UNIVERSITY OF CALCUTTA

Notification No. CSR/ 12 /18

It is notified for information of all concerned that the Syndicate in its meeting held on 28.05.2018 (vide Item No.14) approved the Syllabi of different subjects in Undergraduate Honours / General / Major courses of studies (CBCS) under this University, as laid down in the accompanying pamphlet:

List of the subjects

Sl. No.	Subject	Sl. No.	Subject
1	Anthropology (Honours / General)	29	Mathematics (Honours / General)
2	Arabic (Honours / General)	30	Microbiology (Honours / General)
3	Persian (Honours / General)	31	Mol. Biology (General)
4	Bengali (Honours / General /LCC2 /AECC1)	32	Philosophy (Honours / General)
5	Bio-Chemistry (Honours / General)	33	Physical Education (General)
6	Botany (Honours / General)	34	Physics (Honours / General)
7	Chemistry (Honours / General)	35	Physiology (Honours / General)
8	Computer Science (Honours / General)	36	Political Science (Honours / General)
9	Defence Studies (General)	37	Psychology (Honours / General)
10	Economics (Honours / General)	38	Sanskrit (Honours / General)
11	Education (Honours / General)	39	Social Science (General)
12	Electronics (Honours / General)	40	Sociology (Honours / General)
13	English ((Honours / General/ LCC1/ LCC2/AECC1)	41	Statistics (Honours / General)
14	Environmental Science (Honours / General)	42	Urdu (Honours / General /LCC2 /AECC1)
15	Environmental Studies (AECC2)	43	Women Studies (General)
16	Film Studies (General)	44	Zoology (Honours / General)
17	Food Nutrition (Honours / General)	45	Industrial Fish and Fisheries – IFFV (Major)
18	French (General)	46	Sericulture – SRTV (Major)
19	Geography (Honours / General)	47	Computer Applications – CMAV (Major)
20	Geology (Honours / General)	48	Tourism and Travel Management – TTMV (Major)
21	Hindi (Honours / General /LCC2 /AECC1)	49	Advertising Sales Promotion and Sales Management –ASPV (Major)
22	History (Honours / General)	50	Communicative English –CMEV (Major)
23	Islamic History Culture (Honours / General)	51	Clinical Nutrition and Dietetics CNDV (Major)
24	Home Science Extension Education (General)	52	Bachelor of Business Administration (BBA) (Honours)
25	House Hold Art (General)	53	Bachelor of Fashion and Apparel Design – (B.F.A.D.) (Honours)
26	Human Development (Honours / General)	54	Bachelor of Fine Art (B.F.A.) (Honours)
27	Human Rights (General)	55	B. Music (Honours / General) and Music (General)
28	Journalism and Mass Communication (Honours / General)		

The above shall be effective from the academic session 2018-2019.

SENATE HOUSE
KOLKATA-700073
The 4th June, 2018

Paul 4/6/18
(Dr. Santanu Paul)
Deputy Registrar

University of Calcutta

Under Graduate Curriculum under Choice Based Credit System (CBCS)

Syllabus forAbility Enhancement Compulsory Course-2 (AECC-2) in
Environmental Studies

Semester-2

Total Marks-100*(Credit -2)*
(50 Theory-MCQ type + 30 Project + 10 Internal Assessment + 10 Attendance)

[Marks obtained in this course will be taken to calculate SGPA & CGPA]

Theory

Unit 1	**Introduction to environmental studies**	2 lectures
	•Multidisciplinary nature of environmental studies; •Scope and importance; Concept of sustainability and sustainable development.	
Unit 2	**Ecology and Ecosystems**	6 lectures
	•Concept of ecology and ecosystem, Structure and function of ecosystem; Energy flow in an ecosystem; food chains, food webs; Basic concept of population and community ecology; ecological succession. •Characteristic features of the following: a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, wetlands, rivers, oceans, estuaries)	
Unit 3	**Natural Resources**	8 lectures
	• Concept of Renewable and Non-renewable resources • Land resources and landuse change; Land degradation, soil erosion and desertification. •Deforestation: Causes, consequences and remedial measures •Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). •Energy resources: Environmental impacts of energy generation, use of alternative and nonconventional energy sources, growing energy needs.	
Unit 4	**Biodiversity and Conservation**	8 lectures
	•Levels of biological diversity: genetic, species and ecosystem diversity; • Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots •India as a mega-biodiversity nation; Endangered and endemic species of India •Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; •Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. •Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.	
Unit 5	**Environmental Pollution**	8 lectures
	• Environmental pollution: concepts and types, • Air, water, soil, noise and marine pollution- causes, effects and controls • Concept of hazards waste and human health risks • Solid waste management: Control measures of Municipal, biomedical and e-waste.	

Unit 6	**Environmental Policies and Practices**	7 lectures
	•Climate change, global warming, ozone layer depletion, acid rain and their impacts on human communities and agriculture •Environment Laws: Wildlife Protection Act; Forest Conservation Act. Water (Prevention and control of Pollution) Act; Air (Prevention & Control of Pollution) Act; Environment Protection Act; Biodiversity Act. •International agreements: Montreal Protocol, Kyoto protocol and climate negotiations; Convention on Biological Diversity (CBD). •Protected area network, tribal populations and rights, and human wildlife conflicts in Indian context.	
Unit 7	**Human Communities and the Environment**	6 lectures
	•Human population growth: Impacts on environment, human health and welfare. •Case studieson Resettlement and rehabilitation. • Environmental Disaster: Natural Disasters-floods, earthquake, cyclones, tsunami and landslides; Manmade Disaster- Bhopal and Chernobyl. •Environmental movements: Bishnois.Chipko, Silent valley,Big dam movements. •Environmental ethics: Role of gender and cultures in environmental conservation. •Environmental education and public awareness	
Project/ Field work		Equal to 5 lectures
	•Visit to an area to document environmental assets: Natural resources/flora/fauna, etc. •Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. •Study of common plants, insects, fish, birds, mammals and basic principles of identification. •Study of ecosystems-pond, river,wetland, forest,estuary and agro ecosystem.	
	Total	50 Lectures

Suggested Reading:

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College Roll Number - HISA20F375

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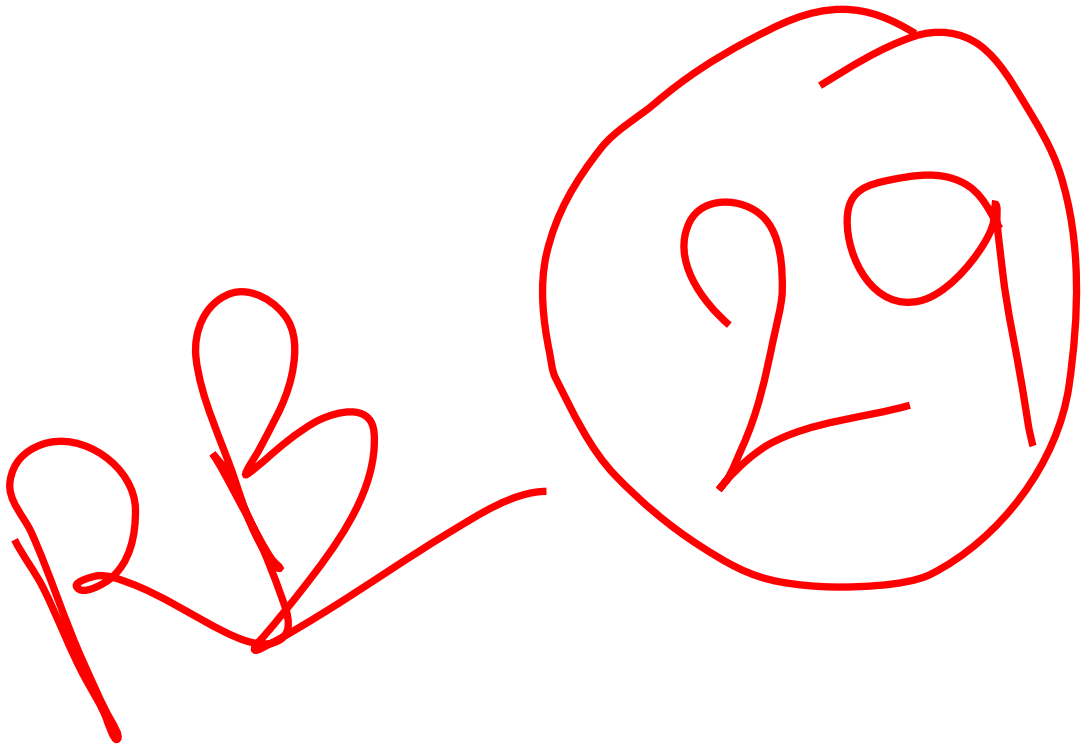
CU Registration Number – 223-1211-0051-20

Semester – 2

Department – History

Paper – Aecc Envs

Topic – Ganges Pollution



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ACKNOWLEDGEMENT

I would love to thank all the teachers who taught us envs and made it so interesting for us and also encouraging us with such interesting topics which helped us in knowing more about the present scenario in our environment . I would also love to thank all our teachers of history department for always encouraging and helping us . Last but not the least I would love to thank our principal ma'am and vice principal sir for always motivating us .

GANGES POLLUTION

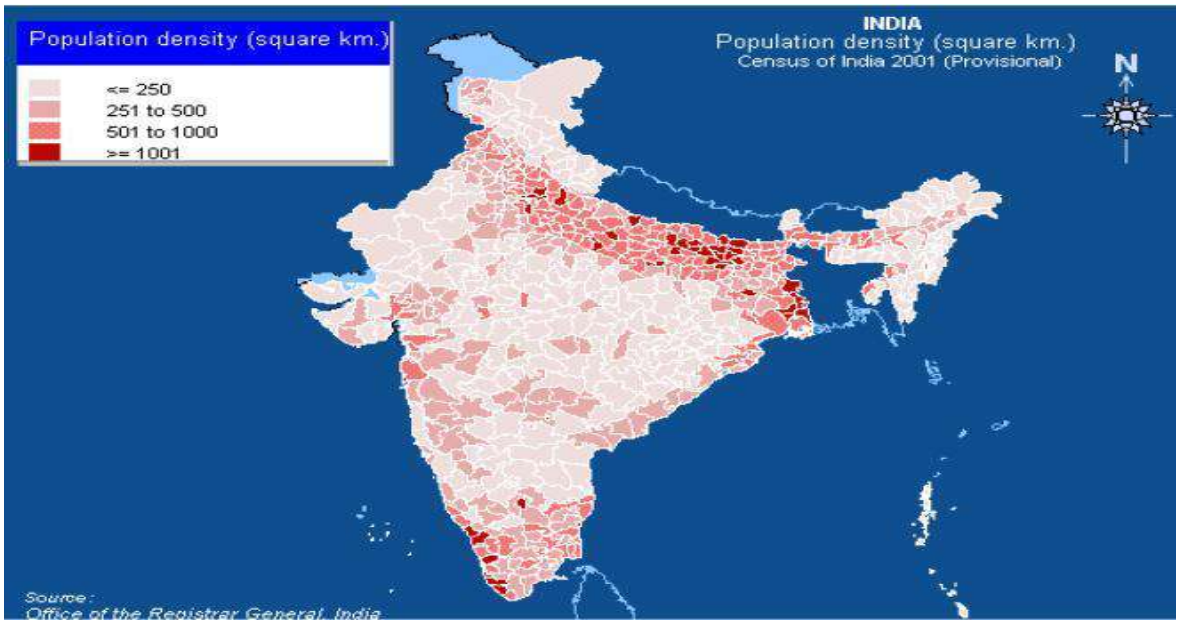
INTRODUCTION

Religious ritual along the Ganges basin , attracts a large crowd (DMMA , 2010)

India's over population and cultural ideologies have led to the intense pollution of the Ganges basin . "Mother Ganga" or the Ganges basin is viewed as a deity so pure that it cannot be tainted . Many Indians believe it cannot be polluted by human action especially religious practices . However the Ganges basin is being polluted through human sewage , agriculture and industrial misuse . The National Ganga River Basin Project has been targeting point source and secondary source pollution by building advanced integrated wastewater pond systems and municipal sewage systems .

There are 29 cities , 70 towns and 1000's of villages located along the Ganges basin (Vasa , 2010). There are 900 persons per kilometer in the Ganges basin , which ends up being 40-45% of India's population (Behera , 2011) . This intense human population has a negative impact on the Ganges basin . Pollution of the Ganges (or Ganga) , the largest river in India , poses significant threats to human health and the larger environment . Severely polluted with human water and industrial contaminants , the river provides water to about 40% of India's population across 11 states , serving

an estimated population of 500 million people , which is more than any other river in the world. Today , the Ganges is considered to be the fifth most polluted river in the world . Raghubir Singh, an Indian photographer , has noted that no one in India spoke of the Ganges as being polluted until the late 1970s . However , pollution has been an old and continuous process in the river by the time people were finally acknowledging it's pollution . Stretches of over 600 km (370 mi) were essentially ecologically dead zones .



Demographic of India's population (Goffman , 2008)

Funeral ghats at Varanasi (image.app.goo.gl)

A number of initiatives have been undertaken to clean the river , but failed to deliver desired results. After getting elected , India's Prime Minister Narendra Modi affirmed to work on cleaning the river and controlling pollution . Subsequently , the Namami Gange Project was announced by the government in the June 2014 budget . An estimated Rs 2,958 crores (US$460 million) have been spent until July 2016 in various efforts to clean up the river .

CAUSES OF THE POLLUTION

The main causes of water pollution in the Ganga river are the disposal of human sewage and animal waste , increasing population density , and disposal of industrial waste into the river .

Human waste:-

Waste disposal by human beings (Business – Insider)

Industrial waste:-

Because of the establishment of a large number of industrial cities on the bank of the Ganga like Kanpur , Prayagraj , Varanasi and Patna , countless tanneries , chemical plants , textile Mills , distilleries , slaughterhouses , and hospitals prosper and grow along this and contribute to the pollution of the Ganges by dumping untreated waste into it . One coal-based power plant on the banks of the Pandu River , a Ganges tributary near the city of Kanpur , burns 600,000 tons of coal each year and produces 210,000 tons of fly ash . The ash is dumped into ponds from which a slurry is filtered , mixed with domestic wastewater , and then released into the Pandu River . Fly ash

contains toxic heavy metals such as lead and copper . The amount of parts per million of copper released in the Pandu . The river flows through 100 cities with populations over 100,000 ; 97 cities with population between 50,000 to 100,000 and about 48 towns . A large proportion of the sewage water with higher organic load e the Ganga is from this population through domestic water usage

before it even reaches the Ganga is a thousand times higher than in uncontaminated water . Industrial effluents are about 12% of the total volume of effluent reaching the Ganges . Although a relatively low proportion , they are a cause for major concern because they are often toxic and non-biodegradable . Plastic and industrial waste , such as waste water from the Factories that sit on the banks of the Ganga , are another cause of pollution . The most worrying problem facing the river is it's increasing lack of water .

Industrial waste disposed directly into the river (Aquafind)

Religious waste :-

During festival seasons , over 70 million people bathe in the Ganga to cleanse themselves of their past sins . Some materials like food , waste or leaves are left in the Ganga which are also responsible for its pollution . Traditional beliefs hold that being cremated on it's banks and floating down the Ganga will cleanse the sins of those who die and carry them directly to Salvation . In Varanasi alone , an estimated forty thousand bodies are cremated every year and are deposited into

the Ganga . Because many families cannot afford the high cost of sufficient quantities of cremation wood , many of the bodies deposited into the Ganges are only half-burnt .

Cremation ground on the banks of the Ganges (BBC)

Waste remains after the religious rituals (iPleader)

DAMS AND PUMPING STATIONS

Built in 1854 during the British colonisation of India , the Haridwar dam has led to decay of the Ganges by greatly diminishing the flow of the river . The Farakka Barrage was built originally to

divert fresh water into the Hoogly River but has since caused an increase of salinity in the downstream of the Ganges , having a damaging effect on the ground water and soil along the river. The barrage has caused major tension between Bangladesh and India . Bangladesh is actively considering to construct Ganges Barrage Project for mitigating the salinity problem. The government of India has planned about 300 dams on the Ganges and its tributaries in the near future despite a government-commissioned green panel report that has recommended scrapping 34 of the dams citing environmental concerns

Three more barrages across the Ganges main river are existing at Bijnor , Narora and Kanpur. The barrages at Bijnor and Narora divert all the water including baseflows during dry season to the canals for irrigating vast area up to Allahabad city . Most of the water available at the upstream of the Kanpur barrage is used during dry season for the drinking water needs of cities . Downstream of Kanpur barrage , adequate water is not available from the barrage to dilute the polluted water reaching the main river during the dry seasons of year .

There are number of pumping stations located on the banks (right and left) of the Ganges downstream of Kanpur barrage serving the irrigation requirements of huge area . These large pump houses are located at Rukunpur 26°10’21”N 80°38’57”E , Kanjauli Kalan 25°17’37”N 82°13’15”E , Hakanipur Kalan 25°12’57”N 83°01’15”E , Bhosawali 25°20’46”N 83°10’11”E , Shekpur 25°32’13”N 83°25’11”E , Chochakpur 25°28’55”N 83°25’11”E , Lamui 25°23’20”N 83°32’11”E , Chausa 25°31’11”N 83°54’04”E . These lift irrigation schemes and pumping out most of the base flows available in the main river down stream of Kanpur city .

