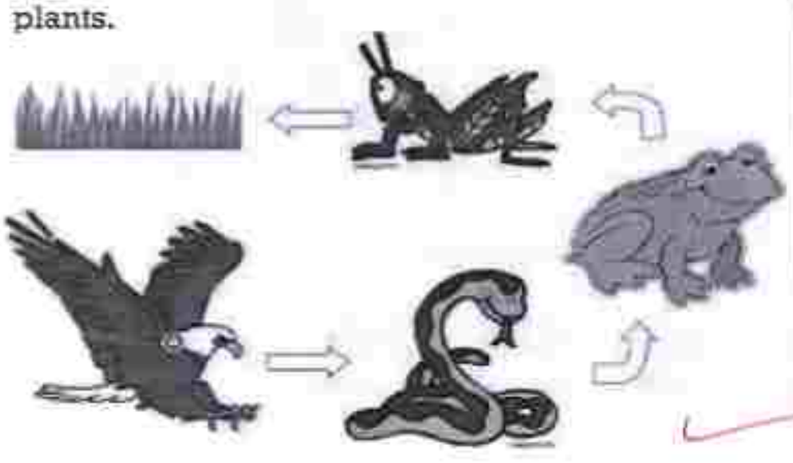
Producers are people who make or grow goods and provide services. Sometimes they are called workers, and they help us do things. For example, a florist is a producer who makes pretty bouquets. A baker is a producer who cooks up yummy cakes, and a painter is a producer who creates artwork for us to admire.

CONSUMERS:-

In an economy, a consumer buys goods or services primarily for consumption and not for resale or for commercial purposes. Consumers pay some amount of money (or equivalent) for something – goods or services – which they (or their families) then consume (use up).

DECOMPOSERS :-

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.



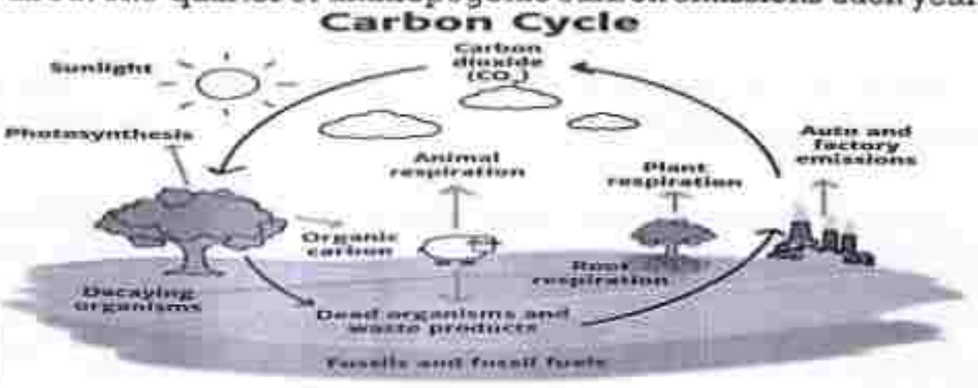
Producers	Consumers	Decomposers
Make their own food	Eat other organisms for food	Break down dead material
		

WATER CYCLE :-

The water cycle describes how water evaporates from the surface of the earth, rises into the atmosphere, cools and condenses into rain or snow in clouds, and falls again to the surface as precipitation. The water falling on land collects in rivers and lakes, soil, and porous layers of rock, and much of it flows back into the oceans, where it will once more evaporate. The cycling of water in and out of the atmosphere is a significant aspect of the weather patterns on Earth.

CARBON CYCLE:-

The carbon cycle is the biogeochemical cycle by which carbon is exchanged among the biosphere, pedosphere, geosphere, hydrosphere, and atmosphere of the Earth. Carbon is the main component of biological compounds as well as a major component of many minerals such as limestone. Along with the nitrogen cycle and the water cycle, the carbon cycle comprises a sequence of events that are key to make Earth capable of sustaining life. It describes the movement of carbon as it is recycled and reused throughout the biosphere, as well as long-term processes of carbon sequestration to and release from carbon sinks. Carbon sinks in the land and the ocean each currently take up about one-quarter of anthropogenic carbon emissions each year.



OXYGEN CYCLE:-

Oxygen cycle refers to the movement of oxygen through the atmosphere (air), Biosphere (plants and animals) and the Lithosphere (the earth's crust). The oxygen cycle demonstrates how free oxygen is made available in each of these regions, as well as how it is used.The oxygen cycle is the biogeochemical cycle of oxygen atoms between different oxidation states in ions, oxides, and molecules through redox reactions within and between the spheres/reservoirs of the planet Earth

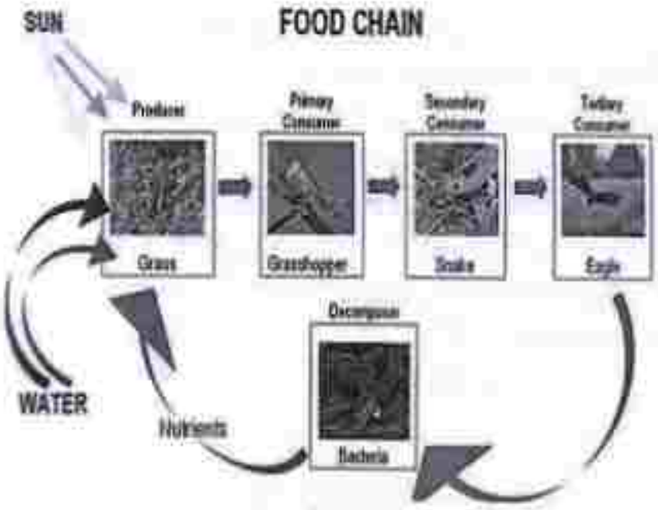
NITROGEN CYCLE:-

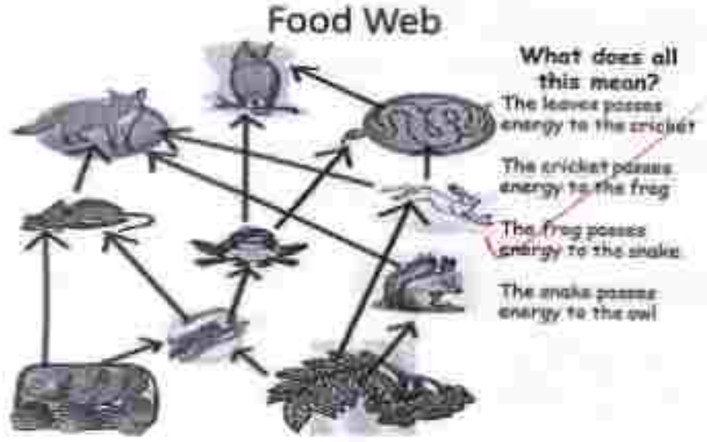
The nitrogen cycle is the biogeochemical cycle by which nitrogen is converted into multiple chemical forms as it circulates among atmosphere, terrestrial, and marine ecosystems. The conversion of nitrogen can be carried out through both biological and physical processes.Important processes in the nitrogen cycle include fixation, ammonification, nitrification, and denitrification. The majority of Earth's atmosphere (78%) is atmospheric nitrogen,making it the largest source of nitrogen.