To make the Ganges live/flowing and dilute the polluted water inflows from habitations and industries , at least 5000 cusecs flow is required from Narora to Farakka as minimum environmental flow during the eight months dry season . This is possible by constructing storage reservoirs of capacity 100 Tmcft across the Ganges tributaries located up stream of Narora city and reserving the stored water only for minimum environmental flows . In addition , a series of cascading barrage cum bridges are to be constructed across the river from Kanpur to Allahabad to increase the surface area of impounded polluted water in the river so that it serves as vast natural oxidation ponds . The accumulated sediments/sludge would get washed away during the annual monsoon floods . Already , a number of barrages are planned between Farakka and Allahabad to

make the 1620 km length of the river navigable from Haldia to Allahabad under National Waterway 1 project

India , Bangladesh and Farakka Barrage (Future Directions)

STATISTICS

A 2006 measurement of pollution in the Ganges revealed that river water monitoring over the previous 12 years had demonstrated fecal coliform counts up to 100,000,000 MPN (most probable number) per 100 ml and biological oxygen demand levels averaging over 40 mg/L in the most polluted part of the river in Varanasi . The overall rate of water-borne/enteric disease incidence , including acute gastrointestinal disease , was estimated to be about 66% .

A systematic classification done by Uttarakhand Environment Protection and Pollution Control Board's (UEPPCB) on river waters into the categories A: safe for drinking , B: safe for bathing , C: safe for agriculture , and D: excessive pollution , puts the Ganges in D: Coliform bacteria levels in the Ganges have also been tested to be at 5,500 , a level too high to be safe for agricultural use let alone drinking and bathing .

The leather industry in Kanpur which employs around 50,000 people in more than 400 tanneries uses chemicals such as toxic chromium compounds . Effectively , chromium levels have not decreased in the Ganges even after a common treatment plant was established in 1995 . It now stands at more than 70 times the recommended maximum level . A study conducted by the National Cancer Registry Program (NCRP) under the Indian Council of Medical Research in 2012 , suggested that "those living along its banks in Uttar Pradesh , Bihar and Bengal are more prone to cancer than anywhere else in the country .

EFFECT

Marine Life :-

Ganga turns green in Varanasi (India Today)

The results of mercury analysis in various specimens collected along the basin indicated that some fish muscles tended to accumulate high levels of mercury . Of it , approximately 50-84% was organic mercury . A strong positive correlation between mercury levels in muscle with food habit and fish length was found .

The Ganges river dolphin is one of the few species of fresh water dolphins in the world . Listed as an endangered species , their population is believed to be less than 2000 . Hydroelectric and irrigation dams along the Ganges that prevents the dolphins from traveling up and down river is the main reason for their reducing population . The Ganges softshell turtle (*Nilssonia gangetica*) is found in the Ganges , Indus , and Mahanadi river systems of Pakistan , northern India ,

Bangladesh , and southern Nepal. This turtle inhabits deep rivers , streams , large canals , lakes and ponds , with a bed of mud or sand . According to the International Union for Conservation of Nature , freshwater turtle species are vulnerable . Due to their long lifespan and high trophic level in the aquatic food web , turtles are vulnerable to heavy metals pollution , a major kind of pollution in the Ganges .

Wildlife :-

The river where swimming lessons can be a health hazard (BBC)

Some of the dams being constructed along the Ganges basin will submerge substantial areas of nearby forest . For example , the kotli-Bhel dam at Devprayag will submerge 1200 hectares of forest , wiping out the forest area .

Human beings :-

Pollution near Taj Mahal causing health problems of human beings (mainichi.jp)

An analysis of the Ganges water in 2006 and 2007 showed significant associations between water-borne/enteric disease and the use of the river for bathing , laundry , washing , eating , cleaning utensils , and brushing teeth . Water in the Ganges has been correlated to contracting dysentery , cholera , hepatitis , as well as severe diarrhoea which continues to be one of the leading causes of death of children in India .

During the summer and monsoon , hospital wards teem with children who need treatment for waterborne diseases – but according to S.C. Singh , a paediatrician at Varanasi Shiv Prasad Gupta Hospital , their parents rarely mention that I have been swimming in the river . They don't appear to have made the connection , he says .

CLEANUP EFFORTS

Ganga Mahasabha :-

Ganga Mahasabha is an Indian organization dedicated to the Ganges , founded by Madan Mohan Malaviya in 1905 . After a long struggle , British India agreed on 5 November 1914 that the uninterrupted flow of the Ganges is the rudimentary right of Hindu believers . The day is known as a 'Aviral Ganga Samjhauta Divas' (Uninterrupted Ganga Flow agreement day) in the history of India and the agreement came into existence on 19 December 1916 which is known as Agreement

of 1916 . The sanctity of the agreement is not preserved by the State and central governments of India after independence though it is legally valid . More and more river water is diverted for irrigation use converting the river into a polluted sewer .

Ganges Action Plan :-

The Ganges Action Plan (GAP) was launched by Rajiv Gandhi , the then Prime Minister of India, on June 1986 with covering 25 Class 1 towns (6 in Uttar Pradesh , 4 in Bihar and 15 in West Bengal) ; Rs 862.59 crore were spent . It's main objective was to improve the water quality by the interception , diversion , and treatment of domestic sewage and to prevent toxic and industrial chemical wastes from identified polluting units from entering the river . The other objectives of GAP are as follows :-

- Control of non-point from human defecation , cattle wallowing , and the disposal of human remains in the river .
- Research and development to conserve the biotic diversity of the river to augment it's productivity .
- Development of sewage treatment technology such as Up-flow Anaerobic Sludge Blanket (UASB) and sewage treatment through afforestation .
- Rehabilitation of soft-shelled turtles for pollution abatement .
- Resource recovery options such as methane production for energy generation and use of aquaculture for revenue generation .
- To act as a trendsetter for taking up similar action plans in the other grossly polluted stretches in other rivers .
- The ultimate objective of the GAP is to have an approach of integrated river basin management considering the various dynamic interactions between abiotic and biotic eco-system .

Notwithstanding some delay in the completion of the first phase of the GAP , it has generated considerable interest and set the scene for evolving a national approach towards replicating this program for the other polluted rivers of the country . The government of India proposed to extend this model with suitable modifications to the national level through a National River Action Plan (NRAP) . The NRAP mainly draws upon the lessons learned and experience

gained from the GAP besides seeking the views of the State Governments and the other concerned Departments/Agencies . Under the NRCP scheme , the CPCB had conducted river basin studies and had identified 19 gross polluted stretches and 14 less polluted stretches along 19 rivers , which include 11 stretches situated along 7 rivers of MP . It was much more effective as compared to the previously launched programs .

Phase II covered 59 towns in five states , Rs 505.31 cr were spent . Rivers such as Yamuna , Gomti , Damodar , Mahananda had separate action plans .

Ganges canal dried for cleaning (image.app.goo.gl)

National River Ganga Basin Authority (NRGBA) :-

NRGBA was established by the Central Government of India , on 20 February 2009 under Section 3 of the Environment Protection Act , 1986 . It declared the Ganges as the "National River" of India . The chair includes the Prime Minister of India and Chief Ministers of states through which the Ganges flows . In 2011 , the World Bank approved $1 billion in funding for the National Ganges River Basin Authority .

2010 Government Clean-Up Campaign :-

In 2010 , it was announced that "the Indian government has embarked on a $4 billion campaign to ensure that by 2020 no untreated municipal sewage or industrial runoff enters the 1,560-mile river . A World Bank spokesman described the plan in 2011 , saying Earlier efforts to clean the Ganges concentrated on a few highly polluting towns and centres and addressed 'end-of-the-pipe' wastewater treatment there ; Mission Clean Ganga builds on lessons from the past,

and will look at the entire Gangetic Basin while planning and prioritising investment instead of the earlier town-centric approach .

Lobby group Sankat Mochan Foundation (SMF) "is working with GO2 Water Inc. , a Berkeley, California , wastewater-technology company" to design a new Sewage treatment system for Varanasi .

The Supreme Court of India has been working on the closure and relocation of many of the industrial plants like Tulsi along the Ganges . In 2010 the government declared the stretch of river between Gaumukh and Uttarkashi an Eco-sensitive zone .

Ganga Manthan :-

Ganga Manthan was a national conference held to discuss issues and possible solutions for cleaning the river .

The conference aimed to take feedback from stakeholders and prepare a road map for rejuvenating the Ganges . The event was organised by the National Mission for Clean Ganga (NMCG) on 7 July 2014 at Vigyan Bhawan in New Delhi .

CLEAN GANGA FUND

The Union Cabinet gave its approval for setting up of Clean Ganga Fund in September 2014 with the aim of using the collection for various activities under the Namami Gange Programme for cleaning the Ganges .

Utilisation of funds :-

- Cleaning up of the Ganges
- Setting up of waste treatment plants
- Conservation of biotic diversity of the river
- Development of public amenities
- Activities such as Ghat redevelopment and Research and Development and innovative projects .

National Mission for Clean Ganga :-

Pollution in Ganges (image.app.goo.gl)

The National Mission for Clean Ganga (NMCG) is the implementation wing of National Ganga Council which was set up in October 2016 under the River Ganga (Rejuvenation , Protection and Management) Authorities order 2016 . The order dissolved National Ganga River Basin Authority. The aim is to clean the Ganges and its tributaries in a comprehensive manner . Gajendra Singh Shekhawat is the present Union Cabinet Minister in Ministry of Jal Shakti.

Namami Gange programme :-

Under National Mission for Clean Ganga , Namami Ganga Programme was launched in 2014 . This is a Flagship program under Union Government . A budget of 20,000 crore was given with the twin objective of effective abatement of pollution , conservation and rejuvenation of National River Ganga . Unlike previous projects for cleaning Ganga , Namami Gange is most comprehensive river conservation program .

PROTESTS FOR CLEANING THE GANGA

Nigamanand:-

In early 2011 , a Hindu monk named Swami Nigamananda Saraswati fasted to death , protesting against pollutive river bed quarrying of the Ganges happening in the district of Haridwar , Uttarakhand . Following his death in June 2011 , his ashram leader Swami Shivananda fasted for

11 days starting on 25 November 2011 , taking his movement forward . On 5 December 2011 , the Government of Uttarakhand released an order to ban river bed mining in the Bhogpur and Bishanpur Ghats . According to administration officials , quarrying in the Ganges would now be studied by a special committee which would assess it's environmental impacts on the river and it's nearby areas .

G.D. Agrawal :-

G.D. Agrawal was a environment activist and patron of Ganga Mahasabha , an organisation founded by Madan Mohan Malaviya in 1905 , demanding removal of dams on Ganges . Because of support from other social activists like Anna Hazare , the then Prime Minister of India , Manmohan Singh agreed to Agrawal's demands . Accordingly , he called for a National River Ganga Basin Authority (NRGBA) meeting and urged the authorities to utilise the $26 billion (US$520M) sanctioned "for creating sewer networks , sewage treatment plants , sewage pumping stations , electric crematoria , community toilets and development of river fronts" . Agrawal died on 11 October 2018 , after being on an indefinite fast since 22 June 2018 , demanding the government act on its promises to clean and save the Ganges .

CONCLUSION

Addressing Pollution in the Ganges basin involves changing the treatment of effluent water and preventing and changing the polluting practices . This is more than a scientific endeavor as it collides with the Indians religious beliefs and ways of Life .

Child in slum stands in garbage filled stream (Meg & Rahul , 2005)

As India is known for its beauty we need to take initiatives in reducing the amount of Pollution in River Ganga and restore back its beauty . As Pollution is not only harmful for nature but also it has dangerous effects on human beings and wildlife as well . So we all need to stand together in this and try to reduce the Pollution .

BIBLIOGRAPHY

- https://pollutionoftheganges.weebly.com
- https://en.m.wikipedia.org/wiki/Pollution_of_the_Ganges
- https://pollutionoftheganges.weebly.com/conclusion.html

TITLE : AIR POLLUTION

CU ROLL NO. : 202223 – 21 – 0013

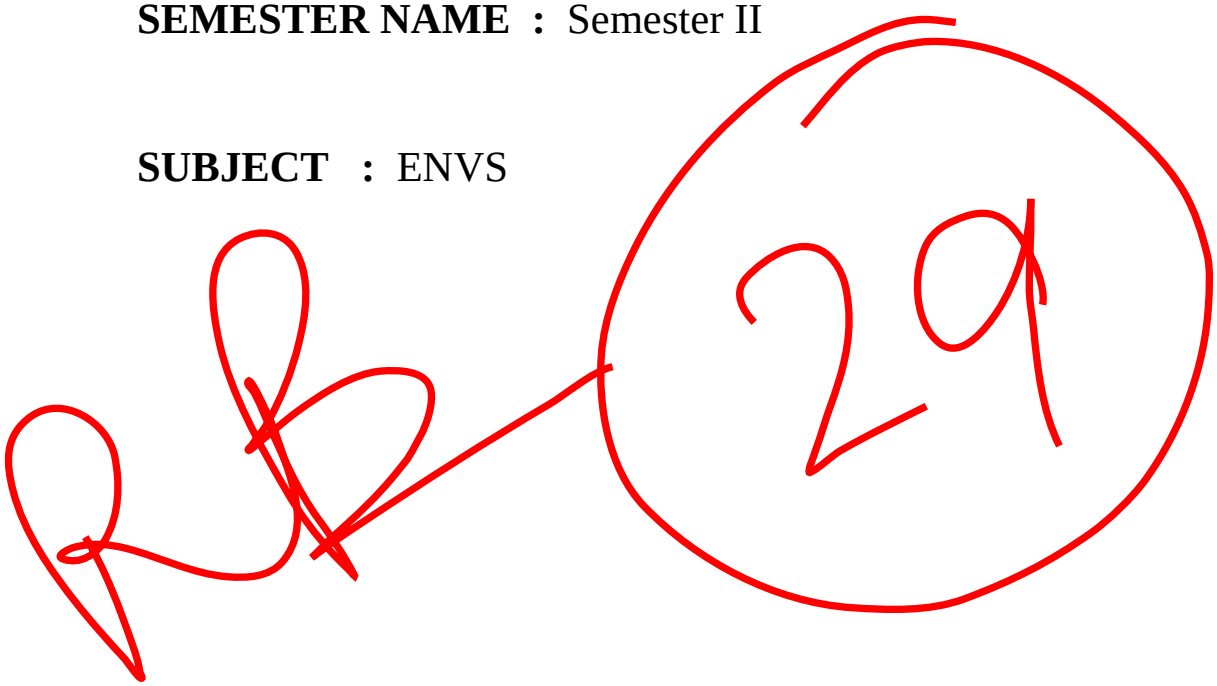
CU REGISTRATION NO. : 223 – 1111 – 0048 – 20

COLLEGE ROLL NUMBER : HISA20M374

DEPARTMENT : BA HISTORY (HONOURS)

SEMESTER NAME : Semester II

SUBJECT : ENVS



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AIR POLLUTION

INTRODUCTION :

The mantle of gases, which surrounds our planet, is referred to as “atmosphere’. It is a complex mixture of gases, water vapours and a variety of fine particulate material. It consists of about 5.137 x 10^{15} metric ton of gases, which exert pressure of about 1 kg per Sq. cm. on earth’ surface . Most of these gases are compressed in the lowermost layer of the atmosphere. Pressure decreases as we move upward. Living being inhale a considerable quantity of air. About 90% of man’s total daily intake of materials – food, water and air – is contributed by air. An average human being breathes about 22,000 times a day and inhales about 16 kg of oxygen. The pollution of air, therefore, may have a profound influence on living organism. Unfortunately, an alarming quantity of gases, particulate material, vapours and smoke is discharged daily into the atmosphere. Dilution, dissemination, transformation and clearance of the pollutants are strongly influenced by the structure and prevailing meteorological conditions.

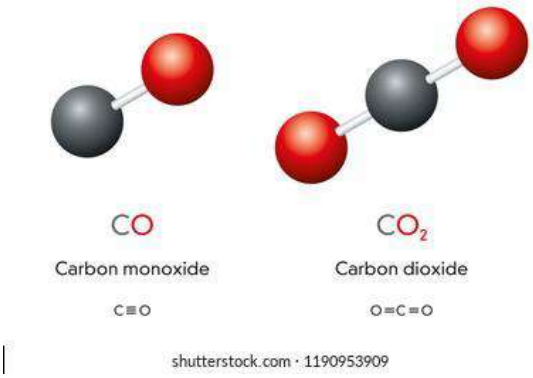
(I) Major pollutants of the atmosphere

The gaseous cover over the surface of our planet essentially consists of 78.0% nitrogen, 20.95% oxygen, 0.93% argon, 0.03% carbon dioxide, a number of other gases and water vapours. In addition to these gases, air also contains a variety of particulate matter, which includes dust, pollen grains, algae, bacteria, fungal spores etc. so also are various odours, fumes and vapours, which occur in small traces. In this huge and divers admixture, a number of substances harmful to a biological system also occur. But their concentration is usually, so low that they hardly pose any problems. Human activity has, however, been introducing a number of undesirable and harmful materials in large quantities which pollute the atmosphere. Major pollutants of the atmosphere are :

1. Particulate matter : Most of particulate material in the environment is contributed by dust particles form various sources, fibrous material of plant and animal origin, finer particles of fly-ash derived form combustion of coal, oil and organic matter or from mining and processing operations carried on to obtain metals and other elements. To these may be added pollen grains, fungal spores, algae, bacteria, virus etc, which are capable of causing various disease, allergy etc.

2. Oxides of Carbon : Combustion of organic matter and fossil fuels in presence of oxygen result in the formation of carbon dioxide while carbon monoxide is formed due to incomplete combustion of these materials under oxygen deficient conditions.

Carbon monoxide is the most important atmospheric pollutant as it accounts for about 52% of the total air pollution. The commonest source of carbon monoxide pollution in cites is automobile exhausts. In USA alone, as far back as 1960, it was estimated that about 66 million tons of carbon monoxide was injected into the environment by automobile exhausts. Annual global emission of this gas 841.08 million metric tons in 1990 which shot up to 1.076 billion metric tons in the year 2000 AD. Large cosmopolitan cites of India may have carbon monoxide concentration almost 250-300 times higher than the unpolluted rural areas.