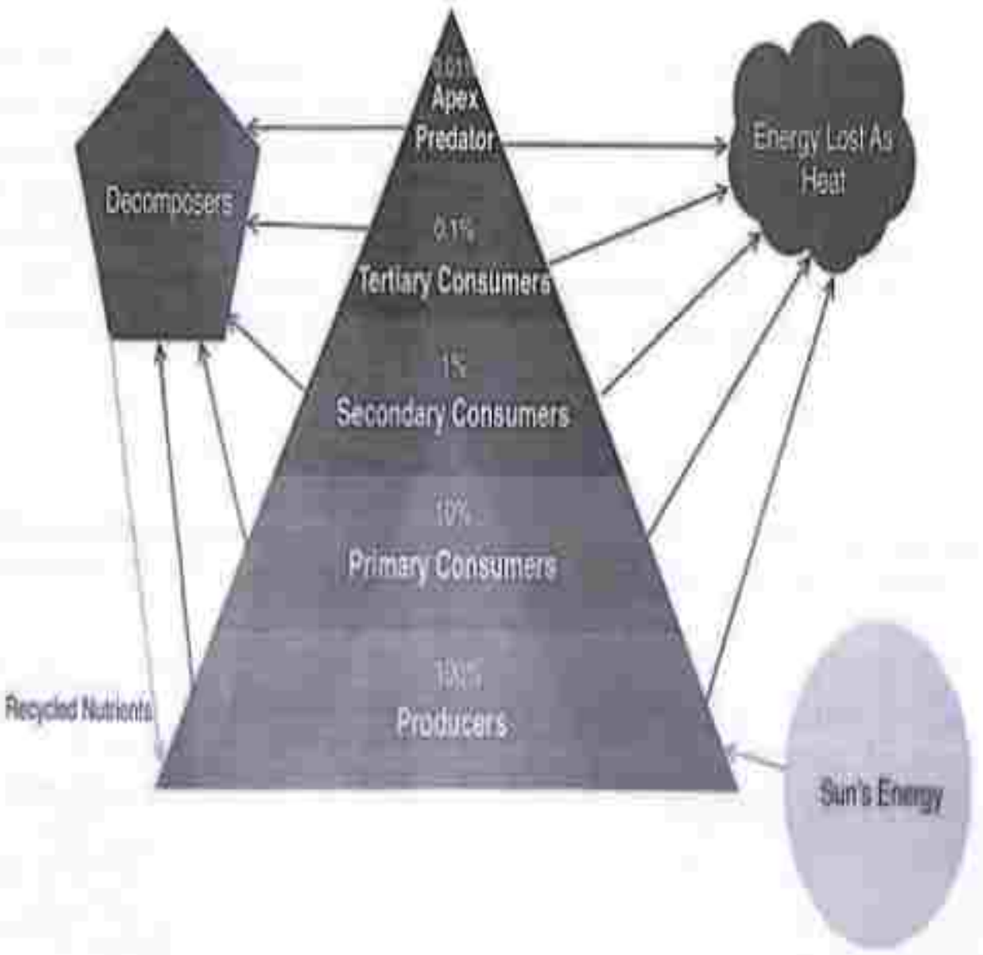
ENERGY CYCLE:-

The energy cycle describes the interactions between energy sources within the Earth's environment. These interactions are very complex, and even small changes in them can lead to significant changes in long-term climate behavior.

Energy enters the ecosystem from the Sun and exits after the organisms have taken as much as they need. Organisms release energy back into the biosphere as heat. Energy also enters the ecosystem from the interior of the Earth.







FOREST ECOSYSTEM:-

Forest ecosystems are areas of the landscape that are dominated by trees and consist of biologically integrated communities of plants, animals and microbes, together with the local soils (substrates) and atmospheres (climates) with which they interact.There are three general types of forest that exist: temperate, tropical, and boreal.The benefits provided by forest ecosystems include: goods such as timber, food, fuel and bioproducts. Ecological functions such as carbon storage, nutrient cycling, water and air purification, and maintenance of wildlife habitat. Social and cultural benefits such as recreation, traditional resource uses.The characteristic features of forest ecosystems include vegetation dominated by large tree species.

GRASSLAND ECOSYSTEM:-

It is also known as a transitional landscape and is also known by different names in different regions of the world like steppes in Europe and Asia, pampas in South America, Veldt in South Africa, and Downs in Australia.

Grasslands are the areas that are dominated by a nearly continuous cover of grasses. It is one of the most widespread of all major vegetation in the world. They occupy about 20% of the land on the surface of the earth. Grasslands are found in both tropical and temperate regions where rainfall is not enough to support the growth of trees. They are also found in areas consisting of well-defined hot, dry, warm, and rainy seasons.

DESSERT ECOSYSTEM:-

Desert ecosystem is the driest ecosystem of the earth and this is the reason it has less vegetation and less diversity of life. It is one of the parts of the terrestrial ecosystem. The plants and animals of the desert ecosystem have mastered the art of survival in harsh conditions.The lack of vegetation exposes the unprotected surface of the ground to the processes of denudation. About one-third of the land surface of the Earth is arid or semi-arid. This includes much of the polar regions, where little precipitation occurs, and which are sometimes called polar deserts or "cold deserts". Deserts can be classified by the amount of precipitation that falls, by the temperature that prevails, by the causes of desertification or by their geographical location.

AQUATIC ECOSYSTEM:-

An aquatic ecosystem is an ecosystem in and surrounding a body of water, in contrast to land-based terrestrial ecosystems. Aquatic ecosystems contain communities of organisms that are dependent on each other and on their environment. The two main types of aquatic ecosystems are marine ecosystems and freshwater ecosystems. Freshwater ecosystems may be lentic (slow moving water, including pools, ponds, and lakes); lotic (faster moving water, for example streams and rivers); and wetlands (areas where the soil is saturated or inundated for at least part of the time).

CONCLUSION

- Life interacts with its abiotic environment in ecosystems through which energy flows and materials are recycled.
- Understanding biogeochemical cycles is crucial.
  - Humans are causing significant changes in the ways those cycles function.
- Understanding energy, energy flow, and chemistry increases our understanding of organisms, their environment, and how environmental systems function.
- Thinking in terms of systems can teach us how to avoid disrupting Earth's processes and how to mitigate any disruptions we cause.

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  - ENVIRONMENT AND ITS FUNCTIONS

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OVERVIEW

Environmental pollution is one of the significant international rather worldwide concern today. Various emerging pollutants in the environment such as persistence organic pollutants, nanomaterials pollutants, microplastics radioactive pollutants and heavy metals display harmful effects on the human body animals and plants. The main types of pollution that lead to harmful effects today are water pollution, soil pollution, air pollution noise and marine pollution. Environmental pollution with Synthetic polymers nowadays poses serious threats to the environment and human health. Unfortunately, most conventional plastics are highly recalcitrant even under conditions known to be favourable for microbial degradation. Many pollutants such as and pharmaceutical compounds, heavy metals and Pedustrial dye compounds in environmental samples display hazardous effects to humans, animals and plants. Environmental pollution caused by heavy metals has been responsible for numerous pathologies in wild species. Cadmium (Cd) is widely distributed in the environment and has been described in the environment as highly toxic for living beings affecting specially the survival and reproduction of birds

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Environmental pollution is one of the most crucial global issues today. Various pollutants in our environment (air water soil etc) including pesticides, herbicides and heavy metals exhibit hazardous effects on the human body, animals and plants. There is a great need for sensitive simple, rapid, cost-effective and portable detection methods to allow more comprehensive on-site monitoring with spatial and temporal resolutions. Thus various precautionary measures are to be taken and kept in mind so that we can reduce environmental pollution to an extent.

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INTRODUCTION

Environmental pollution is the unfavourable alteration of our surroundings, wholly or largely as a byproduct of man's actions through direct or indirect effects. It is the introduction of contaminants into the natural environment that cause adverse change. Pollution may take the form of any substance (solid, liquid or gas) or energy. Pollutants, the components of pollution, can be either foreign substances/energies or naturally occurring contaminants. Although environmental pollution can be caused by natural events, the word pollution generally implies that the contaminants have an anthropogenic source—that is, a source created by human activities. Pollution is often classed as point source or nonpoint source pollution. In 2015, pollution killed 9 million people worldwide. One of the most significant natural sources of pollution are volcanoes which during eruptions release large quantities of harmful gases into the atmosphere. Volcanic gases include carbon dioxide which can be fatal in large concentrations and contribute to climate change, hydrogen halides which can cause acid rain, sulfur dioxides which are harmful to animals and damage the ozone layer, which are capable of killing humans at concentrations of less than 1 part

per thousand. Motor vehicle emissions are one of the leading causes of air pollution. China, US, Russia, India, Mexico and Japan are the world leaders in air pollution emissions. Smokestacks from power plants emit carbon dioxide and particulate matter. Leakage from gasoline storage tanks. Discharge pipes at a wastewater treatment plant. A drainage ditch on a feedlot that seeps into groundwater — these are some examples of point-source pollution. Thus in order to save the planet certain measures definitely needs to be taken.

Air pollution occurs due to the presence of undesirable solid or gaseous particles in the air in quantities that are harmful to human health and the environment. Air may get polluted by natural causes such as volcanoes which release ash, dust, sulphur and other gases, or by forest fires that are occasionally naturally caused by lightning. However unlike pollutants from human activity, naturally occurring pollutants tend to remain in the atmosphere for a short time and do not lead to permanent atmospheric change. Pollutants that are emitted directly from identifiable sources are produced both by natural events (for example dust storms and volcanic eruptions) and human activities (emissions from vehicles, industries, etc.) These are called PRIMARY POLLUTANTS. There are five primary pollutants that together contribute about 90 percent of the global air pollution. These are Carbon oxides (CO and CO_2), nitrogen oxides, sulfur oxides, volatile organic compounds (mostly hydrocarbons) and suspended particulate matter. Pollutants that are produced in the atmosphere when certain chemical reactions take place among the primary pollutants are called Secondary pollutants E.g:- SULFURIC ACID, NITRIC ACID, CARBONIC ACID etc. Pollutants are also found indoors from infiltration of polluted outside air and from various chemicals used or produced inside buildings. Both indoor and outdoor air pollution are

equally harmful.

SOURCES

CARBON MONOXIDE - Is a colourless, odorless and toxic gas produced when organic material such as natural gas, coal or wood are incompletely burnt. The no. of vehicles has been increasing over the years all over the world. Vehicular exhausts are the single largest source of carbon monoxide.

SULFUR OXIDES - These are produced when sulfur containing fossil fuels are burnt.

NITROGEN OXIDES - These are found in vehicular exhausts. Nitrogen oxides are significant, as they are involved in the production of secondary air-pollutant such as ozone.

HYDROCARBONS - These are a group of compounds consisting of carbon and hydrogen atoms. They either evaporate from fuel supplies or are remnants of fuel that did not burn completely. Hydrocarbons are washed out of the air when it rains and run into surface water.

PARTICULATES - Particulates are small pieces of solid material (for example smoke particles from fires, bits of asbestos, dust particles and ash from industries) dispersed into the atmosphere. The effects of particulates range from soot to the carcinogenic (cancer causing) effects of asbestos, dust particles and ash from industrial plants that are dispersed into the atmosphere.

LEAD - It is a major air pollutant that remains largely unmonitored and is emitted by vehicles. High lead levels have been reported in the ambient air of metropolitan cities. Leaded petrol is the primary source of airborne lead emissions in Indian cities.

Pollutants are also found indoors from infiltration of polluted outside air and from various chemicals used or produced inside buildings. Both indoor and outdoor air pollution are equally harmful.