Carbon dioxide is produced in large amounts when organisms respire but almost a similar quantity is assimilated by green plants. Combustion of fossil fuels, organic matter, incineration of limestone for the production of cement and lime, various metallurgical operations and a number of industrial practices, however, produce a large amount of this gas. In addition oxidation of carbon monoxide, methane etc. also contributes some carbon dioxide to the atmosphere.

Carbon dioxide is an important resource for plants. It is raw material for photosynthesis – a process that is essential for sustenance of life on this planet. A higher concentration of this gas shall have little effect on plants, which could be benefited due to stepped up photosynthetic rate as suggested by some workers. Animals and humans may experience breathlessness and anoxia under higher concentration of Carbon dioxide. However, a rise in carbon dioxide content on global scale shall further strengthen the gaseous insulation around the globe resulting in global warming and a chain of catastrophic events such as rise in mean sea level, changed climatic conditions, precipitation patterns etc.

3. Oxides of Sulphur : Oxides of sulphur, primary sulphur dioxide is the second most important pollutant of the atmosphere, nest only to oxides of carbon in magnitude and severity of effects on a biological system. Most of the atmospheric sulphur dioxide comes form burning of organic matter, fossil fuels and from industrial units processing sulphur-bearing ores. Global emission of Sulphur dioxide amounts to about 150 million metric tons per year.

Sulphur dioxide is capable of causing a wide variety of harmful effect both on plants and on animals. The oxidizing power of dissolved sulphur dioxide affects electron transport system adversely. It competes with carbon dioxide, retards photosynthesis and thereby carbon assimilation. Hydrogenion concentration is shifted towards acidic side when this gas

dissolves in water, which affects the activity of various enzyme systems drastically and this in turn disturbs the entire metabolism of the living beings.

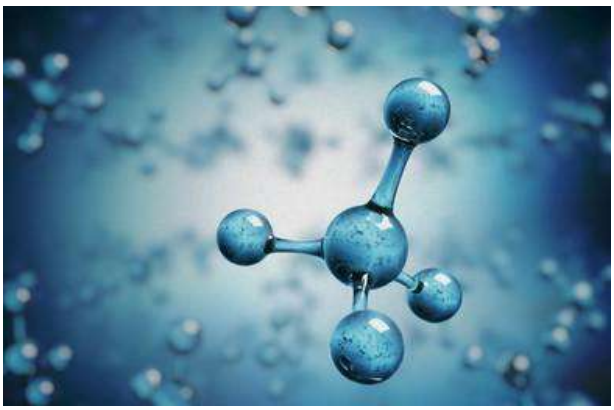
4. Oxides of Nitrogen : The three oxides of nitrogen, nitrous oxide (N_2O), nitric oxide (N0) and nitrogen dioxide (NO_2) are important pollutants of the atmosphere. Most of these gaseous oxides are introduced in the atmosphere in considerable amount by burning fossile fuels, organic matter as well as by microbial action on nitrogenous organic matter and on chemical fertilizer applied in agricultural fields. It has been estimated that about 70 – 80% of the total input of nitrous oxide comes from natural sources and form the breakdown of nitrogenous fertilizers. A considerable amount of these gases are also generated by natural event like solar flares and volcanic emissions. Nitrous oxide is reacted upon very slowly in the atmosphere, slower than the rate of its input and hence it has been accumulating in the atmosphere at a rate of 0.3% per year.

5. Ozone : Ozone is generated in the lower atmosphere during the formation of photochemical smog when nitrogen dioxide splits up to produce reactive oxygen atoms, which combine with molecular oxygen to give rise to ozone. High up in the stratosphere oxygen molecules split up under ultraviolet radiations to produce oxygen atoms which recombine with molecular oxygen to form ozone. It is this gas, which forms the protective ozone umbrella in the stratosphere and shields life form biocidal high-energy radiation. However, this gas is a serious pollutant lower down in the troposphere.

Ozone is highly reactive gas, which causes oxidation of a number of macromolecules within a biological system and produces free radicals, which have been implicated in a number of ozone, induced pulmonary or extra-pulmonary damages. It has been suspected that these free radicals can damage DNA molecules and cause carcinogenesis.

6. Hydrocarbons : Biological decomposition of organic matter, natural gas, volatile emissions, incomplete combustion of fossil fuels and biomass, automobile exhausts etc. are some of the sources of hydrocarbons in the atmosphere. Harmful effects caused by these substances vary from compound to compound.

Methane : Methane is a gaseous hydrocarbon and is a greenhouse gas. Like carbon dioxide, it is capable of absorbing infrared and heat waves, radiated back to space form earth's surface, thereby causing a heating effect. Human activity has caused an increase in the production of this gas, the main sources of which are decomposition of organic matter under anaerobic conditions, burning of biomass and excessive use of fossil fuels.



Chlorofluorocarbons :

Another group of hydrocarbons, which is causing great concern these day is that of Chlorofluorocarbons (CFCs). These are non-toxic, colourless, odourless and inert chemicals, which persist in the atmosphere for long durations.

The use of CFCs in refrigerators and air conditions involves circulation in a close circuit from where their release is only accidental. However, use of these chemicals in spray cans or aerosol sprays, plastic foam blowing, instant foam shaving creams and as cleaning solvents etc causes the release of substantial amount of CFCs in the atmosphere on global scale.

Aldehydes :

Exhausts from automobiles and incomplete combustion of fossil fuels, biomass, and the glue used in plywood etc generate a good amount of aldehydes most of which are toxic chemicals. Formaldehyde, acetaldehyde and acrolein, an unsaturated aldehyde, probably contribute much to the odour, eye and lung irritation produced by the photochemical smog. Formaldehyde usually accounts for about 50% while acrolein accounts for about 5% of the total estimated aldehydes present in polluted air.

ACUTE VERSUS CHRONIC EFFECTS OF AIR POLLUTION

Air pollution usually causes slow and gradual effects, which are of chronic type. As the main route of entry of pollutants is through respiratory track various chronic, non-specific respiratory diseases such as bronchitis, chronic obstructive ventilatory diseases, pulmonary emphysema, bronchial asthma etc. may be caused by air pollution.

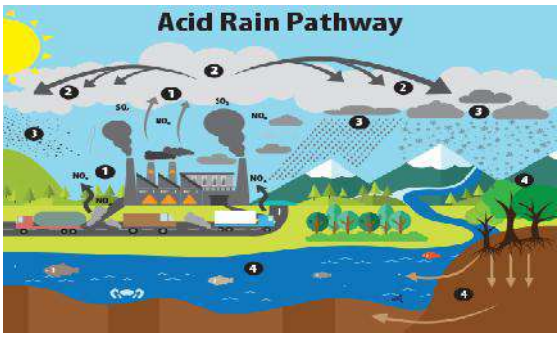
Very large doses of most of the common pollutants of air are required to produce acute toxicities. Such concentrations are very rare. Most of the instances of acute toxicity so far recorded involve industrial emission of toxic gases and vapours, which are not usually present in the environment, or if present, they occur in traces only. The faous Bhopal tragedy of 1984, in which about 40 tons of Methyl isocyanate was accidentally released into the atmosphere, left about 2800 people dead within 15 minutes and many more crippled for life. The release of chlorine gas in a subway tunnel in Brooklyn is another such example. Both these case were caused by toxic agents not commonly found in toxic concentration in the atmosphere. It was only the accidental release of these gases from industries which resulted in the disasters.

FOG, SMOG AND REDUCING TYPE OF POLLUTION

The pollution, which is characterized by presence of large quantities of oxides of sulphur, nitrogen, smoke and fumes, is known as reducing type of pollution. Burning of fossil fuels , smelting of metallic ores and various industrial operations yield a large amount of particulate materials as well as oxides of sulphur, carbon and nitorogen. The gaseous mixture and particulate material, under normal conditions are carried up and dispersed in the atmosphere causing little harm to the living beings.

Acid Rains

The phenomenon of acid rains is a consequence of accumulation of huge amounts of oxides of sulphur, nitrogen and fine particulate materials or aerosols. However, unlike the reducing type of pollution, which involves fog or smog, these gases and aerosols accumulate high up in the atmosphere. Water vapours condense on aerosol surface and form a fine film providing suitable loci as well as catalysts for the oxides of sulphur and nitrogen to dissolve in water and react to form to corresponding acids. These acids form salts, such as sulphates and nitrates, when thy come in contact with aerosols ob basic nature.

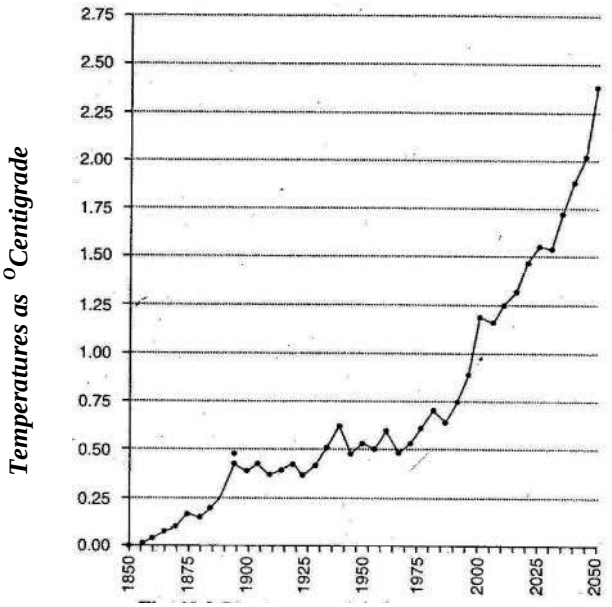


Global warming or the green house effect

The gaseous mantle, the atmosphere, forms an insulating blanket around our globe and allows a considerable portion of solar radiations to enter right up to the surface of earth, which absorbs it and radiates back infrared and heat waves. Much of the solar radiations are radiated back to space as infrared and heat waves. Much of the solar radiations are radiated back to space as infrared and heat waves. The system consisting of our globe and its atmosphere is in a state of dynamic equilibrium with the rate of absorption of solar radiations and its emission back to space as infrared and heat waves, nearly balancing each together. The gases and vapours which allow free passage to radiations of relatively shorter wavelengths (2900A – 7000A) while absorbing effectively infra-red and heat waves (700 A onwards) play a very important role in maintaining surface temperatures within a range in which life can exist. The phenomenon is similar to that of greenhouse in which the glass-enclosed atmosphere get heated up due to its insulation form the rest of the environment. Hence, global warming is also known as **Green House effect** and the gases responsible for it are called **green house gases**.

Causes of Global warming

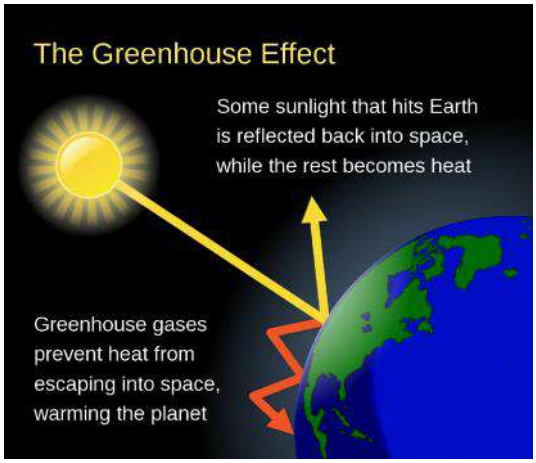
Very slow, almost imperceptible rise of about $4 – 5^{O}C$ in the global temperature has occurred in the past 20,000 years. However, a rise of about $0.3^{O} – 0.8^{O}C$ was recorded during the last century alone, which is remarkably faster as compared to change that occurred in the past. This acceleration in the pace of global warming coincides with a rise in the concentration of green house gases in the atmosphere. The insulation of earth's surface form the outer space caused by green house gases tends to become more and more effective as the concentration of these gases rises. More heat and infrared radiations are trapped by the gaseous mantle around the globe, which accelerates the pace of global warming.



Rise in mean global temperat

Gases Responsible for Global Warming :

There are a number of gases present in the atmosphere, which are capable of absorbing effectively heat waves and infrared rays while being transparent to radiations of lower wavelengths, Carbon dioxide, methane, oxides of nitrogen, sulphur dioxide, ozone, chlorofluorocarbons and water vapours are some of the gaseous constituents of troposphere, which come in this category.



a. Carbon Dioxide : It is one of the most important green house gas of which about 18 billion tons are being introduced into the atmosphere annually. A rise of about 26% has already been recorded in a period of 200 years only.

b. Methane : Methane is another greenhouse gas, which is produced when organic matter decays under anaerobic conditions. In 1950, its concentration was about 1.1 ppm while in the year 1985 it was estimated to be 1.7 ppm. The concentration of this gas is rising at a rate of about 1% per year.

c. Nitrous Oxide : Nitro oxide is another troublesome gas. Other oxides of nitrogen are reacted upon or clearance rapidly while nitrous oxide undergoes decomposition very slowly and hence it tends to accumulate in the atmosphere. In 1950, its concentration was bout 280 ppb while in 1985 it had reached 380 ppb.

d. Water Vapours : About 70% of earth's surface is covered with water wherefrom an enormous quantity of water evaporates. Likewise , the process of transpiration introduces a substantially large among of water vapors into the atmosphere.

e. Chlorofluorocarbons : Chlorofluorocarbons represent a group of men-made, colourless, odourless, easily liquefiable chemicals, which has more potential for global warming than any other greenhouse molecules. They are very stable compounds, which may persist in the atmosphere for period as long as 80 – 100 years.

Consequences of Global Warming

Global record of earth's surface temperature indicate that a warming about 0.5^{O} (0.3^{O} – 0.7^{O}C) has occurred during the last century alone. Result from recent climatic models suggest that mean global temperature shall rise by 2^{O} – 6^{O}C during the next century if we assume that the carbon dioxide concentration in the troposphere increases to 600 ppm.

There are considerable uncertainties, regarding the precise consequences of global warming. However, some of the obvious consequences of the general heating up of earth's surface as suggested by mot of the climatic models shall be :

1. **Global climatic change :** While tropics shall expand, world's climatic belt shall shift away from equator while polar areas shall shrink. The rise in global temperatures shall not be inform all over the surface area of the world. Most of the workers agree that Polar Regions of the world would undergo larger increase in temperature, about ten to twelve times as much as the tropics. This shall bring unprecedented changes in wind and precipitation patterns within a span of a single century.
2. **Rise in mean sea level :** Low lying areas of the world shall be submerged. Many small island countries shall disappear. Evidences suggest that about 12,000 years back it was nearly 100m lower than the present-day level. It is expected that global rise in temperatures shall further enhance the rate of already rising sea level in two ways. Firstly, large deposits of ice present on earth's surface shall melt which will add more water to the oceans. Secondly, rise in temperatures shall also cause thermal expansion of the upper layers of water.
3. **Raised intensity and destructive power of weather events like rains, thunderstorms and cyclones :** The intensity and destructive power of weather events like rains, thunderstorms and cyclones etc. shall increase. Rain for example shall take on the shape of heavy downpours and shall deposit large volumes of water in a brief spell of time which could cause flash floods, a raised rate of nutrient-leaching and soil erosion and a highly reduced rate of recharge of ground water table.
4. **Drastic reduction in biodiversity :** As the climatic belts shift away form equator towards poles, vegetation shall have to shift in the same direction to stay in favourable climatic conditions. Those species, which are unable to do so, shall die. There will be losses of genetic resources on large scale. Hardy and resistant forms shall come up and survive. An altogether changed biotic spectrum shall replace the earlier ones and almost all important biomes shall be affected. As temperature changes will affect wind and

precipitation patterns also water could play an important part in altering the biotic communities.

5. **Increased losses due to insects, pests and pathogens and changes in disease patterns :** Insects and pests and pathogens may increase as warmer conditions could be more favourable to their growth and coupled with higher humidity pathogenic disease shall multiply. The small size, an active metabolic rate, prolific reproduction, a life cycle which can be completed within a few hours or days provide an enormous evolutionary advantage to insects, pests and pathogens over man.

OCEAN ACIDIFICATION

An unfortunate consequence of rising concentration of CO_2 in the atmosphere is the danger of ocean acidification. In the past 200 years the oceans have absorbed nearly half of the CO_2 produced by fossil fuel burning and cement production. CO_2 dissolves in water to produce Carbonic acid, H_2CO_3 a weak acid which lower the pH of oceans water. Observations on measurements of pH of the surface water of oceans and our understanding of ocean chemistry indicate that the uptake of CO_2 by oceans has led to are duction of the pH of surface waters by about 0.1 units. The pH of sea-surface waters around the year 1700 AD was 8.18. This value may seem small because of the manner in which pH is measured, however, it is equivalent to about 30% increase in the concentration of hydrogen ions (20). Increasing atmospheric concentration of will CO_2 lead to further acidification of the oceans. By the years 2050 and 2100 the pH could decline to about 7.95 and 7.82 respectively.

THE PROBLEM OF STRATOSPHERIC OZONE DEPLETION

Sun emits radiations at all wavelengths. Of these, radiations important to our planet are : ultraviolet radiations, light rays, and infrared rays or heat waves. Radiations of visible

spectrum and infrared rays carry little energy, which does not harm living beings. The energy content of ultraviolet radiations is however, larger than the limits of tolerance of a living cell and hence is harmful or even lethal to a living system. Ultra-violet radiations are capable of causing damages to DNA and RNA and other macromolecules and could result in carcinogenic, teratogenic and mutagenic effects. Life therefore, had to await the development of an effective shield of atmospheric gases, which could check the biocidal radiations high up in the atmosphere before it could come out on land.