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TYPES OF PARTICULATES

TERM	MEANING	EXAMPLES
Aerosal	General term for particles suspended in air	Sprays from pressurized cans.
Mist	Aerosal consisting of liquid droplets	Sulfuric acid mist
Dust	Aerosol containing of solid particles or a mixture of solid/larger particles that are blown into the air by grinding them down.	Dust Storm.
Smoke	Aerosol consisting of solid particles or a mixture of solid and liquid particles produced by chemical reaction such as fires.	Cigarette smoke, smoke from burning garbage
Plume	Geometrical shape or form of the smoke coming out of a chimney.	—

EFFECTS

EFFECTS OF AIR POLLUTION ON LIVING ORGANISMS

Our respiratory system has a no. of mechanisms that help in protecting us from air pollution. The hair in our nose filters out huge particles. The sticky mucus in the lining of the upper respiratory tract captures smaller particles and dissolves some gaseous pollutants. Prolonged smoking or exposure to air pollution can overload or break down these natural defenses causing or contributing to diseases such as lung cancer, asthma, chronic bronchitis and emphysema. Elderly people, infants, pregnant women and people with heart disease, asthma or other respiratory diseases are especially vulnerable to air pollution. Cigarette smoking is responsible for the greatest exposure to carbon monoxide. Sulfur dioxide irritates respiratory tissues. Chronic exposure causes a condition similar to bronchitis. Nitrogen oxides specially NO_2 can irritate the lungs, aggravate asthma or chronic bronchitis and also increase susceptibility to respiratory infections such as influenza or common colds. Many volatile organic compounds such as benzene and formaldehyde and toxic particulates such as lead, cadmium can cause mutations, reproductive problems or cancer.

EFFECTS ON PLANTS

When some gaseous pollutants enter leaf pores they damage the

damage the leaves to air plant. Chronic exposure of the leaves to air pollutants can break down the waxy coating that helps prevent ex-cessive water loss and leads to damage from diseases, pets, drought and frost. Such exposure interferes with photosynthesis and plant growth, reduces nutrient uptake and causes leaves to turn yellow, brown or drop off altogether. At a higher concentration of sulphur dioxide majority of the flower buds become stiff and hard. They eventually fall from the plants, as they are unable to flower.

EFFECTS ON MATERIALS

Every year air pollutants cause damage worth billions of rupees. Air pollutants break down exterior paint on cars and houses. All around the world air pollutants have discoloured irreplaceable monuments, historic buildings, marble statues, etc.

EFFECTS ON THE STRATOSPHERE

The upper stratosphere consists of considerable amounts of ozone, which works as an effective screen for ultraviolet light. This region called the ozone layer extends upto 50Kms above the surface of the earth. Though the ozone is present upto 60 Kms its greatest density remains in the region between 20 to 25Kms. The ozone layer does not consist of solely ozone but a mix

tore of other common atmospheric gases. Ozone is a form of oxygen with three atoms instead of two. It is produced naturally from the photodissociation of oxygen gas molecules in the atmosphere. The ozone thus formed is constantly broken down by naturally occurring processes that maintain its balance in the ozone layer.

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CONTROL MEASURES

Air pollution can be controlled by two fundamental approaches preventive techniques and effluent control.
One of the effective means of controlling air pollution is to have proper equipment in place. This includes devices for removal of pollutants from the flue gases through scrubbers closed collection recovery systems through which it is possible to collect the pollutants before they escape use of dry and wet collectors, filters, electrostatic precipitators, etc. Industries should be located in places so as to minimize the effects of pollution after considering the topography and the wind directions. Substitution of raw material that causes more pollution with those that cause less pollution can be done.

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Water is the essential element that makes life on earth possible. Without water there would be no life. Although 71% of the earth's surface is covered by water only a tiny fraction of this water is available to us as fresh water. About 97% of the total water available on earth is found in oceans and is too salty for drinking or irrigation. The remaining 3% is fresh water. Of this 2.997% is locked in ice-caps or glaciers. Water that is found in streams, rivers, lakes, wetlands and artificial reservoirs is called surface water. Water that percolates into the ground and fills the pores of soil and rock is called groundwater. Porous water-saturated layers of sand, gravel or bedrock through which ground water flows are called aquifers. Most of these are replenished naturally by rainfall that percolates downward through the soil and rock. This process is called natural recharge. Any pollutant that is discharged onto the land above is also pulled into the aquifer and pollutes the groundwater resulting in polluted water in the nearby wells.

Groundwater pollution - While oil spills are highly visible and often get a lot of media attention, a much greater threat to human life comes from our groundwater being polluted which is used for drinking and irrigation. Groundwater flows are slow and not turbulent hence the contaminants are not

effectively diluted and dispersed as compared to surface water. Groundwater is polluted due to urban run-off untreated or poorly treated waste water and garbage. Industrial waste storage located above or near aquifers also cause groundwater pollution.

SOURCES

* **SEWAGE (WASTE WATER):** Sewage is another for waste water from domestic and industrial processes. Despite strict regulatory control, the environment data show that the water and sewage industry accounted for almost a quarter of the serious water incidents in England in 2004.

* **OIL POLLUTION:** Oil spillages affect water quality in a number of ways. Oil can make drinking water unsafe to drink. A substantial amount of oil released into oceans and seas will destroy wildlife and the ecosystems that sustain them.

* **RADIOACTIVE SUBSTANCES:** Radioactive waste is another source of water pollution. Radioactive substances are used in nuclear power plants, industrial, medical and other scientific processes. They can be found in watches, luminous clocks, television sets and x-ray machinery.

* **RIVER DUMPING:** Lots of people dump supermarket trolleys, bicycles, garden cuttings and electronic waster into rivers or river banks. River dumping not only causes water pollution; it also harms wildlife and increase the risk of flooding.

* **MARINE DUMPING:** The Worldwide fund for Nature (WWF) estimates that a staggering amount of waste enters into the sea every year. Other sources of waste at sea include plastics and other materials blown or washed from land.

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THE STATE OF INDIAN RIVERS

India has always had a tradition of worshipping rivers. Most of the rivers in India are named after gods, goddesses or Saints. Urbanization, industrialization, excess withdrawal of water, agricultural run-off, improper agricultural practices all contribute to river pollution in India. Waters from the Ganga and the Yamuna are drawn for irrigation through the network of canals as soon as these rivers reach the plains reducing the amount of water that flows downstream. What flows in the river is water from small nalas, and streams that carry with them sewage and industrial effluents. The residual freshwater, is unable to dilute the pollutants and the rivers turn into stinking sewers. Sewage and municipal effluents account for 75% of the pollution load in rivers while the remaining 25% is from industrial effluents and non-point pollution sources. In 1985, India launched the Ganga Action Plan (GAP) the largest ever river clean-up operation in the country. The plan has been criticized for overspending and slow progress. The GAP Phase II in 1991 included cleaning operations for the tributaries of the Ganga i.e. the Yamuna, Gomti and the Damodar. Thus the Yamuna Action Plan (YAP), Gomti Action Plan and the Damodar Action Plan were added.