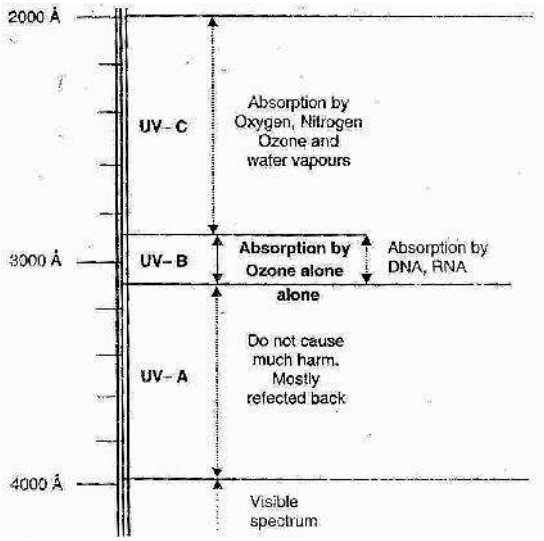
Ultraviolet Radiations and Ozone

Ultraviolet radiations are usually grouped, rather arbitrarily, into the following three categories :

1. **ULTRAVIOLET – A (UV-A) :** With a wavelength range between 3150 – 4000 A which do not cause much harm to a living system. Only a part of these radiations reaches earth's surface, which are tolerated by the living beings.

2. **ULTRAVIOLET – B (UV-B) :** With a wavelength from 2800 A to 3150 A which are more damaging than UV- A. Absorption maxima of DNA and RNA fall within this range.

3. **ULTRAVIOLET – C (UV-C) :** With a wavelength range from 2000A to 2800 a, which carry larger amount of energy. These are the most damaging radiations for the biosphere. However, they are almost completely absorbed by atmospheric gases.

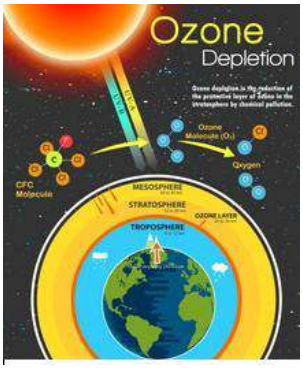


Electromagnetic spectrum of solar radiations

Much of harmful high-energy solar radiation are absorbed at various heights by the gaseous mantle which **surrounds** our planet. Through oxygen, nitrogen, ozone, water vapour and a number of other constituents of the atmosphere absorb short wavelength ultraviolet radiations, none of these gases can absorb effectively wavelengths greater than 2800 A. This leaves a gap, which is filled by ozone alone. It absorbs all radiations between 2800 to 3150 A. Radiations above 3150 A are not completely absorbed by this gas, which however are considerably diluted by the ozone layer.

The Ozone Layer

High up in stratosphere, about 15 – 40 kms above earth's surface, short wavelength ultraviolet radiations in the range of 1800 A to 2200 A are absorbed by molecular oxygen which splits up into its constituent atoms. Oxygen atoms combine with oxygen molecules to form ozone.



Therefore, ozone is a result of photochemical reactions in which the starting molecule is oxygen. Along with this reaction another photochemical reaction which causes breakdown of ozone molecules due to absorption of 2000 – 2900 A radiations also occurs.

The two reactions, i.e., the formation and destruction of ozone molecule normally balance each other and ultimately result in effective absorption of short wavelength ultraviolet radiation in the stratospheric region. Life underneath is thus protected from the biocidal soalr radiations.

Causes of Stratospheric Ozone Depletion

The tree main reactants, namely nitric oxide, chlorine atoms and hydroxyl ions are normally parents in the environment. Through much of these are derived from natural sources, human activity is also equally responsible for contributing many of such constituents in the atmosphere, which give rise to these reactants.

Human activities responsible for polluting the stratosphere may be summed up as follows :

1. **Combustion of Fossil Fuels and Organic Matter :** Huge quantities of various oxides such as oxides of carbon, nitrogen and sulphur, hydrocarbons and fine particulate material is introduced daily into the troposphere some of which goes high enough to reach the stratosphere.
2. **Excessive Use of Nitrogenous Fertilizers :** Microbial action on nitrogenous fertilizers produces nitrous oxide, which escapes into the atmosphere. As this gas decomposed with difficulty, it tends to accumulate in the atmosphere.
3. **Excessive Use of Chlorofluorocarbons :** Chlorofluorocarbons are inert, highly stable, colorless, odourless chemicals, which can be easily liquefied. These are mostly halogenated hydrocarbons, which under the influence of high-energy radiations break up to yield a chlorine atom.
4. **Supersonic Transports, Rockets and Space Shuttles :** Supersonic jet-liners, which fly in lower region of the stratosphere, discharge various oxides of nitrogen, carbon,

sulphur, hydrocarbons and particulate material. Space flights, which are powered by powerful rockets, also release large quantities of these pollutants right into the stratosphere. Ammonium perchlorate used in may of these rockets as oxidant release plenty of chlorides.

5. **Nuclear Tests :** Surface nuclear explosions produce huge quantities of various gases dust shoot and debris with enormous force which carries much of material straight into the stratosphere. Much of this material damages the ozone layer.

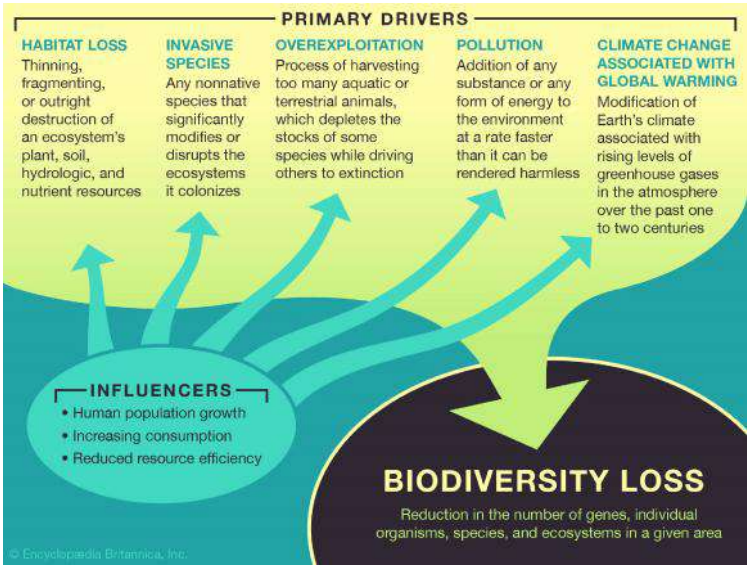
Consequences of Stratospheric Ozone Depletion

Ozone layer shields us from biocidal ultraviolet radiations. Depletion of stratospheric ozone concentration shall result in an increased penetration of Ultraviolet – B radiation. A higher loss of stratospheric ozone could cause entry of not only UV-B radiations but also Ultraviolet – C radiations. This could turn the geological clock back to the era when the ozone umbrella was very thin. Terrestrial life shall be drastically affected so also will be aquatic life, which occurs in shallower waters. In brief, consequences of ozone depletion may be summed up as follows :

1. As absorption of ultraviolet radiations in the range of 2800-3150 A is largely due to the absorption by DNA and RNA molecules, which therefore beak down. Increased UV-b penetration shall cause a rapid rise in ailments and damages associated with DNA and RNA disruption. Cancers of the parts exposed to solar radiations shall become more frequent. Crude estimates suggest that there could be 100% rise in incidence of skin cancers for a 25% reduction in stratospheric ozone content.
2. A direct correlation has been observed between cataract formation in eyes and ultraviolet radiations. Our skin and eye-lens contains chromatophores, which absorb

ultraviolet radiations and generate highly reactive oxygen, hydroxyl radicals and hydrozen peroxide, which cell's structural and functional components.

3. Higher animals process thick skin, hairs etc. as protective devices. However, plants an lower animals, which are often at a lower level in the trophic structure, shall be the worst sufferers, as they have nothing but a simple cell wall for their protection against high-energy radiations. With the primary trophic levels drastically impaired, the entire ecosystem could collapse. This is more likely in marine environment where the tiny phytoplanktons are the sole producers.



4. With rise in high-energy ultraviolet radiations a number of complex photochemical reactions are likely to occur which shall produce a variety of toxic highly irritating chemicals – the photochemical smong – form seemingly harmless constituents. These chemicals could be highly injurious to living systems. In plants, adverse effects on the process of photosynthesis could drastically affect primary production, which in turn could disturb the entire ecosystem.

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TOPIC- ENVIRONMENTAL POLLUTION

UNIVERSITY ROLL NUMBER: 202223-11-0080

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COLLEGE ROLL NUMBER: HISA20F404

DEPARTMENT: BA. HISTORY (HONOURS), SEMESTER 2.

SUBJECT: AECC ENVS

INTRODUCTION

The **natural environment** encompasses all living and non-living things occurring naturally, meaning in this case not artificial. The term is most often applied to the Earth or some parts of Earth. This environment encompasses the interaction of all living species, climate, weather and natural resources that affect human survival and economic activity. Environmental pollution is a global problem that is inextricably linked with rapid industrialization and urbanization. Pollution hampers the environment sustainability and ecosystem services. Environmental pollution is one the major problems that affects biodiversity, ecosystems, and human health worldwide by contaminating soil and water. This issue cannot be resolved through conventional tools and traditional strategies. The in-depth understanding of biotechnological interventions with the prospect to upgrade the phyto remediation potential needs to be elucidated. Plants deploy multiple physiological, biochemical, and molecular mechanisms to counter the deleterious effects of environmental pollutants.

ENVIRONMENTAL POLLUTION

Environmental pollution is the unfavourable alteration of our surroundings, wholly or largely as a by product of man's actions, through direct or indirect effects of the changes in the energy pattern, radiation levels, and chemical and physical constitution and abundance of organisms. Environmental pollution is a global problem and is common to both developed as well as developing countries, which attracts the attention of human beings for its severe long-term consequences. The decline in environmental quality as a consequence of pollution is evidenced by loss of vegetation, biological diversity, excessive amounts of harmful chemicals in the ambient atmosphere and in food grains, and growing risks of environmental accidents and threats to life support systems. Pollution is viewed from different angles by different people but is commonly agreed to be the outcome of urban-industrial and technological revolution and rapacious and speedy exploitation of natural resources, increased rate of exchange of matter and energy, and ever-increasing industrial wastes, urban effluents, and consumer goods. Environmental pollution is of 4 kinds:-

Air pollution

Water pollution

Noise pollution

Soil pollution

CAUSES OF ENVIRONMENTAL POLLUTION

The causes of environmental pollution are of two types:-

Natural causes

Man-made causes

NATURAL CAUSES

Natural forms of pollution are those that result from naturally-occurring phenomena. This means they are caused by periodic activities that are not man-made or the result of human activity. What's more, these sources of pollution are subject to natural cycles, being more common under certain conditions and less common under others. Being part of Earth's natural climatic variations also means that they are sustainable over long periods of time.

Dust and Wildfires:

In large areas of open land that have little to no vegetation, and are particularly dry due to a lack of precipitation, wind can naturally create dust storms. This particulate matter, when added to the air, can have a natural warming effect and can also be a health hazard for living creatures. Particulate matter, when scattered into regions that have natural vegetation, can also be a natural impediment to photosynthesis. Wildfires are a natural occurrence in wooded

areas when prolonged dry periods occur, generally as a result of season changes and a lack of precipitation. The smoke and carbon monoxide caused by these fires contribute to carbon levels in the atmosphere, which allows for greater warming by causing a Greenhouse Effect.

 The Chiwaukum Fire in Washington State in 2014.

Animal and Vegetation:

Animal digestion (particularly by cattle) is another cause of natural air pollution, leading to the release of methane, another greenhouse gas. In some regions of the world, vegetation – such as black gum, poplar, oak, and willow trees – emits significant amounts of volatile organic compounds (VOCs) on warmer days. These react with primary anthropogenic pollutants – specifically nitrogen oxides, sulfur dioxide and carbon compounds – to produce low-lying seasonal hazes that are rich in ozone.

Volcanic Activity:

Volcanic eruptions are a major source of natural air pollution. When an eruption occurs, it produces tremendous amounts of sulphuric, chlorine, and ash

products, which are released into the atmosphere and can be picked up by winds to be dispersed over large areas. Additionally, compounds like sulphur dioxide and volcanic ash have been known to have a natural cooling effect, due to their ability to reflect solar radiation.

MAN-MADE CAUSES

But by far the greatest contributing to air pollution today are those that are a result of human impact – i.e. man-made causes. These are largely the result of human reliance on fossil fuels and heavy industry, but can also be due to the accumulation of waste, modern agriculture, and other man-made processes.

Emissions by vehicles are a major cause of anthropogenic air pollution.

Fossil-Fuel Emissions:

The combustion of fossil fuels like coal, petroleum and other factory combustibles is a major cause of air pollution. These are generally used in power plants, manufacturing facilities (factories) and waste incinerators, as well

as furnaces and other types of fuel-burning heating devices. Providing air conditioning and other services also requires significant amounts of electricity, which in turn leads to more emissions. But by far the greatest contributing to air pollution today are those that are a result of human impact – i.e. man-made causes. These are largely the result of human reliance on fossil fuels and heavy industry, but can also be due to the accumulation of waste, modern agriculture, and other man-made processes.

Agriculture and Animal Husbandry:

Greenhouse gas emissions from agriculture (aka. the cultivation of crops and livestock) is created by a combination of factors, one is the production of methane by cattle. Another cause is deforestation, where the need for pastureland and growing fields requires the removal of trees that would otherwise sequester carbon and clean the air.

According to the IPCC Fifth Assessment Report, agriculture accounts for 24% of annual emissions. However, this estimate does not include the CO2 that ecosystems remove from the atmosphere by sequestering carbon in biomass, dead organic matter and soils, which offset approximately 20% of emissions from this sector.

Waste:

Landfills are also known to generate methane, which is not only a major

greenhouse gas, but also an asphyxiate and highly flammable and potentially hazardous if a landfills grow unchecked. Population growth and urbanization have a proportional relationship with the production of waste, which in turn leads to greater demand for dumping grounds that are far removed from urban environments. These locations thus became a significant source of methane production. For some time, environmental scientists have been aware that the Earth has several self-regulating mechanisms. When it comes to the Earth's atmosphere, these mechanisms allow for the sequestration of carbon and other pollutants, ensuring that the balance of its ecosystem remains unaffected. Unfortunately, the growing impact humanity has had on the planet is threatening to permanently alter that balance.

Basically, we are adding pollutants to the air (as well as the oceans and land masses) faster than the Earth's natural mechanisms can remove them. Add the results of this are being felt in terms of acid rain, smog, global warming, and a number of health problems that can be directly attributed to exposure to these harmful pollutants. If we intend to go on living on planet Earth, then sustainability and less pollution need to be our goals!

Industry and Power Generation:

During the Industrial Revolution in the 1800s lots of factories, such as cotton factories, were built in Scotland near to the large towns and cities. Today

the main industrial hubs tend to be in the countryside away from cities. Nitrogen dioxide and sulphur dioxide are the main pollutants associated with industrial processes.

To generate electricity fuels such as coal, gas or oil are burned at power stations. When these fuels are burnt they release nitrogen oxides, sulphur dioxide and particulate matter as well as greenhouse gases which can cause climate change.


Smoke emission from chimneys

TYPES OF ENVIRONMENTAL POLLUTION

AIR POLLUTION- **Air pollution** refers to the release of harmful contaminants (chemicals, toxic gases, particulates, biological molecules, etc.) into the earth's atmosphere. These contaminants are quite detrimental and in some cases, pose serious health issues. Some causes that contribute to air pollution are:

- Burning fossil fuels
- Mining operations
- Exhaust gases from industries and factories

The effects of pollution vary based on the kind of pollutant. But generally, the impact of air pollution ranges from:

- Increased risk of respiratory illness and cardiovascular problems
- Increased risk of skin diseases
- May increase the risk of cancer
- Global warming
- Acid rain
- Ozone depletion
- Hazards to wildlife

Among the other types of pollution, air pollution is theorized to have a planet-wide implication. Scientists have even speculated an apocalypse-like scenario

where air pollution if left unchecked can bring about an extreme form of global warming called the runaway greenhouse effect. Though this is purely speculative, it is a phenomenon that has already occurred on Venus.

Air pollution

WATER POLLUTION- **Water pollution** is said to occur when toxic pollutants and particulate matter are introduced into water bodies such as lakes, rivers and seas. These contaminants are generally introduced by human activities like improper **sewage treatment** and oil spills. However, even natural processes such as eutrophication can cause water pollution.

Other significant causes of water pollution include:

- Dumping solid wastes in water bodies
- Disposing untreated industrial sewage into water bodies
- Human and animal wastes
- Agricultural runoff containing pesticides and fertilisers

The effects of water pollution are very pronounced in our environment. Furthermore, toxic chemicals can bio accumulates in living beings, and these chemicals can travel their way up the food chain, ultimately reaching humans.

Among the other types of pollution, water pollution has more disastrous consequences on humans. For instance, in 1932, a grave case of water pollution incapacitated the inhabitants of an entire city in Japan with neurological diseases and mental illness for many decades. However, the immediate cause was not apparent but was eventually attributed to acute mercury poisoning. Methyl mercury was dumped into the surrounding bay and had ultimately bio accumulated inside the fish. The local population then consumed these fish, and this resulted in the manifestation of ill-effects and neurological diseases.

Other consequences of water pollution include:

- Disruption of the ecosystem
- Threats to marine life
- Increased risk of water-borne diseases
- Increases toxic chemicals (such as mercury) in water bodies
- Eutrophication

 Polluted water

NOISE POLLUTION- **Noise pollution** refers to the excessive amount of noise in the surrounding that disrupts the natural balance. Usually, it is man-made, though certain natural calamities like volcanoes can contribute to noise pollution.

In general, any sound which is over 85 decibels is considered to be detrimental. Also, the duration an individual is exposed plays an impact on their health. For perspective, a normal conversation is around 60 decibels, and a jet taking off is around 15o decibels. Consequently, noise pollution is more obvious than the other types of pollution.