EFFECTS

* DESTRUCTION OF BIODIVERSITY: Water pollution depletes aquatic ecosystems and triggers unbridled proliferation of phyto plankton in lakes.

* CONTAMINATION OF THE FOOD CHAIN: Fishing in polluted waters and the use of waste water for livestock farming and agriculture can introduce toxins into foods which are harmful to our health when eaten.

* LACK OF POTABLE WATER: The UN says that billions of people around the world have no access to clean water to drink or sanitation particularly in rural areas.

* DISEASE: The WHO estimates that about 2 billion people have no option but to drink water contaminated by excreta, exposing them to diseases such as cholera, hepatitis A and dysentery.

* INFANT MORTALITY: According to the UN diarrhoeal diseases linked to lack of hygiene cause the death of about 1000 children a day worldwide.

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CONTROL MEASURES

While the foremost necessity is prevention, setting up effluent treatment plants and treating waste through these can reduce the pollution load in the recipient water. The treated effluent can be reused for either gardening or cooling purposes wherever possible. A few years ago a new technology called the Root Zone Process has been developed by the Thermax. This System involves running contaminated water through the root zones of specially designed reed beds. The reeds, which are essentially wetland plants have the capacity to absorb oxygen from the surrounding air through their stomatal openings. The oxygen is pushed through the porous stem of the reeds into the hollow roots when it enters the root zone and creates conditions suitable for the growth of numerous bacteria and fungi. These micro-organisms oxidize impurities in the wastewaters, so that the water which finally comes out is clean.

Soil pollution or soil contamination as a part of land degradation is caused by the presence of xenobiotic (human-made) chemicals or other alteration in the natural soil environment. It is typically caused by industrial activity, agricultural chemicals or improper disposal of waste. The most common chemicals involved are petroleum hydrocarbons, polynuclear aromatic hydrocarbons (such as naphthalene and benzo(a) pyrene), solvents, pesticides, lead and other heavy metals. Contamination is correlated with the degree of industrialization and intensity of chemical substance. The concern over soil contamination stems primarily from health risks, from direct contact with the contaminated soil, vapours from the contaminators/contaminants or from secondary contamination of water supplies within and underlying the soil. There are radical soil chemistry changes which can arise from the presence of many hazardous chemicals even at low concentration of the contaminant species. These changes can manifest in the alteration of metabolism of endemic microorganisms and arthropods resident in a given soil environment. Effects occur to agricultural lands which have certain types of soil contamination. Contaminants typically alter plant metabolism, often causing a reduction in crop yields.

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This has a secondary effect upon soil conservation, since the languishing crops cannot shield the Earth's soil from erosion. Some of these chemical contaminants have long half-lives and in other cases derivative chemicals are formed from decay of primary soil contaminants. Heavy metals and other soil contaminants can adversely affect the activity species composition and abundance of soil microorganisms thereby threatening soil functions such as biochemical cycling of carbon and nitrogen.

SOURCES

MAN-MADE POLLUTANTS

Accidental spills and leaks: During storage, transport or use of chemicals (leaks and spills of gasoline and diesel at gas stations.

Foundry activities: Manufacturing processes that involve furnaces or other processes resulting in the possible dispersion of contaminants in the environment.

Mining Activities: It involves the crushing and processing of raw materials for instance, heavy materials, emitting toxic substances.

Chemical waste dumping: Whether accidental or deliberate— such as illegal dumping

NATURAL POLLUTANTS

Natural accumulation: It compounds in soil due to imbalances between atmospheric deposition and leaving away with precipitation water (eg. concentration and accumulation of perchlorate in soils of arid environments).

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* Natural production: In soil under certain environmental conditions (e.g. natural formation of perchlorate in soil in the presence of a chlorine sauce, metallic object and using the energy generated by a thunderstorm.

* Leaks from sewer lines: Into subsurface (e.g. adding chlorine which could generate trihalomethanes such as chloroform).

AREA AND DRAINAGE LINE TREATMENT

AREA TREATMENT

PURPOSE	TREATMENT MEASURE	EFFECT
* Reduces the impact of rain drops on the soil	Develop vegetative cover on the non arable land	Minimum disturbance and displacement of soil particles.
* Infiltration of water where it falls	Apply water infiltration measures on the area.	In situ soil and moisture conservation.
* Minimum surface run-off	Store surplus rain water by constructing bunds, ponds in the area	Increased soil moisture in the area, facilitate ground water recharge.
* Ridge to valley sequencing	Treat the upper catchment first and then proceed towards the outlet	Economically viable, less risk of damage and longer life of structures of the lower catchments

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DRAINAGE LINE TREATMENT

PURPOSE	TREATMENT MEASURE	EFFECT
* Stop further deepening of gullies and retain sediment run-off	Plug the gullies at formation	Stops erosion, recharges groundwater at the upper level
* Reduce run-off velocity pass cleaner water to the downstream side	Create temporary barriers in gulies	Delayed flow and increased ground water recharge
* Minimum sedimentation in the storage basins	Use various methods to treat the catchments	
* Low construction cost	Use local method/materials and skills for constructing the structures	Structures are locally maintained.

EFFECTS

DAMAGE TO HEALTH → Soil pollutants enter our body through the food chain causing illnesses to appear. Moreover, the spread of antibiotics in the environment increases the pathogens resistance to these drugs.

POORER HARVESTS → Soil pollution agents jeopardize world food security by reducing the amount and quality of harvest.

CLIMATE CHANGE → In the first decade of the 21st century, soil degradation released between 3.6 and 4.4 billion tonnes of CO_2 into the atmosphere.

SPECIES EXTINCTION → Soil contamination is one of the main causes that could trigger the sixth mass extinction event in history – the population of land vertebrates fell by 38% between 1970 and 2012 –

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CONTROL MEASURES

Proper dumping of unwanted materials. Excess wastes by man and animals pose a disposal problem. Open ~~dumpture~~ dumping is the most commonly practiced technique. Nowadays, controlled tipping is followed for solid waste disposal. The surface so obtained is used for housing or sports field. Biopesticides should be used in place of toxic chemical fertilizers or pesticides. Organic fertilizers should be used like used in place of synthesized chemical fertilizers. Organic wastes in animal dung may be used to prepare compost manure instead of throwing them wastefully and polluting the soil. People should be trained regarding sanitary habits. To minimize soil pollution, the wastes such as paper, plastics, metals, glasses, organics, petroleum products and industrial effluents etc. should be recycled and reused. Ban should be imposed on chemicals and pesticides like DDT, BHC etc. which are fatal to plants and animals. Nuclear explosions and improper disposal of radioactive wastes should be banned.


Stop Noise Pollution

Sound is a special kind of wave action, which is usually transmitted through air in the form of pressure waves. These waves are received by hearing apparatus of animals, man transformed into electrical impulses in the ear and carried to the brain, which enables us to hear. Sound waves are generated in a number of ways such as explosive expansion of gases, turbulent movement of liquids, vibrations of solid objects etc. which start a series of pressure waves in all directions. The intensity of these waves diminishes as the distance from the object producing them increases. Sound waves are reflected and deflected by objects, which happen to come in their way. Porous materials, such as perforated board, absorb these waves. When two or more than two such waves superimpose they reinforce each other and in opposite phase they may cancel each other out.

MEASUREMENT HEARING ABILITY AND THE LOUDNESS OF SOUND.

Hearing ability of an individual is monitored by audiometric tests, the most common technique of which is referred to as The Threshold technique. It is based on the determination of the minimum sound level which an individual can hear. An average of the two values is taken as the threshold of hearing of the individual concerned. The intensity or loudness of sound is measured on a scale called decibel scale or dB scale. The scale starts from 0 dB, which is considered as the threshold of hearing.

SOURCES

AIR TRAFFIC NOISE: There are fewer aircraft flying over cities than there are cars on the roads, but the impact is greater, a single aircraft produces 130 dB

CONSTRUCTION SITES: Building and car park construction and road and pavement resurfacing works are very noisy for example, a pneumatic drill produces 110 dB.

CATERING AND NIGHT LIFE: Bars, restaurants and terraces that spill outside when the weather is outside good can produce more than 100 dB. This includes noise from pubs and clubs.

ANIMALS: Noise made by animals can go unnoticed but a howling or barking dog for example can produce around 60-80 dB

LOUDNESS OF SOME COMMON SOUNDS ON DECIBEL SCALE

	SOURCE OF NOISE	APPROXIMATE LOUDNESS
1	Threshold of hearing	0 dB
2	Churches, hospitals etc	10-10 dB
3	A room in a quiet house	20-30 dB
4	Public library	30-40 dB
5	Offices	40-50 dB
6	Normal Conversation	50-60 dB
7	Normal city traffic	60-70 dB
8	Alarm clock	70-80 dB
9	Heavy city traffic	85-95 dB
10	Jetliners 150 metres overhead	100-115 dB
11	Running motor cycle	115-120 dB
12	Threshold of pain to human ears	120-140 dB
13	Jet planes - taking off	140-150 dB
14	Launching of space rocket	160-180 dB

EFFECTS

* Loss of hearing → The most common ill effect of noise pollution is impairment of hearing ability of an individual. Prolonged exposures to loud noise can cause temporary or permanent loss of hearing. People working in noisy places such as industrial establishments, factories etc often suffer from temporary loss of hearing. If the loudness of the noise is moderate or the duration of exposure is short, the damage is only temporary. Longer exposures to louder noises may cause phenomenon / permanent shift in the threshold of hearing an individual.

Ill effects of high levels of noise pollution → High levels of unwanted sound or noise can adversely effect both our physiological and psychological health. It can cause annoyance and aggression, tinnitus, sleep disturbances and other harmful effects. It is to note that our optical system is considerably affected by noise pollution. Dilation of pupils, impairment of night vision and decrease in ability to perceive colours are some of the effects caused by exposure to loud noise for long durations.

Environmental effects of noise pollution → Loud noise has detrimental effect on animals which causes stress and can lead to temporary

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on permanent loss of hearing. It usually makes an individual communicate louder placing additional strain on their energy resource.

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CONTROL MEASURES

* REDUCTION OF NOISE AT THE SOURCE OF IT'S ORIGIN: Often a little precaution can reduce much of the nuisance caused by loud noise. Noise level can be reduced effectively by replacement of noisy and rattling parts, providing better cushioning to check the vibrations, proper oiling and greasing to ensure smooth running and using effective silencers etc.

* APPLICATION OF SOUND PROOFING TECHNIQUES TO MUFFLE DOWN LOUD NOISES: Sound waves are absorbed by porous material such as perforated sheets and other objects. Just as putting cotton plugs in the ears reduces noise level for the individual concerned, sound barriers placed around the sources of origin of loud noises drastically reduce the intensity of sound on the other side of the obstacle.

* KEEPING RESIDENTIAL LOCALITIES FREE OF NOISY INDUSTRIES, BUSY HIGHWAYS, AERODROMES ETC: Residential localities should be established away from noisy industries, busy highways and aerodromes or else these noisy establishments should be developed away from quiet residential areas.

* ENACTMENT OF STRICT LEGISLATION AND IT'S EFFECTIVE COMPLIANCE: In most of the countries, legal framework against noise

pollution has been developed. However, in most of the cases little efforts are made to enforce these rules and regulations effectively. If we ensure only effective compliance of these rules much of the nuisance of noise pollution shall automatically be curtailed.

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Marine pollution is a combination of chemicals and trash, most of which comes from land sources and is washed or blown into the ocean. This pollution results in damage to the environment, to the health of all organisms and to economic structures worldwide. Marine pollution is a growing problem in today's world. Our ocean is being flooded with two main types of pollution: chemicals and trash. Chemical contamination or nutrient pollution is concerning for health, environmental and economic reasons. This type of pollution occurs when human activities, notably the use of fertilizer on farms, lead to the runoff of chemicals into waterways that ultimately flow into the ocean. The increased concentration of chemicals, such as nitrogen and phosphorus, in the coastal ocean promotes the growth of algal blooms which can be toxic to wildlife and harmful to humans. The negative effects on health and the environment caused by ~~toxic~~ algal blooms hurt local fishing and tourism industries. Marine trash encompasses all manufactured products — most of them plastic — that end up in the ocean. Littering storm winds, and poor waste management all contribute to the accumulation of this debris, 80 percent of which comes from sources on land. Common types of marine debris include various plastic items like shopping bags and beverage bottles along with cigarette butts, bottle caps, food wrappers, fishing gear. Plastic waste is particularly problematic as a pollutant because it is so long-lasting. Plastic items can take hundreds of years to decompose. This trash poses dangers to both humans and animals.