Noise pollution has several contributors, which include:

- Industry-oriented noises such as heavy machines, mills, factories, etc.
- Transportation noises from vehicles, aeroplanes, etc.
- Construction noises
- Noise from social events (loudspeakers, firecrackers, etc.)

- Household noises (such as mixers, TV, washing machines, etc.)

Noise pollution has now become very common due to dense urbanisation and industrialisation. Noise pollution can bring about adverse effects such as :

- Hearing loss
- Tinnitus
- Sleeping disorders
- Hypertension (high BP)
- Communication problems

Noise pollution

SOIL POLLUTION- **Soil pollution**, also called **soil contamination**, refers to the degradation of land due to the presence of chemicals or other man-made substances in the soil. The xenobiotic substances alter the natural composition of soil and affect it negatively. These can drastically impact life directly or indirectly. For instance, any toxic chemicals present in the soil will get absorbed

by the plants. Since plants are producers in an environment, it gets passed up through the food chain. Compared to the other types of pollution, the effects of soil pollution are a little more obscured, but their implications are very noticeable.

Some of the common causes of soil pollution are:

- Improper industrial waste disposal
- Oil Spills
- Acid rain which is caused by air pollution
- Mining activities
- Intensive farming and agrochemicals (like fertilisers and pesticides)
- Industrial accidents

The effects of soil pollution are numerous. Specific wastes, such as radioactive waste become particularly hazardous when they are not well-contained. A well-documented example is a nuclear accident in Chernobyl, which has left an area of 2,600 km^2 uninhabitable for several thousand years.

Other effects of soil pollution include:

- Loss of soil nutrients, which renders the soil unfit for agriculture
- Impacts the natural flora and fauna residing in the soil
- Degrades vegetation due to the increase of salinity of the soil

- Toxic dust (such as silica dust) can cause respiratory problems or even lung cancer

Soil pollution

WAYS TO REDUCE ENVIRONMENTAL POLLUTION:-

1. Using public transports

Using public transport is a sure short way of contributing to less air pollution as it provides with less gas and energy, even carpools contribute to it. In addition to less release of fuels and gas, using a public transport can also help in saving money.

2. Turn off the lights when not in use

The energy that the lights take also contribute to air pollution, thus less consumption of electricity can save energy. Use energy saving fluorescent lights to help the environment.

3. Recycle and Reuse

The concept of recycle and reuse is not just conserve resources and use them judicially but also is helpful for air pollution as it helps in reducing pollution emissions. The recycled products also take less power to make other products.

REUSE, REDUCE, RECYCLE

4. No to plastic bags

The use of plastic products could be very harmful to the environment as they take a very long time to decompose, due to their material made up of oil. The use of paper bags instead is a better alternative as they decompose easily and are recyclable.

5. Reduction of forest fires and smoking

The collecting of garbage and getting it on fire in dry seasons or dry leaves catching fires is a huge factor for causing air pollution, moreover smoking also causes air pollution and causes the air quality to worsen along with obviously damaging one's health.

6. Use of fans instead of Air Conditioner

The usage of AC's takes a lot of energy and emits a lot of heat which is bad for the environment. AC's also taking a lot of power and energy to work as compared to fans.

7. Use filters for chimneys

The gas that is emitted from fireplaces in homes and factories are extremely dangerous for air pollution and harms the air quality severely. The use of filters should be used at least if the consumption couldn't be lessened, this will help to reduce the effect of harmful gases absorbing in the air.

8. Avoid usage of crackers

The use of crackers during festivals and weddings is sadly one of the biggest contributors to air pollution, leading to a layer of smog which is extremely harmful for health. So, practice of no crackers should be implemented.

9. Avoid using of products with chemicals

Products that use the chemicals in their usage or smell strongly, like paints or perfumes should be used less or outside the house. There can also be an alternative to use products with low chemical content and organic properties.

10. Implement Afforestation

Last but not the least, plant and grow as many trees as possible. The practice of planting trees provides a lot of benefits to the environment and helps with the release of oxygen.

CONCLUSION

Environmental pollution is not a new phenomenon, yet it remains the world's greatest problem facing humanity, and the leading environmental causes of morbidity and mortality. Man's activities through urbanization, industrialization, mining, and exploration are at the forefront of global environmental pollution. Both developed and developing nations share this burden together, though awareness and stricter laws in developed countries have contributed to a larger extent in protecting their environment. Despite the global attention towards pollution, the impact is still being felt due to its severe long-term consequences.

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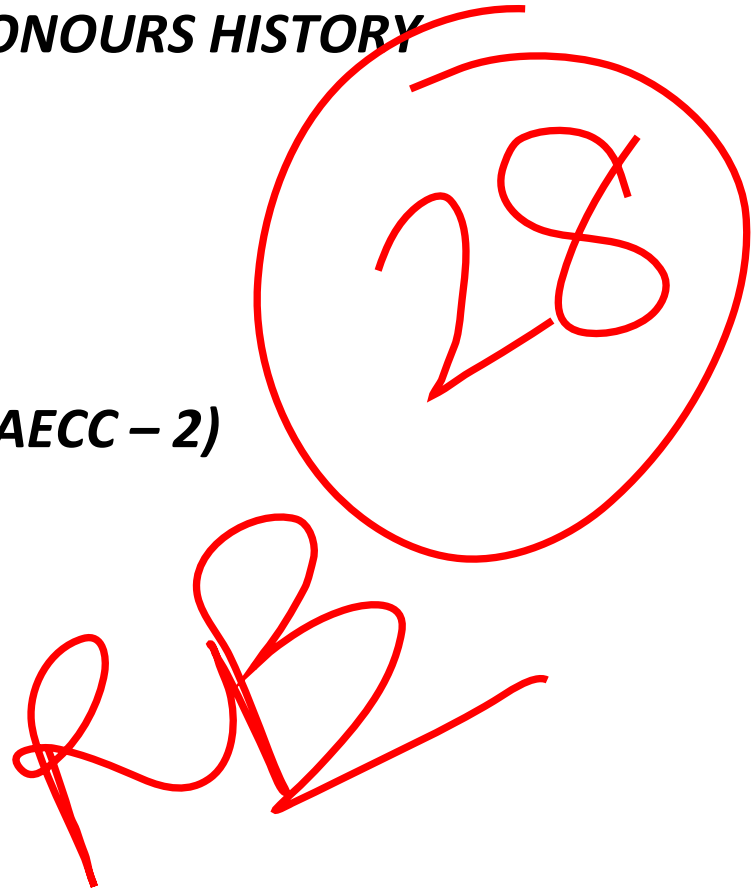

POLLUTION

OF THE

GANGES

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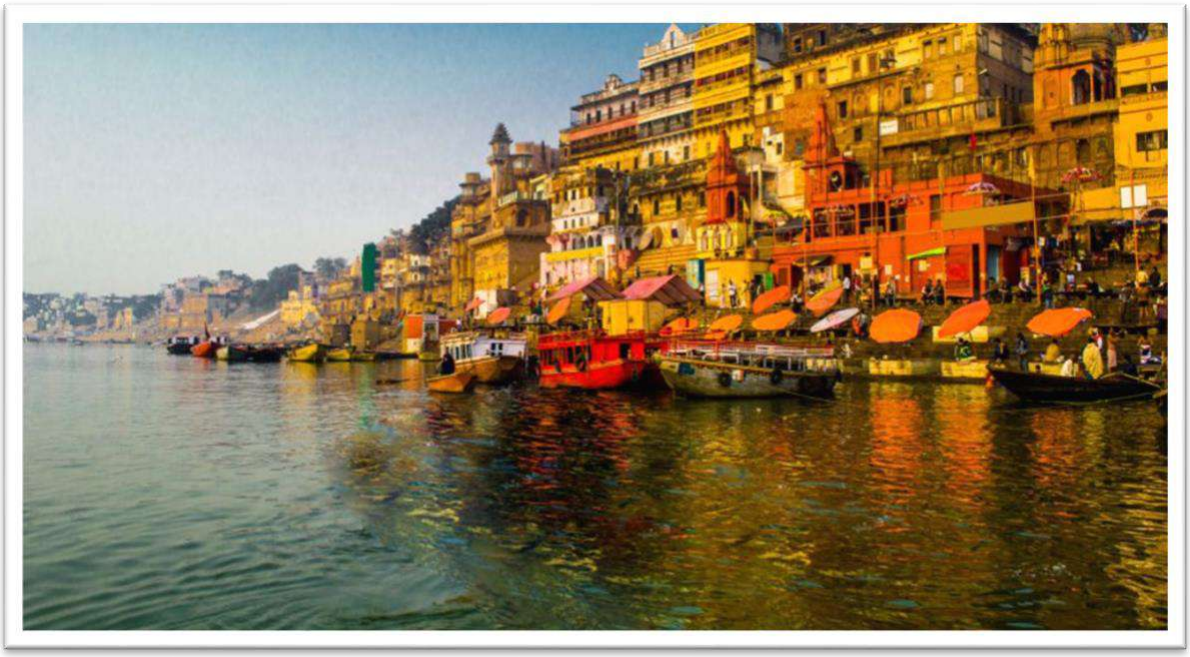
INTRODUCTION

The Ganges or Ganga is a trans – boundary river of Asia which flows through India and Bangladesh. The 2,525 km river rises in the Western Himalayas in the Indian state of Uttarakhand, and flows south and east through the Gangetic Plain of North India into Bangladesh where it empties into the Bay of Bengal. It covers the Indian cities of Kedarnath, Varanasi, Haridwar, Prayagraj, Kolkata, Patna, Kanpur and Ghazipur.

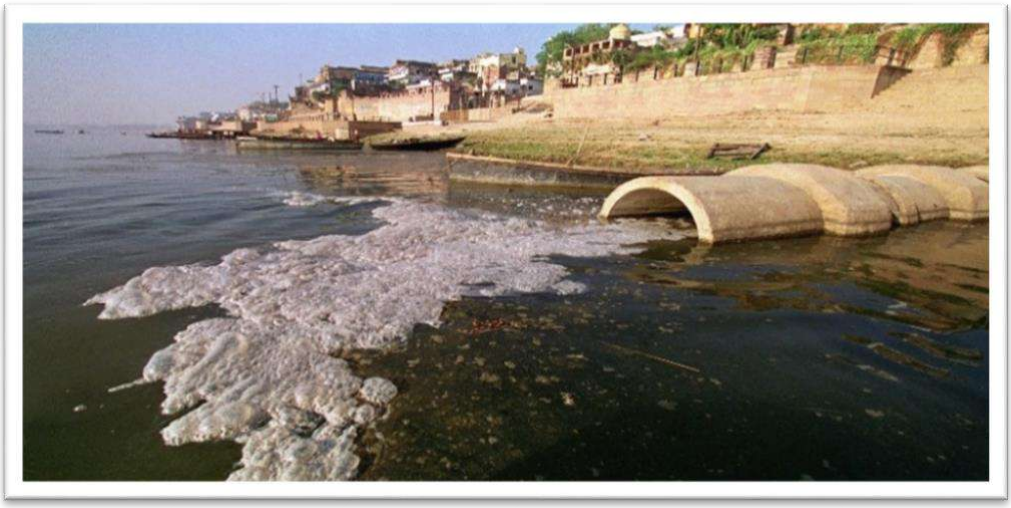
River Ganga is considered sacred by people of India for providing life sustenance to enviornment and ecology. Water is the most key resource required to sustain the life on this planet. The river Ganga is the most important river system in India and is great source of water. Ganga basin is among the most heavily populated areas in the world with an average density of 5.20 persons /km².

The basin of river Ganga, which rich heritage, cultural and very religious values, drains about one- fourth of the Indian subcontinent covering about 29 class- I cities, 23 class- II cities and approximately 50 towns because of which of different types of wastes such as industrial, sewage, etc. are released into this mighty river eco-system, causing water pollution gradually leading to fresh water crisis and also death of several aquatic plants and animals.



CAUSES LEADING TO THE POLLUTION OF THE GANGES

1. ***INDUSTRIAL WASTES*** - Anthropogenic activities, have generated huge transformations in the Ganges river eco-system during the past few decades. Advancement of technology in the form of a rise in the number of industries and the subsequent discharge of untreated and semi-treated wastes into the rivers has raised serious concern about the safe use of river water for drinking and other purposes.These wastes discharged from several industries entering the water system lead to changes in the physiochemical and biological properties of the riverine ecology and may lead to bioaccumulation and biomagnification in the bodies of aquatic organisms and hence can enter the food web. The most important industrial pollution sources is from UP which accounts nearly 55%, followed by Haryana, Madhya Pradesh, Rajasthan, West Bengal and others. The major industries located along the rivers are tanneries (Kanpur), comparts and locomotives (Varanasi) and engineering (Allahabad). The tributaries of this river is also surrounded by several large and small scale industries such a as paper, sugar, pharmaceuticals, automobiles, textiles, etc. Major industries responsible for pollution are the chemical and pharmaceutical industries due to harmful chemical release into water and also the thermal & steel & coal mining industries.



INDUSTRIAL WASTES

1. ***SEWAGE*** - Organic waste on sewage of the major cause for the pollution of River Ganga. Around 2900 million kilograms of sewage are pumped into Ganga river. Out of this 31 % of Sewage is treated (Pokharel) and rest 69% is dumped into the Ganga as raw sewage. The count of coliform bacteria at the confluence of the Salori sewage with the Ganges river is 15,000 mpn/100 ml, as compared to the government limit of 500 mpn/ 100 ml. It is an indication of human or animal wastes. This is gradually leading to depletion of oxygen level in the water leading to death of aquatic lives.

ORGANIC WASTES

RITUALS - Ironically the sacred River of India is mostly polluted by the religious wastes. Some materials like food, wastes or leaves left in the to rivers Ganga. Even the immersion of the deities after keeping them for days at home is another ritual causing damage to rivers. Even believing that Ganga purifies souls leads to dumping of ashes or Asthias of dead humans into the water leading to pollution. Kumbha Mela also causes pollution of river due to throw of flowers and fruits into

RELIGIOUS WASTES

2. ***IMPROPER AGRICULTURAL PRACTISE*** – Agricultural water pollution includes the sediments, fertilizers and animal wastes. The unbalanced use of inorganic fertilizers and other fertilizers have immensely contributed to water pollution. The fertilizers rich in nitrates create toxic composition after reaching several other entities. Large quantities of fertilizers, when washed through the irrigation, rain or drainage to the river, and pollutes the river. The fertilizers rich in nitrate content are used to get more productivity from the land. This led to pollution in the entire food chain wherever the

by-product of the produce is consumed. When these fertilizers wash away due to rain or other factors and pollute the river.

3. ***WITHDRAWAL OF WATER*** - There is plenty of water in the upper course of the Ganges, however, starved of water when the river enters the plain areas. Irrigation whisk away clean water, denying water to flow in the river downstream. Upper and Lower Ganga canals have left the downstream of Ganga almost dry. Moreover, the studies have revealed that it is not possible to maintain the minimum flow of water in the entire course of the river because it depends on the discharged pollutants which creates pollution at different points of the river.

4. ***DAMS AND PUMPING STATIONS*** - Built in 1854 during the British colonisation of India, the Haridwar dam has led to decay of the Ganges by greatly diminishing the flow of the river. The Farakka Barrage was built originally to divert fresh water into the Hooghly River but has since caused an increase of salinity in the downstream of the Ganges, having a damaging effect on the ground water and soil along the river. The barrage has caused major tension between Bangladesh and India. Bangladesh is actively considering to construct Ganges Barrage Project for mitigating the salinity. problem. The government of India has planned about 300 dams on the Ganges and its tributaries. Three more barrages across the Ganges main river are existing at Bijnor, Narora and Kanpur. Most of the water available at the upstream of the Kanpur barrage is used during dry season for the drinking water needs of cities. Downstream of Kanpur barrage, adequate water is not available from the barrage to dilute the polluted water reaching the main river during the dry seasons of year. There are number of pumping stations located on the banks (right and left) of the Ganges downstream of Kanpur barrage serving the irrigation requirements of huge area.

FARAKKA BARRAGE

IMPACT OF CORONA ON THE GANGES

Images of corpses drifting down the Ganga river, which Hindus consider holy, have shocked the nation reeling under the world's worst surge in infections. Bodies of Covid-19 victims have been found dumped in some parts of the Ganges river. Although media have linked the recent increase in number of such bodies to the pandemic, the northern state of Uttar Pradesh, home to 240 million population, has until now not publicly revealed the cause of the deaths.

DEAD BODIES

EFFECTS OF THE GANGES POLLUTION

The pollutants include oils, greases, plastics, fertilizers, pesticides, harmful chemicals, suspended solids, acids, toxins, cyanides, salts, etc. Many of these are not easily susceptible to degradation and thus cause serious pollution problems. Contamination of ground water and fish-kill episodes are the major effects of toxic releases from industries. It leads to number of conspicuous effects on the river enviornment. The impacts involve gross change in water quality viz reduction in dissolved oxygen and also dissolved light penetration capacity of river water, thus leading to death of several aquatic creatures and plants & also reducing the amount of fresh flowing water.

STEPS TO BE TAKEN TO REDUCE THE POLLUTION OF THE GANGES

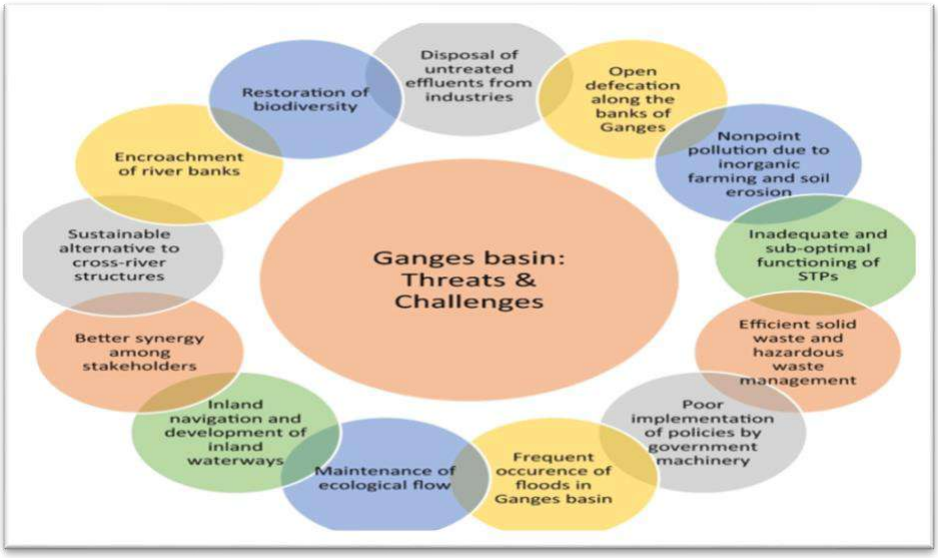
1. Firstly the brain-scale management as we know Ganges is a complex trans boundary basin which flows across different states. Therefore basin-scale approach would help to manage the water resources in much better way. It requires close coordination among all the countries which are sharing Ganga, such as Nepal and Bangladesh, so that upstream and downstream users are taken into consideration. We can say that

existing treaties on 'sharing water resources could be retermed or renegotiated as 'shared management of water resources'.

2. Secondly the river Ganga is highly polluted, still 400 million people living along the banks of the river rely on the water for daily purpose. So, government should look after this issue and must limit the usage of water so that maximum amount of water does not get dirty or wasted daily.

3. Thirdly, the environmental flows are essentially the water requirements of aquatic ecosystems and of basic human and social needs. The concept behind the environmental flow only refers to the quantity of water required to maintain river ecology under different environmental conditions. Different innovative methods for maintaining environmental flows and the water quality during environmentally critical periods, along with procedures for implementing these methods, need to be investigated. Cities, towns and industrial estates are most vulnerable to flooding in the Ganges river basin. Major investments are done to address climate variability. Existing flood forecasts are too much technical and not easily understand by the public. Innovative approaches such as underground taming of floods for irrigation and aquifer management could offer solutions to the flood problems.

4. Lastly towards the common goal, the steps taken by the government to clean the river Ganga. Successful implementation of this task would be possible only if there would be partnerships with various stakeholders. The private sector and civil society groups has also shown there interest in cleaning of the river Ganga, especially at critical points (Varanasi). By taking small steps, we can still reduce the pollution load and restore the river to people.



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NAMAMI GANGES PROJECT

Namami Gange's primary objective was to put an end to the direct dumping of waste in the river by creating effluent treatment plants and sewage infrastructure in all major riverine cities. Riverfronts were to be built, the ghats cleaned, afforestation initiated and toilets built in more than 4,700 villages situated on the banks of the river.

Figures from 2016, the latest available, showed that cities and towns along the Ganga generated about 2,950 MLD--about 300,000 tanker loads--of sewage every day, but existing treatment capacity could take care of 48% of this load. That leaves 1,520 MLD (52%) untreated.

Bridging this gap was one of the top priorities of the Namami Ganges programme.

GANGA ACTION PLAN

The Ganga Action Plan was started in 1986 for control of water pollution in the river Ganga. The main function of this plan was to make Ganga River free from the pollution from the disposal of waste from the cities settled on the banks of the river. The plan was to make Ganga pollution free from Rishikesh to Kolkata. The central pollution control board had prepared a plan of 5 years in 1984 to make Ganga pollution-free. The central Ganga authority was formed in 1985 and a Ganga action plan was launched in 1986 to make the Ganga pollution free.

The first phase of the Ganga action plan was inaugurated by late Rajiv Gandhi at Rajendra prasad ghat of Banaras. The National Protection Agency was constituted for its implementation. During the first phase of Ganga Action Plan 256 schemes of 462 crores were undertaken in Uttar Pradesh, Bihar and West Bengal. Special stations have been created to check the quality of water.

The experts from Bharat Heavy Electricals Limited and National Environment Engineering Research Institute were appointed to check the quality of the water. Despite so much effort, the Ganga action plan failed miserably and crores of money were spent on the Ganga action plans. The failure of such a big plan has led to economic disruption. The government launched the second phase of the Ganga Action Plan in 2001 wherein the central pollution board, central public works department and public works department are the bodies to carry out the plan.

PROTEST AGAINST THE MEASURES TAKEN TO REDUCE GANGES POLLUTION

Religious heads had disagreed to the project of saving Ganga water as they are determined to throw the wastes of food, of flowers, leaves, etc. into the holy water. Also the Farakka Barrage has also resulted in occupational displacement of the fisher people in both upstream and downstream. For long time fisher people in Bihar have been protesting against the barrage as this has hindered the natural migration of valuable fishes from the sea, especially Hilsa.

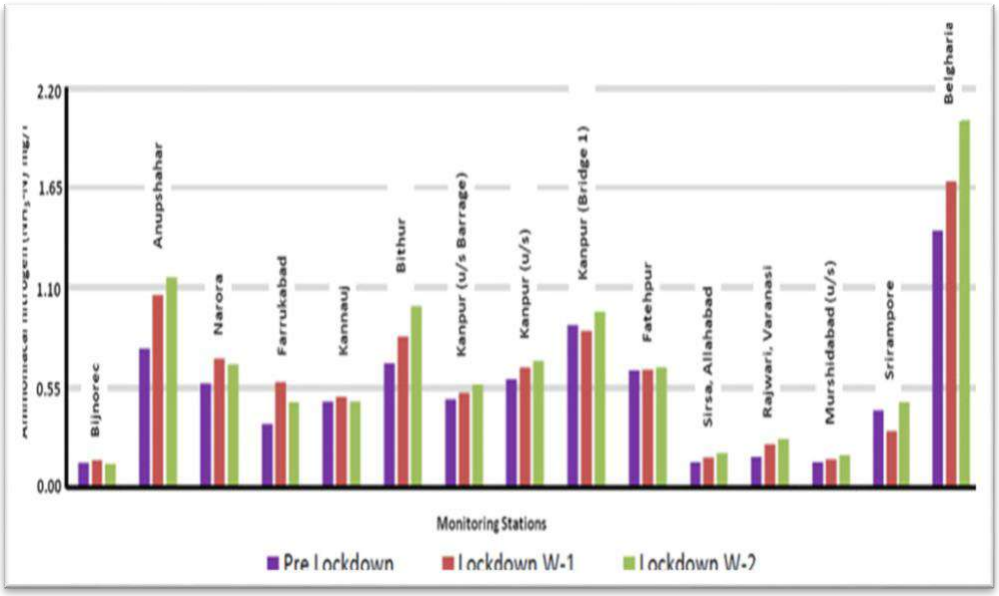
REASONS FOR FAILURE OF MANY PROJECTS TO PROTECT THE GANGES

1. One of the failures of the Ganga Action plan was that it was a completely bureaucratic exercise, top-down, end of the pipe interventions. Lack of data on the water use and wastewater generation ensured that the plans failed miserably.

2. The Namami Ganges programme can't succeed unless it has a bottom-up approach. " Almost four years since Modi's promise of cleaning the Ganga, cities along the river remain highly polluted and data shows that people might be drinking partially-treated sewage.

3. Promises such as construction of waterways, promotion of Dolphin Tourism and bringing a Blue Revolution, among others, send the signal that the Narendra Modi government's focus has now shifted to earning revenue from the holy river and not restoring it back to its ancient form.

4. The government is still trapped in the water quality scale developed by the Central Pollution Control Board (CPCB) and does not want to understand the concept of 'Gangatva'. It has become difficult for the government to simply accept that 'Gangatva' does not just mean 'clean water'. The government and scientists do consider 'Gangatva' as an 'element' but would never make it an integral part of any legislation on river planning. And this is because preserving 'Gangatva' would mean ensuring virtuous treatment of the river — saying goodbye to the idea of generating revenue from it



POLLUTION STATISTICS OF GANGES DURING LOCKDOWN

FUTURE OF THE GANGES

Apart from the visible improve in the water quality, the awareness generated by the project is an indicator of its success. It has resulted in the expansion of the entire programme over the entire Ganga basin to cover the other polluted tributaries. The GAP has further evolved to cover all the polluted stretches of the major national rivers, and including a few lakes. Considering the huge costs involved, the Central & State government have agreed in the principle to each share the half of the costs of the projects under the "National River Action Plan" 'The State government are also required to organize funds for sustainable O&M in perpetuity. Initially, the plan fully sponsored by the Central.

CONCLUSION

The Ganga River is one of the most polluted rivers in the world, yet is used by more than 500 million people for different purposes. People are using this contaminated water out of necessity and it is causing many experiences of health deteriorations of both humans and aquatic plants on animals.

Researchers have pointed out that the level of pollution in the Ganges has been relatively constant over time due to lack of Sewage treatment plants. While the local government has implemented waste treatment facilities and water monitoring stations, these plans have been largely ineffective in improving the water quality to a level safe for inhabitant usage.

It is an immediate need to make the Ganges free of pollution for the well being of the humans and aquatic fishes and plants. It is a peak moment to control water pollution effectively so that the world does not face water crisis in the near future. It has been pointed out that this can only be done by adequate fund raising in order to make required changes in the current system. More people must be made aware of the harmful results of water pollutions besides other policies.

This is a multivariable problem with no easy solution, however strategic actions must be a priority of Indian government in order to improve the condition of Ganges. If this is done effectively, then in near feature Ganga may get rid of water pollution, improving the lives of inhabitants and the river eco-system.

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THE END

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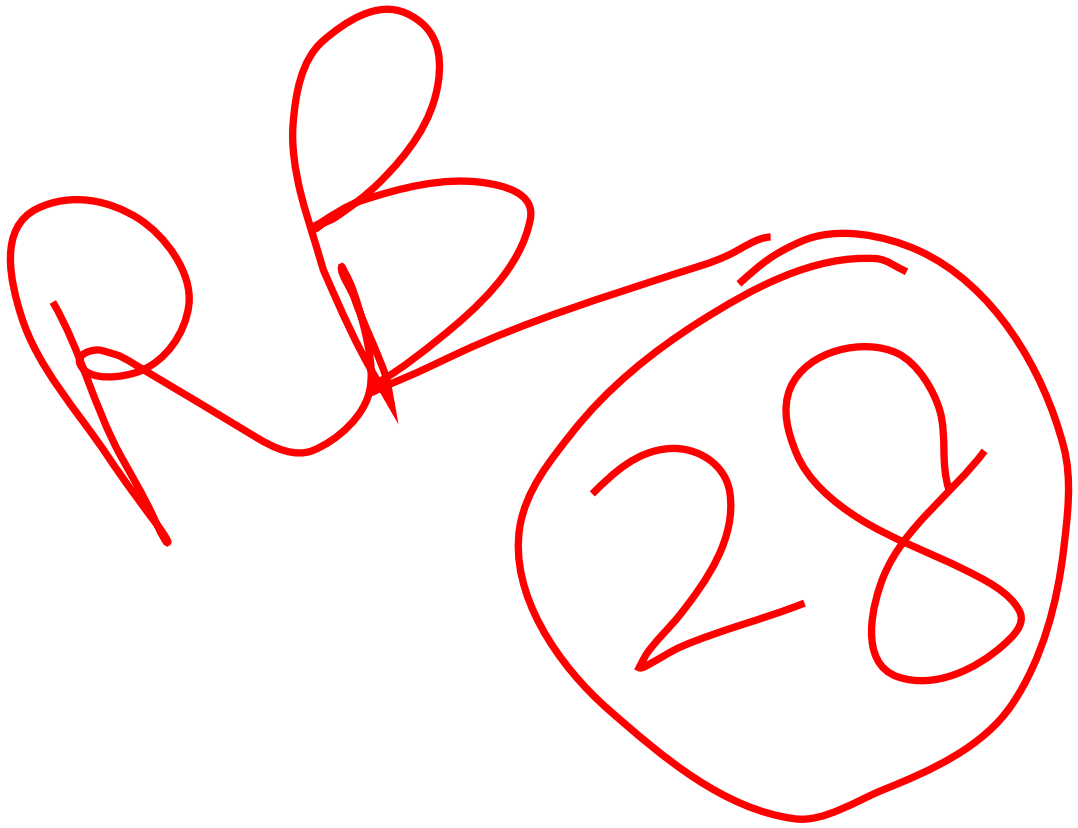

জল দূষণ ; সংকট ও নিয়ন্ত্রণ এবং জল অপচয়

কৃতজ্ঞতা স্বীকার

"জল দূষণ ; সংকট ও নিয়ন্ত্রণ এবং জল অপচয়" শীর্ষক প্রকল্পটি সার্থকভাবে রূপায়ণ করতে পরামর্শ দান ও সহযোগিতার জন্য আমার মহাবিদ্যালয় -এর পরিবেশ বিদ্যার শ্রদ্ধেয় / শ্রদ্ধেয়া অধ্যাপক / অধ্যাপিকাদের কাছে আমি বিশেষ ভাবে কৃতজ্ঞ সেই সঙ্গে আমার সহপাঠী ও সহপাঠিনী এবং এলাকার কিছু অধিবাসী যারা আমার এই প্রকল্প রূপায়ণে নানা ভাবে সাহায্য করেছেন। তাঁদের সকলকে সবিনয়ে কৃতজ্ঞতা জানাই।

ভূমিকা

প্রাণী ও উদ্ভিদের কাছে জল ই জীবন। মানব দেহের প্রায় ৭০ শতাংশ জল দ্বারা তৈরী এই জলকেই তরল বা গ্যাসীয় বা কঠিন বস্তু রূপে পাওয়া যায়। এর প্রতিটি রূপ ই মানুষের অতিপ্রয়োজীয়। কৃষি থেকে শুরু করে শিল্প, বিদ্যুৎ উৎপাদন, অগ্নি নি্বাপণ এবং দৈনন্দিন জীবনে জলের ভূমিকা অত্যন্ত গুরুত্বপূর্ণ। বর্তমানে মানুষ অপ্রয়োজীয় ক্ষেত্রে এবং অত্যধিক পরিমাণে ব্যবহার করছ যার ফলে ভবিষ্যত কালে জল সংকট ভয়াবহ আকার ধারণ করতে চলেছে। এমনকি সাম্প্রতিক কালে দক্ষিণ ভারতে জল সংকট ভয়াবহ আকার ধারণ করেছিল। এছাড়াও পৃথিবীর মোট জলের শতকরা ৩ ভাগ মিষ্টি জলও আজ দূষিত। নিম্নে এই বিষয়ে বিশদে আলোচনা করা হল।

জলের প্রয়োজনীয়তা

পৃথিবীর আদিমতম প্রাণের সৃষ্টিস্থল হল জল।জল ছাড়া শুধুমাত্র মানুষই নয় যেকোনো প্রাণীর অস্তিত্ব কল্পনা করাই কঠিন। প্রাণী তথা উদ্ভিদ জগতের মূল ভৌত উপাদানই হল জল। তাছাড়া, মানুষের ব্যবহার্য্য সকল দ্রব্যের কোনদিনও অস্তিত্ব জল ছাড়া সম্ভব নয়। তাই মানুষ এবং গোটা পৃথিবীর সকল প্রানী ও উদ্ভিদের জীবনে জলের অপরিসীম গুরুত্বের

মাথায় রেখে জল ব্যবহারের ব্যপারে সচেতনতা অবলম্বন করা উচিত।

জল অপচয়

পৃথিবীর মূল গঠনগত উপাদান জল হলেও মানুষের ব্যবহারযোগ্য জলের মাত্রা অফুরন্ত নয়, কারণ, পৃথিবীর মোট জলের শতকরা ৩ ভাগ জল হলো মিষ্টি জল। ইতিমধ্যেই বিভিন্ন মহলের বিজ্ঞানীরা মানুষের ব্যবহারযোগ্য জলের উৎস নিঃশ্বেসিত হওয়ার ব্যাপারে সাবধান বাণী দিয়েছেন। মানুষ যে ভাবে জল অপচয় করে তা হলো -

- রাস্তায় জলের কল ব্যবহার করার পর বন্ধ না করা।

- শাক শবজি ধোয়ার সময় জলের কল খুলে রাখা।
- ব্রাশ করার পর মুখ ধোয়ার সময় জলের কল খুলে রাখা।
- স্নানের সময় মাত্রাতিরিক্ত জল ব্যবহার করা ও কল খুলে রাখা।
- জামা কাপড় ধোয়ার সময় মাত্রাতিরিক্ত জল ব্যবহার করা ও কল খুলে রাখা।
- রান্নার বাসন মাজার সময় অতিরিক্ত জল ব্যবহার করা।

এছাড়াও বিভিন্ন ভাবে আমরা জল অপচয় করে থাকি।

জল দূষণ

সঙ্গা: যখন বিভিন্ন উৎস থেকে নির্গত বিভিন্ন অবাঞ্ছিত বস্তু (দূষক) জলে মিশে তার ভৌত ও রাসায়নিক বৈশিষ্ট্যের পরিবর্তন ঘটে , যা জলকে মানুষের এবং অন্যান্য প্রাণীর ব্যবহারের অনুপযোগী করে তোলে বা জলজ জীবের বসবাসের অযোগ্য হয়ে যায়,তখন সেই অবস্থাকেই জল দূষণ বলা হয়।

জল দূষণ বিভিন্ন ভাবে ঘটে থাকে, নিম্নে তা নিয়ে আলোচনা করা হল।

১ | গৃহস্থালির আবর্জনা দ্বারা জল দূষণ

গৃহস্থালির কাজে ব্যবহৃত জল, বিভিন্ন খাদ্য প্রস্তুতকারী হোটেল ও কারখানার বিভিন্ন দ্রব্য,মানুষ ও গৃহপালিত পশু পাখির মল মুত্র, অপ্রয়োজনীয় কাপড়, প্লাস্টিক,সাবান, বিভিন্ন জ্বালানির অবশিষ্টাংশ, প্রভৃতি পদার্থসমূহ জলাশয় বা নদীতে জমা হয়। এই পদার্থগুলোর