SOURCES

* EUTROPHICATION: When there is an excess of chemical nutrients, mainly nitrates and phosphates in the water, it leads to eutrophication or nutrient pollution. It decreases the level of oxygen, reduces the quality of water, make the water inhabitable for fish, affects the breeding process within the marine life and increases the primary productivity of the marine ecosystem.

* ACIDIFICATION: Oceans act as a natural reservoir for absorbing the carbon dioxide from the Earth's atmosphere. Due to rising level of carbon dioxide in the atmosphere, the oceans across the world are becoming acidic in nature as a consequence it leads to acidification of oceans. It can also affect the formation of shell in shellfish and also the corals.

* TOXINS: There are persistent toxins that do not get dissolved or disintegrate with the marine ecosystem rapidly. Toxins such as pesticides, DDT, PCB's, furans, TBT, radioactive waste, phenols and dioxins get accumulated in the tissue cells of the

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CONCLUSION

Environmental pollution is causing a lot of distress not only to humans but also animals, driving many species to endangerment and even extinction. The transboundary nature of environmental pollution makes it even more difficult to manage it - you cannot build brick walls along the borders of your country or put customs cabins at every point of entry to regulate the flows into your country. Everything on our planet is interconnected and while the nature supplies us with valuable environmental resources without which we cannot exist, we all depend on each other's actions and the way we treat natural resources. We are hugely overspending our current budget of natural resources - at the existing rates of its exploitation, there is no way for the environment to recover in good time and continue performing well in the future. We should adopt a holistic view of nature - it is not an entity that exists separately from us, the nature is us, we are an inalienable part of it and we should care for it in the most appropriate manner. ONLY then can we possibly solve the problem of environmental pollution.

Samanta
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While preparing this project, I gained more knowledge regarding the harmful effects of pollution on our lives and how our constant efforts can prevent us from it's perilous effects.

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INTRODUCTION

It means adding impurities to the environment.
It is an undesirable change in chemical, physical, and biological characteristics of air, water and soil, which causes the health problem to all the living beings.

TYPES OF POLLUTION

These are categorised as :
Air pollution
Water pollution
Soil pollution
Sound / noise pollution
Nuclear pollution
E-waste
Further it may be
Indoor pollution / outdoor pollution.

CLASSIFICATION OF POLLUTANTS

The pollutants may be classified as

Degradable or non-persistent pollutants:- these can be broken down rapidly by the natural process e.g. Domestic waste, garbage and sewage.

Slowly degradable or persistent pollutants:- these remains in environment for a very long period of time, in unchanged condition, may be for few decades e.g. Pesticides, aerosole

Non-degradable pollutants:- these are pollutants never get degraded by any natural process. E.g. Toxic elements like lead, mercury, nuclear waste.

SOURCES OF AIR POLLUTION

It can be classified as :

Air pollution by natural and manmade sources.

Air pollution by human activities.

Air Pollution classification

Primary pollutants Secondary pollutants

Released directly in
to the air Added after they are formed as
a chemical reaction in the air
between primary pollutants

--- Ash
--- Salt particles
--- Pollen and spores
--- Smoke
--- Wind blown dust
--- Smog = sunlight + NO_x
--- Acid rain
--- Pollen and spores
--- Smoke
--- Wind blown dust

Primary pollutants

Nox
=15%
VOCs =
14%
SO2
=16%
Pm = 6%
CO =
49%

Sources of Primary pollutants

Fuel
Consumption
=27%
industrial
processes
=14-15%
SWD =3%
Miscellaneou
s =9%
Transportatio
n = 46%

Source of primary pollutants created by Nature :

Volcanoes

Breaking seas

Pollens

Blowing dust

Bacteria

Viruses

Source of primary pollutants created by human activities :

Combustion processes

Chemical processes

Nuclear or Atomic processes

Refining/Heating/Heating/processes

Farming/Mining/Quarrying processes .

Secondary pollutants : Atmospheric

H_2SO_4 formed by reaction of moisture or

water + SO2 / SO3

SECONDARY POLLUTANTS

Acid rain: Atmospheric H_2SO_4 formed by reaction of moisture or water + SO_2 / SO_3
Photochemical smog:- it is harmful mixture formed by gases of nitrogen and particulated matter due to photochemical reactions under influence of strong sunlight.
Ozone contributes majorly to photochemical smog.

MAJOR AIR POLLUTANTS

Carbon compounds: CO_2 is released by complete combustion of fossil fuels and CO, a very toxic gas is released by automobile exhausts.
Sulphur compounds : through the thermal power plants, using coal and from the oil refineries, SO_2, H_2S, H_2SO_4, are released.
Nitrogen Oxides:- these oxides like NO, NO_2, HNO_3 are released by automobiles, power plants and industries

Ozone: due to cooling industries the CFC is released which has affected the O_3 in the atmosphere.

Fluorides: they are produced by the industrial and insecticide spary.

Hydrocarbons:- they are released by the automobiles e.g. Benzene, Benzpyrene etc.

Metals: the metal such as lead, nickel, tin, beryllium, titanium are present in to form of solid particles produced by metallurgical processes.

Photochemical matter: the product such as PAN, PB_2N are the photochemical smog produced by automobile.

Particulate matter: the suspended particulated matter (SPM) is released into the air by the stone crushing industries and dust and the ash from the thermal power plants.

Biological particulate : they are mainly the bacterial cells.

EFFECT OF AIR POLLUTION

Effect on living things
Effect on non-living things

EFFECTS ON LIVING THINGS

Air pollution and human health:

Irritation of eyes, throat, nose and respiratory system
Respiratory damage through tobacco smoke
Convulsions, coma due to lead poisoning
Cigarette smoking cause cardiovascular diseases, due to cadmium particulates
Radioactive dust causes genetic effects on the next generation.The mercury from combustion of fossil fuel affects the nerves, brain and kidney.

Air pollution and vegetation:

The direct use of pesticides affect the growth of metabolic activities by destroying chlorophil and also by disrupting photosynthesis.
Rise of ozone causes Necrosis i.e. Damaging the leaves
The rise of NO_2 causes Abscission i.e. Premature fall of leaves - results in reduction

in crop production
Rise in SO_2 causes chlorosis i.e. Yellowing of the leaves.
Thus the air pollution has qualitative and quantitative effects on the plants.

Air pollution and animals:

When the animals during grazing consume the particulate coated plants mainly with fluorine, lead, arsenic they get affected, resulting into illness or poisoning or even death.
The pets also suffer due to the lung diseases.
When animals are fed with oil cakes or grass, the remains of insecticides/ pesticides settled on vegetation, harm the digestive system very severely.

EFFECT ON NON-LIVINGS

Effect on metals:

Corrosion or abrasion of metals
The acid gases like O_3, SO_2, NO_2, affect the strength of the textile
The building material gets affected by SO_2

PREVENTION OF AIR POLLUTION

There are various air pollution control technologies and land use planning strategies available to reduce air pollution

Following are the commonly used pollution control devices by industry or transportation devices :

They can either destroy contaminants or remove them from an exhaust stream before it is emitted into the atmosphere.

Particulate control:-Mechanical collectors (dust cyclones, multi-cyclones) – electrostatic precipitators or elestrostatic air cleaner is a particulate collection device that removes particles from a flowing air/gas using force of an induced electrostatic charge.

It is highly efficient filtration devices which can easily remove fine particulate matter such as dust and smoke form the air stream.

Particulate scrubber / wet scrubber is a form of pollution control technology in which polluted gas stream is brought in contact with the scrubbing liquid by spraying it with the liquid by forcing it through a pool of liquid or by some

other contact method so as to remove the pollutants.

Scrubbers:-

Baffle spray scrubber
Cyclonic spray scrubber
Ejector venturi scrubber
Mechanically aided scrubber
Spray tower
Wet scrubber.

Nox control:

Low NOx burner
Selective catalytic reduction (SCR)
Selective non-catalytic reduction (SNCR)
NOx scrubbers
Exhaust gas recirculation (EGR)
Catalytic converter (also for VOC control)

Acid gas / SO_2 control:

Wet scrubbers
Dry scrubers
Flue-gas desulfurization

VOC Abatement:-

Adsorption systems, such as activated carbon
Flares
Thermal oxidizers
Catalytic converters

Biofilteres
Absorption (scrubbing)
Cryogenic condensers
Vapor recovery systems

Mercury control:-

Sorbent injection technology
Electro-catalytic oxidation (ECO)
K-fuel.

WATER POLLUTION

Definition:-

It can be defined as "the presence of impurities and foreign substance in water in such a quantity that lowers its quality and makes it unfit for consumption and causes health hazard.

OR

" Any physical, biological or chemical change in water quality that adversely affects living organism can be considered pollution.

CLASSIFICATION OF WATER POLLUTION

Surface water pollution:- ocean, rivers, lakes get polluted in number of ways

Ground water pollution:- is often caused by pesticide contaminations from soil

Oxygen depleting:- when biodegradable material is added to water the number of micro-organisms increases rapidly consuming available oxygen. When this happens harmless aerobic micro-organisms die and anaerobic micro-organisms produce harmful toxins such as ammonia and sulfides

Nutrients and their effect on water:- nutrients are essential for plant growth and development. Many nutrients are found in waste water & fertilizers, if these are in excess it can cause weed and algae growth.

This can contaminate drinking water and clog filters

This can damage other aquatic organisms as algae use up the oxygen in the water

Microbiological water pollution:- it is

natural way of water pollution form by micro-organisms.

CAUSES OF WATER POLLUTION

The water gets polluted by various causes and at various sources which are divided as:

Point source – Source is identifiable (if pollution comes from single source such as oil spill it is called point source)

Non-point source – Source is not identifiable. (if pollution comes from many sources is called non-point source)

MEASURES TO CONTROL WATER POLLUTION

Through the natural water cycle the water itself gets converted into pure water

Disinfection of water, in this process harmful bacteria are killed making water safe for drinking. This is done by chlorination by using bleaching powder

Sedimentation, in this process suspended materials are removed from water. For this

SOURCES OF SOIL POLLUTION

Polluted water discharged from factories
Oil and petroleum leaks from vehicles washed off the road by the rain into the surrounding habitat.
Chemicals fertilizer runoff from farms and crops.
Acid rain (fumes from factories mixing with rain)
Sewage discharged into rivers instead of being treated properly
Over application of pesticides and fertilizers
Purposeful injection into groundwater as disposal method
Interconnections between aquifers during drilling .

Agriculture:-

Reduced soil fertility
Reduced nitrogen fixation
Increased erodiability
Larger loss of soil and nutrients

Deposition of slit in tanks and reservoirs
Reduced crop yield
Imbalance in soil fauna and flora
Industrial:-
Dangerous chemicals entering underground water
Ecological imbalance
Release of pollutant gases
Release of radioactive rays causing health problems
Increased salinity
Reduced vegetation
Urban:-
Clogging of drains
Public health problems
Pollution of drinking water sources
Foul smell and release of gases
Waste management problems

PREVENTION OF SOIL POLLUTION

Reducing fertilizer and pesticide use – using bio-fertilizers and manures
Reusing of materials – materials such as glass containers, plastic bags, paper, cloths can be reused at domestic level rather than being disposed thus reducing solid waste pollution

Recycling and recovery of materials –papers, plastic and glass can be recycled
Reforesting – control of land loss and soil erosion can be possible through restoring forests
Solid waste treatment – proper method should be adopted for management of solid waste disposal. Industrial waste can be treated physically, chemically and biologically until they are less hazardous.
Acidic and alkaline waste shall be first neutralised before disposed
Incineration of other waste is expensive and leaves a huge residue and adds to air Pollution.

CONCLUSION

Our natural environment makes human life possible, and our cultural environment helps define who we are. It is therefore essential that our population and economic growth are environmentally sustainable. The most positive outlook for our environment is one in which we get the balance right between:

- continuing to support and implement effective policies, programs and resources (e.g. community engagement and volunteering programs; IMOS, Australia's Biodiversity Conservation Strategy 2010–2030, the Great Barrier Reef Science Strategy, the Reef 2050 Sustainability Plan, NESP, the Terrestrial Ecosystem Research Network, the Australian Heritage Strategy, the National Reserve System, the National Representative System of Marine Protected Areas, Indigenous Protected Area programs)
- further developing, testing and, as appropriate, implementing innovative approaches and initiatives that are currently being developed (e.g. policies, technologies and management that are decoupling the economy from environmental harm, environmental–economic accounting and valuation, initiatives to reduce plastic pollution in coastal and marine environments, initiatives to reduce air pollutants in urban areas)
- developing and implementing new policies, processes, programs and tools in the medium to longer term, including the further integration of policies and management approaches across jurisdictions and sectors (e.g. green or blue economy approaches, development of a sophisticated impact investment market, regulatory reform to provide for rapid response to new incursions of potentially harmful invasive species and disease).

REFERENCES

The information for preparing this project has been collected from the following websites :

www.google.com

www.wikipedia.com

Saman 26/05/2021