বিঘটনকারী জীবাণু সংখ্যা সীমিত হওয়ায় এই দ্রব্য গুলি পূর্ণরূপে বিঘটিত হয়ে প্রাকৃতিক চক্রে মিশে যেতে পারে না। ফলে এইসব দূষণকারী পদার্থের উপস্থিতিতে জল দূষিত হয়ে পড়ে।

ধোওয়া ও পরিষ্কার করার জন্যে ব্যবহৃত ডিটারজেন্টের মূল উপাদান হলো ফসফেট যৌগ। এই ফসফেট যৌগ নর্দমার মাধ্যমে বিভিন্ন জলভান্ডারে সঞ্চিত হলে শৈবাল জাতীয় উদ্ভিদের পশক খাদ্যের পরিমান বৃদ্ধি পায় এবং জলে শৈবাল সাম্রাজ্য তৈরি হয়।শৈবালের এই বৃদ্ধির হারকে ইউট্রিফিকেশন বলে। ফলে জলাশয় এর নব্যতা হ্রাস পায়। এই সব শৈবাল গুলো পচে গিয়ে স্ট্রিকনিন নামক একধরনের বিষ উৎপাদন করে । এমতাবস্থায় এই জল পান করলে গবাদি পশুর মৃত্যু ঘটতে পারে।

২ | শিল্পঘটিত জল দূষণ

শিল্প কারখানা গুলি থেকে নির্গত বিভিন্ন তেজস্ক্রিয় পদার্থ থেকে জল দূষণ ঘটে। এর ফলে আম্লবৃষ্টি হয় । এইসব জার খান থেকে নির্গত প্রচন্ড গরম জল জলে থাকা প্রাণীদের ক্ষতি কর

৩ । খনিজ তেল জনিত দূষণ

বিভিন্নতা জাহাজ থেকে নির্গত পোড়া তেল, সমুদ্রগর্ভ থেকে তেল উত্তোলন, অন্তদেশীয় সমুদ্রের মধ্যে প্রবাহিত তেলের পাইপ লাইনে ফাটল এবং বিভিন্ন তৈলবাহী জাহাজ ডুবে যাওয়ার জন্য প্রচুর পরিমাণে খনিজ তেল সমুদ্রে পড়ে। এর ফলে জলের উপরের স্তরে একটা তেলের আস্তরণ পড়ে, ফলে জলে সূর্যালোক প্রবেশ করতে পারে না, সালোকসংশ্লেষ ব্যাহত হয় । জলের সঙ্গে বায়ুর অক্সিজেন মিশতে না-পারায় জলজ প্রাণীর শ্বাসপ্রশ্বাস ক্রিয়ায় বিঘ্ন ঘটে। ফলে বহু উদ্ভিদ ও প্রাণীর মৃত্যু ঘটে।

৪ । কৃষিকাজ জনিত দূষণ

কৃষিকার্যে ব্যবহৃত কীটনাশক, আগাছানাশক,ছত্রাকনাশক, ইঁদুরনাশক ইত্যাদি ছাড়াও DDT, BHC, PCB ইত্যাদি প্রচুর পরিমাণে ব্যবহার করা হয়।

এছাড়াও প্রাকৃতিক কারনে জল দূষণ হয়ে থাকে।

নিয়ন্ত্রণ

নগরায়ন, শিল্পায়ন ও ক্রমবর্ধমান জনসংখ্যার চাপে এবং জলের লাগামহীন অপচয়ে দূষণ মুক্ত জলের ভাণ্ডার দ্রুত হ্রাস পাচ্ছে। জলদূষন নিয়ন্ত্রনের জন্য নিম্নলিখিত উপায় অবলম্বন করা উচিত।

১. আইন প্রনয়ন ও বলবৎ - জল দূষণ নিয়ন্ত্রন ও প্রতিরোধের জন্য ১৯৭৪ ও ১৯৮৮ সালের সেস আইন ১৯৭৭ ও ১৯৯১ সালে প্রয়োগ করে দূষণকারীদের বিরুদ্ধে কঠোর ব্যবস্থা নেওয়ার মাধ্যমে জলদূষন নিয়ন্ত্রন করার চেষ্টা করা হয়।

২. প্রযুক্তির ব্যবহার - প্রযুক্তিগত উপায়ে জল পরিশোধন ও উন্নত প্রযুক্তির সাহায্যে আবর্জনা প্রক্রিয়াকরণ প্ল্যান্ট বসিয়ে কলকারখানা, হাসপাতাল, পৌরসংস্থা ও অন্যান্য প্রতিষ্ঠানের দূষিত জল ও আবর্জনা কে জীবাণু মুক্ত ও পরিশোধন করে নদী ও সমুদ্রে নিষ্কাশিত করতে হবে।

৩. কীটনাশক ও রাসায়নিক সারের ব্যবহার হ্রাস - কৃষি জমিতে রাসায়নিক সার, কীটনাশক ও আগাছানাশক ওষুধের ব্যবহার কমালে কৃষি জমি থেকে ধুয়ে আসা জল দূষক পদার্থের পরিমান কমবে এবং জলদূষণের মাত্রা হ্রাস পাবে।

৪. উষ্ণ জল শীতলীকরন - তাপ ও পারমানবিক বিদ্যুৎ কেন্দ্র এবং লৌহ ইস্পাত ইত্যাদি শিল্পকেন্দ্র গুলির প্রচণ্ড গরম জলকে ঠাণ্ডা করে নদী বা সমুদ্রে ফেললে জলের ভৌত ধর্ম বজায় থাকে।

৫. খনিজ তেল পরিবহনে সর্তকতা অবলম্বন - সমুদ্রের অগভীর অংশ থেকে খনিজ তেল উত্তোলন ও জাহাজে করে পরিবহনের সময় যাতে তেল সমুদ্রে ছড়িয়ে পড়তে না পারে, সেদিকে নজর রাখতে হবে।

৬. জলের অপব্যবহার রোধ - জলাশয় বা নদনদীতে কাপড় কাঁচা, গবাদি পশুর স্নান ইত্যাদি বন্ধ করলে জল দূষণ হ্রাস করা সম্ভব।

৭. জনসচেতনতা বৃদ্ধি - জল একটি মহার্ঘ বস্তু। তাই জলের দূষণে মানুষের স্বাস্থ্য ও পরিবেশের ওপর কুপ্রভাব অবসম্ভাবী। এভাবে চলতে থাকলে ভবিষ্যতে পানীয় জলের তীব্র

সংকট ঘটবে। এবিষয়ে মানুষ কে সচেতন করে তুলতে পারলে জলদূষন বহুলাংশে নিয়ন্ত্রন করা সম্ভব হবে।

উপসংহার

সুতরাং, ভবিষ্যত বিশ্বের জন্য আমাদের জলদূষণ ও জল অপচয় বন্ধ করার দরকার।

গ্রন্থ পঞ্জি

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TUTORIAL TOPIC: WATER POLLUTION

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INTRODUCTION

Water pollution is a broad term that describes any kind of contamination of bodies of water such as rivers, lakes or wetlands with substances that can pose threats to human health or the natural enviournment. Such pollution is a major source of death and dieseas worldwide especially in developing nations.

Mainly water pollution is cause of human activities which generally includes discharge of waste from factories directly into the water body without any treatment

PROJECT ON WATER POLLUTION

Water pollution (or aquatic pollution) is the contamination of water bodies, usually as a result of human activities. Water bodies include for example lakes, rivers, oceans, aquifers and groundwater. Water pollution results when contaminants are introduced into the natural environment. For example, releasing inadequately treated wastewater into natural water bodies can lead to degradation of aquatic ecosystems. In turn, this can lead to public health problems for people living downstream. They may use the same polluted river water for drinking or bathing or irrigation. Water pollution is the leading worldwide cause of death and disease, e.g. due to water-borne diseases.

Water pollution can be classified as surface water or groundwater pollution. Marine pollution and nutrient pollution are subsets of water pollution. Sources of water pollution are either point sources or non-point sources Point sources have one identifiable cause of the pollution, such as a storm drain or a wastewater treatment plant. Non-point sources are more diffuse, such as agricultural runoff. Pollution is the result of the cumulative effect over time. All plants and organisms living in or being exposed to polluted water bodies can be impacted. The effects can damage individual species and impact the natural biological communities they are part of.

The causes of water pollution include a wide range of chemicals and pathogens as well as physical parameters. Contaminants may include organic and inorganic substances. Elevated temperatures can also lead to polluted water. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. Elevated water temperatures decrease oxygen levels, which can kill fish and alter food chain composition, reduce species biodiversity and foster invasion by new thermophilic species.

Water pollution is measured by analysing water samples. Physical, chemical and biological tests can be conducted. Control of water pollution requires appropriate infrastructure and management plans. The infrastructure may include wastewater treatment plants. Sewage treatment plants and industrial wastewater treatment plants are usually required to protect water bodies from untreated wastewater. Agricultural wastewater treatment for farms and erosion control at construction sites can also help prevent water pollution. Nature-based solutions are another approach to prevent water pollution.Effective control of urban runoff includes reducing speed and quantity of flow. In the United States, best management practices for water pollution include approaches to reduce the quantity of water and improve water quality.

DEFINITION

Water is typically referred to as polluted when it is impaired by anthropogenic contaminants. Due to these contaminants it either does not support a human use, such as drinking water or undergoes a marked shift in its ability to support its biotic communities, such as fish. Natural phenomena such as volcanoes, algae blooms, storms and earthquakes also cause major changes in water quality and the ecological status of water.

Prevalence

Water pollution is a major global problem. It requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells). It has been suggested that water pollution is the leading worldwide cause of death and diseases. Water pollution accounted for the deaths of 1.8 million people in 2015.
The organization Global Oceanic Environmental Survey (GOES) consider water pollution as one of the main environmental problems that can present a danger for the existence of life on earth in the next decades. One of the main concerns is that water pollution, heart phytoplankton who produce 70% of oxygen and remove a large part of carbon dioxide on earth. The organization proposes a number of measures for fixing the situation, but they should be taken in the next 10 years for being effective.
Water pollution in India and China is wide spread. About 90 percent of the water in the cities of China is polluted.
In addition to the acute problems of water pollution in developing countries, developed countries also continue to struggle with pollution problems. For example, in a report on water quality in the United States in 2009, 44 percent of assessed stream miles, 64 percent of assessed lake acres, and 30 percent of assessed bays and estuarine square miles were classified as polluted.

Types

Surface water pollution

Mean eutrophying emissions (water pollution) of different foods per 100g of protein

Surface water pollution includes pollution of rivers, lakes and oceans. A subset of surface water pollution is marine pollution

Water pollution from human activity, including oil spills and also presents a problem for freshwater resources. The largest petroleum spill that has ever occurred in fresh water was caused by a Royal Dutch Shell tank ship in Magdalena, Argentina, on 15 January 1999, polluting the environment, drinkable water, plants and animals. Chemical contamination of fresh water can also seriously damage eco-systems.

In industrialized areas rain can be acidic because of dissolved oxides of sulphur and nitrogen formed from burning of fossil fuels in cars, factories, trains and aircraft and from the atmospheric emissions of industry. In some cases this acid rain results in pollution of lakes and rivers.

Marine water pollution

One common path of entry by contaminants to the sea are rivers. An example is directly discharging sewage and industrial waste into the ocean. Pollution such as this occurs particularly in developing nations. In fact, the 10 largest emitters of oceanic plastic pollution worldwide are, from the most to the least, China, Indonesia, Philippines, Vietnam, Sri Lanka, Thailand, Egypt, Malaysia, Nigeria, and Bangladesh, largely through the rivers Yangtze, Indus, Yellow, Hai, Nile, Ganges, Pearl, Amur, Niger, and the Mekong, and accounting for "90 percent of all the plastic that reaches the world's oceans.
Large gyres (vortexes) in the oceans trap floating plastic debris. Plastic debris can absorb toxic chemicals from ocean pollution, potentially poisoning any creature that eats it. Many of these long-lasting pieces end up in the stomachs of marine birds and animals. This results in obstruction of digestive pathways, which leads to reduced appetite or even starvation.
There are a variety of secondary effects stemming not from the original pollutant, but a derivative condition. An example is silt-bearing surface runoff, which can inhibit the penetration of sunlight through the water column, hampering photosynthesis in aquatic plants.

Groundwater pollution

Interactions between groundwater and surface water are complex. Consequently, groundwater pollution, also referred to as groundwater contamination, is not as easily classified as surface water pollution. By its very nature, groundwater aquifers are susceptible to contamination from sources that may not directly affect surface water bodies. The distinction of point vs. non-point source may be irrelevant in some situations.
Analysis of groundwater contamination may focus on soil characteristics and site geology, hydrogeology, hydrology, and the nature of the contaminants. Causes of groundwater pollution include: naturally-occurring , on-site sanitation systems, sewage fertilizers and pesticide, commercial and industrial leaks.

Measurement

Water pollution may be analyzed through several broad categories of methods: physical, chemical and biological. Most involve collection of samples, followed by specialized analytical tests. Some methods may be conducted in situ, without sampling, such as temperature. Government agencies and research organizations have published standardized, validated analytical test methods to facilitate the comparability of results from disparate testing events

Sampling

Sampling of water for physical or chemical testing can be done by several methods, depending on the accuracy needed and the characteristics of the contaminant. Many contamination events are sharply restricted in time, most commonly in association with rain events. For this reason "grab" samples are often inadequate for fully quantifying contaminant levels. Scientists gathering this type of data often employ auto-sampler devices that pump increments of water at either time or discharge intervals.

Sampling for biological testing involves collection of plants and animals from the surface water body. Depending on the type of assessment, the organisms may be identified for biosurveys (population counts) and returned to the water body, or they may be dissected for bioassays to determine toxicity

Further information: Water quality § Sampling and measurement

Physical testing

Common physical tests of water include temperature, solids concentrations (e.g., total suspended solids (TSS)) and turbidity.

Chemical testing

See also: water chemistry analysis and environmental chemistry

Water samples may be examined using the principles of analytical chemistry. Many published test methods are available for both organic and inorganic compounds. Frequently used methods include pH biochemical oxygen demand (BOD), chemical oxygen demand (COD), nutrients (nitrate and phosphorus compounds), metals (including copper, zinc, cadmium, lead and mercury, oil and grease, total petroleum hydrocarbons (TPH), and pesticides

Biological testing

Main article: Bio indicator
Biological testing involves the use of plant, animal or microbial indicators to monitor the health of an aquatic ecosystem. They are any biological species or group of species whose function, population, or status can reveal what degree of ecosystem or environmental integrity is present. One example of a group of bio-indicators are the copepods and other small water crustaceans that are present in many water bodies. Such organisms can be monitored for changes (biochemical, physiological, or behavioral) that may indicate a problem within their ecosystem.
For microbial testing of drinking water, see Bacteriological water analysis.

CONTROL AND REDUCTION

Municipal water waste treatment
In urban areas of developed countries, municipal wastewater or sewage is typically treated by centralized sewage treatment plants. Well-designed and operated systems (i.e., with secondary treatment steps or more advanced treatment) can remove 90 percent or more of the pollutant load in sewage. Some plants have additional systems to remove nutrients and pathogens, but these more advanced treatment steps get progressively more expensive.
Nature-based solutions are also being used instead of (or in combination with) centralized treatment plants.
Cities with sanitary sewer overflows or combined sewer overflows employ one or more engineering approaches to reduce discharges of untreated sewage, including:

- utilizing a green infrastructure approach to improve storm water management capacity throughout the system, and reduce the hydraulic overloading of the treatment plan
- repair and replacement of leaking and malfunctioning equipment
- increasing overall hydraulic capacity of the sewage collection system (often a very expensive option).

On-site sanitation and safely managed sanitation

Further information: Sanitation

Households or businesses not served by a municipal treatment plant may have an individual septic tank, which pre-treats the wastewater on site and infiltrates it into the soil. Improperly designed or installed septic systems can cause groundwater pollution

Globally, about 4.5 billion people do not have safely managed sanitation as of 2017, according to an estimate by the Joint Monitoring Programme for Water Supply and Sanitation Lack of access to sanitation often leads to water pollution, e.g. via the practice of open defecation: during rain events or floods, the human feces are moved from the ground where they were deposited into surface waters. Simple pit latrines may also get flooded during rain events. The use of safely managed sanitation services would prevent this type of water pollution.

Industrial wastewater treatment

Main article: Industrial wastewater treatment

Dissolved air flotation system for treating industrial wastewater.

Some industrial facilities generate wastewater that is similar to domestic sewage and can be treated by sewage treatment plants. Industries that generate wastewater with high concentrations of organic matter (e.g. oil and grease), toxic pollutants (e.g. heavy metals, volatile organic compounds) or nutrients such as ammonia, need specialized treatment systems.[Ch. 16] some industries install a pre-treatment system to remove some pollutants (e.g., toxic compounds), and then discharge the partially treated wastewater to the municipal sewer system.Industries generating large volumes of wastewater typically operate their own treatment

systems. Some industries have been successful at redesigning their manufacturing processes to reduce or eliminate pollutants, through a process called pollution prevention.

To remove heat from wastewater generated by power plants or manufacturing plants the following technologies are used:

- cooling ponds man-made bodies of water designed for cooling by evaporation, convection, and radiation
- cooling towers, which transfer waste heat to the atmosphere through evaporation or heat transfer
- cogeneration, a process where waste heat is recycled for domestic or industrial heating purposes.

Riparian buffer lining a creek in Iowa.

Agricultural wastewater treatment

Main article: Agricultural wastewater treatment

Regarding non-point sources, sediment (loose soil) washed off fields is the largest source of agricultural pollution in the United States.Farmers may utilize erosion controls to reduce runoff flows and retain soil on their fields. Common techniques include contour plowing, crop mulching, crop rotation, planting perennial crops and installing riparian buffers .Nutrients (nitrogenand phosphorus) are typically applied to farmland as commercial fertilizer, animal manure, or spraying of municipal or industrial wastewater (effluent) or sludge. Nutrients may also enter runoff from crop residue, irrigation water, wildlife, and atmospheric deposition Farmers can develop and implement nutrient management plans to reduce excess application of nutrients and reduce the potential for nutrient pollution. To minimize pesticide impacts, farmers may use Integrated Pest Management (IPM) techniques (which

can include biological pest control) to maintain control over pests, reduce reliance on chemical pesticides, and protect water quality.

CONCLUSION

Conclusion

This free course, *Understanding water quality*, provided an introduction to studying *Environment & Development*. It described the main characteristics of natural water and how these may be altered by pollutants of various types. The course also outlined the key stages of treatment for water supply and for treating waste water in sewage treatment works.

In this course you have learned that:

1. Pollution is a deterioration of water quality caused by human agencies that makes the water less suitable for use than it was originally. Water does not have to be completely pure to be considered unpolluted.
2. Natural waters are not completely pure. Rainwater contains dissolved salts in relative proportions similar to those in seawater, but over a thousand times less concentrated. Rainwater contains a greater relative proportion of dissolved gases, particularly carbon dioxide, than seawater, and this makes it slightly acidic. River water has a composition different from both rainwater and seawater; it has a greater concentration of dissolved solids (TDS) than rainwater, and may contain suspended solids. Groundwater usually has slightly greater TDS values than surface water, and varies in composition, depending on the rocks through which it has passed. The TDS value of groundwater depends on the length of time the water has been in contact with rock, so slow-moving, deeper groundwater has a higher TDS value.
3. Pollution can come from many different sources, including domestic sewage, farms, industry, mining, quarrying and cooling. There are many types of pollutants, including natural organic materials, living organisms, plant nutrients, organic and inorganic chemicals, sediments and heat.
4. Water often has to be treated before it is of suitable quality for use. The quality needed depends on the use to which the water is to be put; quality standards for public water supplies are set by the WHO, the EU and some individual countries; but the quality required for industrial water and irrigation water can vary.
5. Sewage treatment aims to reduce the amount of organic and suspended solid material present, remove toxic materials and eliminate pathogenic bacteria, mainly by settlement or biological processes. The effluent is discharged into rivers, lakes or the sea, and the remaining sludge may be dumped at sea (but not in the EU), disposed of on farmland, dumped in landfills or incinerated

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ENVIRONMENTAL POLLUTION

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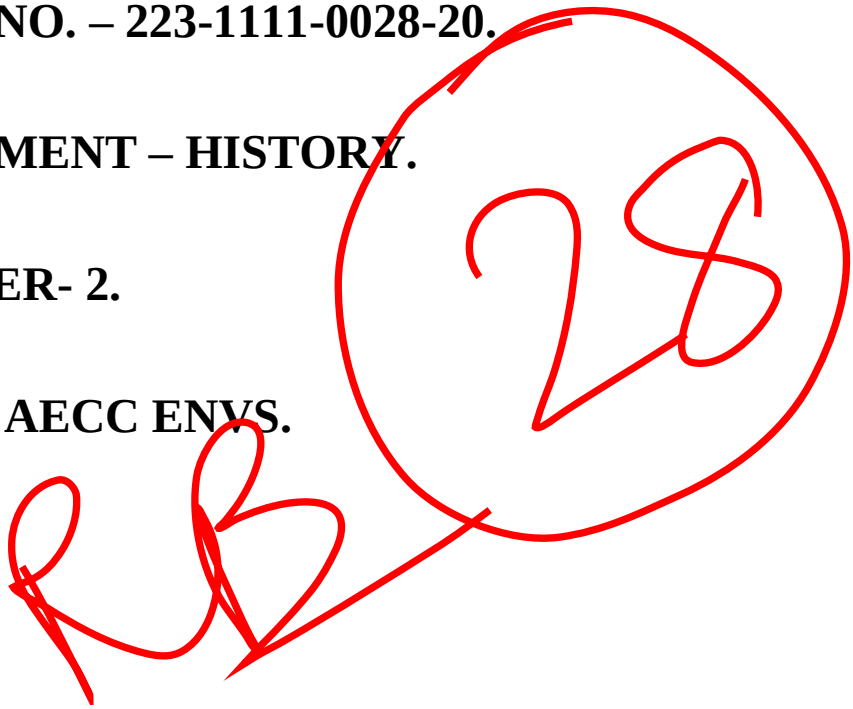
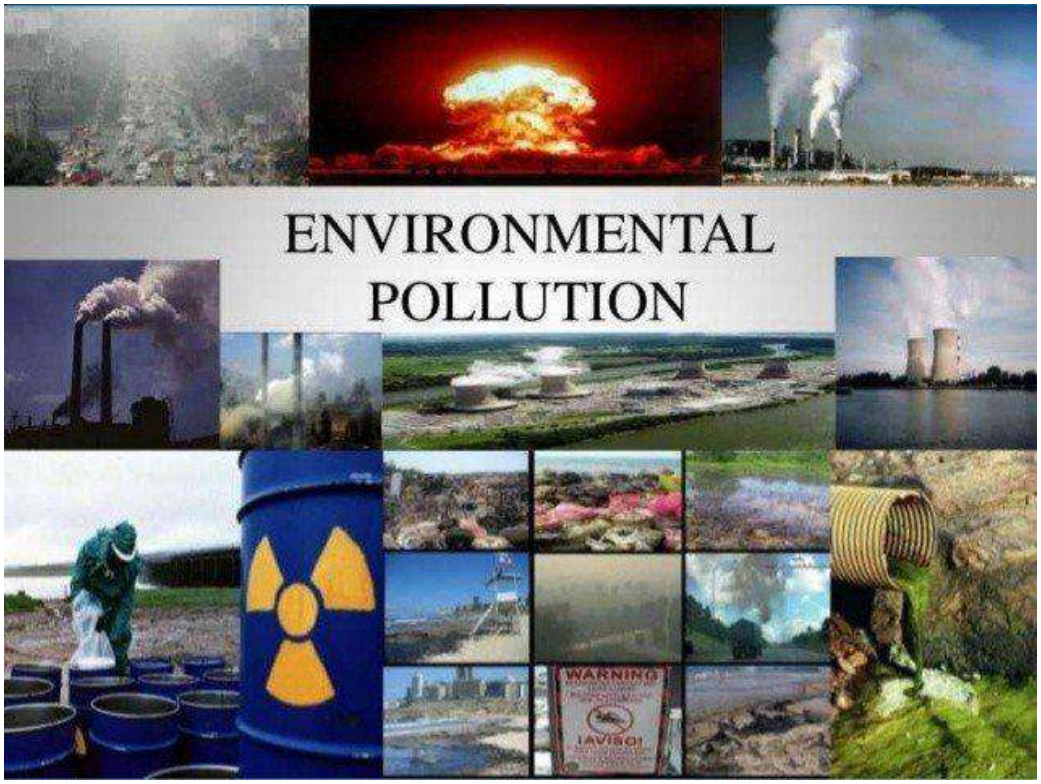


INTRODUCTION:

Environmental pollution is defined as “the contamination of the physical and biological components of the earth’s atmosphere to such an extent that normal environmental processes are adversely affected”. Environmental pollution is not a new phenomenon, yet it remains the world’s greatest problem facing humanity, and the leading environmental causes of morbidity and mortality.



Man’s activities through urbanization, industrialization, mining, and exploration are at the forefront of global environmental pollution. Both developed and developing nations share this burden together, though awareness and stricter laws in developed countries have contributed to a larger extent in protecting the environment. Despite the global attention towards pollution, the impact is still being felt due to its severe long-term consequences. This paper examines the major pollutants, types of pollution—air, water, soil, noise, radioactive etc, their causes and effects and prefers solutions in combating pollution for sustainable environment and health.

ENVIRONMENT POLLUTANTS:

Any substance which causes harmful effects or uneasiness in the organisms may be termed as a pollutant. The materials that cause pollution are of two types:

1. Persistent pollutants: pollutants which remain consistent in the environment for a long period of time without changing its original form are termed as persistent pollutants. For example: pesticides, nuclear wastes and plastics etc.
2. Non-persistent pollutants: pollutants which break down in the simple form are termed as non-persistent pollutants.

From another perspective, pollutants can be classified as follows:

1. Primary Pollutants: Primary pollutants are those which remain in the form in which they were added to the environment for ex. DDT, Plastic etc.
2. Secondary pollutants: Secondary pollutants are formed due to interaction of primary pollutants amongst themselves by the interaction of NOx and Hydrocarbons.

On the basis of nature:

1. Quantitative Pollutants: These substances are already present in the atmosphere but they become pollutant when their concentration level reaches to a particular level which is above a threshold limit.
2. Qualitative Pollutants: These are man-made pollutants e.g. Fungicides, Herbicides etc.

On the basis of origin:

1. Man-made Pollutants.
2. Natural Pollutants.

On the basis of natural of disposal:

1. Biodegradable Pollutants.
2. Non-biodegradable pollutants.

TYPES OF ENVIRONMENTAL POLLUTION:

AIR POLLUTION:

Air pollution is the release of gases and small fragments of human-made particles and chemicals into the air, the concentration of which is harmful to all living and breathing creatures on this planet.

Upon studying global warming, researchers have determined that air pollution is a significant contributor to this problem. The opaqueness of air-polluting particles in the atmosphere traps the sun rays in and prevents the Earth from cooling off naturally. At the same time, other air pollutants are destroying the outer atmospheric layer, primarily the ozone layer (which prevents too much sunlight from entering). Major changes in weather patterns have been recorded around the world, from unexpected monsoons to expanding deserts, caused by primary and secondary air pollutants contributing to climate change.

TYPES OF AIR POLLUTANTS:

Primary pollutants- They are referred to as small solids and particulates that are suspended in the air and come at less than 10 micrometres in size. They can be observed in the form of soot, dust, smoke, fumes and mists, but some are invisible to the human eye. Primary air pollutants are released from the reaction of burning fossil fuels, like when a motorized vehicle running on gasoline emits carbon monoxide. Natural gas burned in houses for heating, major types of fires as well as power plants that release carbon dioxide, carbon monoxide, and sulphur dioxide, nitrogen oxides are also primary air pollutants. Diesel-run

cars and some industrial processes release lead fumes, and at 0.5 micrometres in size, they are extremely harmful primary air pollutants.

Secondary pollutants- refer to as a primary pollutant reacts with another, often natural substance and creates a different pollutant. Ozone is considered a secondary air pollutant as it is formed when a primary air pollutant, nitrogen dioxide, reacts with the hydrocarbon particles naturally present in sunlight. It is the main component of smog, also a secondary pollutant.

Other pollutants are cadmium, lead, mercury, silica, coal dust etc.

CAUSES:

The Burning of Fossil Fuels:

Most of the air pollution takes place due to the burning of fossil fuels such as coal, oil, gasoline to produce energy for electricity or transportation, this is evident from the emission of high levels of carbon monoxide in the environment. Inhaling air induced with pollutants due to the burning of natural gas and fossil fuel reduce earth's ability to pump enough oxygen causing one to suffer respiratory illness.

Industrial Emission:

Industrial activities emit several pollutants in the air that affects the air quality and leads to hazards. Particulate matter like Nitrogen dioxide, Sulphur dioxide, and carbon monoxide are key pollutants that are emitted from industries that use coal and wood as their primary energy source for production of their goods. Industrial pollution effects associated with your health can range from irritation in your eyes and throat to breathing issues, at times can even lead to chronic illness.

Indoor Air Pollution:

Use of toxic products also called as Volatile Organic Compounds (VOCs), inadequate ventilation, humidity level and uneven temperature inside a closed room can lead to indoor air pollution. House air pollution can take place due to ignorant factors, for instance, smoking tobacco in a room or leaving mold infected wall untreated. Use of wood stove or space heaters is capable to increase the humidity level which can lead to health issues.

Microbial Decaying Process:

Manufacturing, chemical, and textiles industries release a large number of carbon monoxides, hydrocarbons, chemicals and organic compounds which contaminate our environment. Bacteria and fungi play a fundamental role in the biogeochemical cycles in nature and are the key indicators of abnormal environmental conditions. Decaying of these microorganisms present in the surroundings releases methane gas which is highly toxic and might lead to death.

Transportation:

Vehicle pollution is a major contributor to air pollution, especially in urban cities. When the car burns gasoline, it emits pollutants like carbon monoxide, hydrocarbons, nitrogen oxide, and particulate matter. When the vehicle pollution is high in the atmosphere, it increases the chances of ozone layer depletion contributing to smog and causing various health issues.

EFFECTS:

GLOBAL WARMING:

Probably global warming is one of the most worrying effects for scientists and environmentalists**.** Global warming is a direct consequence of the greenhouse effect, which is produced by the high emission of CO_2 and methane into the atmosphere. Most of these

emissions are produced by the industry, so this can be remedied by social responsibility and action by companies and factories.

ACID RAIN:

The gases emitted by industries, power plants, boilers, heating and transport are very toxic. Those gases include sulphur dioxide (SO_2) and nitrogen oxides (NOx) issued into the atmosphere that come from fossil fuels burning. When those substances accumulate in the atmosphere and react with water, they form dilute solutions of nitric and sulphuric acid, and when those concentrations become rain, both the environment and surfaces suffer.

SMOG EFFECT:

The smog effect or beret effect happens when there is a kind of dark fog concentrated over the cities and fields. That fog is a load of pollutants and can be of 2 types: sulphurous smog and photochemical smog, both dangerous and harmful to health. Both types of smog are a consequence of industrial and urban action. However, sulphurous smog has its origin mainly in the use of coal in many industrial processes. That has been reduced in the most advanced countries – nevertheless, there are still many developing countries that do not have treatment protocols for pollutants.

HEALTH PROBLEMS IN HUMANS:

It is probably one of the most obvious and worrying effects for human beings. Pollutants can cause respiratory illnesses and allergies ranging from coughs to asthma, cancer or emphysema. Inhalation of toxic agents directly affects the lungs and other organs that makeup the respiratory system. Also, poor oxygenation can lead to cardiovascular problems.

ECONOMIC EFFECTS:

Air pollution costs the world economy $5 trillion per year as a result of productivity losses and degraded quality of life, according to a joint study by the world bank and the Institution

for Health Metrics and Evaluation (IHME) at the University of Washington. These productivity losses are caused by deaths due to diseases caused by air pollution. The report states that additional economic losses caused by air pollution, including health costs and the adverse effect on agricultural and other productivity were not calculated in the report, and thus the actual costs to the world economy are far higher than $5 trillion.

WAYS TO REDUCE AIR POLLUTION:

Because a large share of air pollution is caused by combustion of fossil fuels such as coal and oil, the reduction of these fuels can reduce air pollution drastically. Most effective is the switch to clean power sources such as wind power, hydra power, solar power which don't cause air pollution.

Titanium dioxide has been researched for its ability to reduce air pollution and if used properly can be very effective. For ex: In 2014, Prof Tony Ryan and Prof. Simon Armitage of University of Sheffield prepared a 10 meter by 20 meter-sized posters coated with nanoparticles of titanium dioxide. Placed on a building, this giant poster can absorb the toxic emission from around 20 cars each day.

A very effective means to reduce air pollution is the transition to renewable energy. According to a study published in Energy and Environmental science in 2015 the switch to 100% renewable energy in the United States would eliminate about 62,000 premature mortalities per year and about 42,000 in 2050, if no biomass were used. This would save about $600 billion in health costs a year due to reduced air pollution in 2050, or about 3.6% of the 2014 U.S. gross domestic product.

WATER POLLUTION:

Water pollution is the contamination of the water bodies as a result of human activities or natural phenomena. It occurs when harmful substances often chemicals or microorganisms

contaminate a stream, river, lake, ocean, aquifer, or other body of water, degrading water quality and rendering it toxic to humans or the environment.

TYPES OF WATER POLLUTIONS:

Surface Water Pollution: It refers to the pollution of water resources found above the ground like rivers, lakes and streams. These sources are polluted by the rainwater runoff that transports pollutants to the water. Surface pollution is also caused because of mixing of sewage and toxic chemicals from pesticides, fertilizers and petroleum products.

Chemical Water Pollution: Chemical water pollution is caused because of the various chemicals that mix with water from different sources. These include:

1.Toxic chemicals from industries pollute nearby lakes and rivers and harm aquatic life.
2.Pesticides used in agriculture activities mix with rainwater runoff and enter water sources.
3.Oil spills also harm birds and fishes that come in contact with the contaminate water.

Groundwater Pollution: Groundwater pollution refers to the contamination of water below the earth's surface this water is normally used for drinking purposes and therefore polluting it might lead to health hazards. General pollutants of water are pesticides, chemicals etc.

Microbial Pollution: Various kinds of microorganisms known as pathogens such as bacteria, protozoa and viruses contaminate the water and lead to microbial pollution. This kind of pollution is common in swamps and in uncleaned water bodies. Some examples of microorganisms which contaminate water
are Salmonella, Giardia lamblia, Norovirus and Cryptosporidium parvum.

Ocean Pollution: Substances like plastic, oil, garbage, toxic chemicals when freely suspended in oceans and marines lead to ocean pollution. As stated, more than 80% of ocean pollution is caused because of pollutants from land. Major reasons:

1.Oil spills from marine accidents, routine shipping may pollute the ocean water.

2.Runoff from irrigated land led to increase in nutrients which cause Eutrophication.

3.Dumping of chemicals in oceans is also one major source of ocean pollution.

Thermal Pollution: It is the fluctuation of temperature of water bodies because of human activities which can cause changes to the natural properties of water resources. Major reasons: (a)Power plants and manufacturing industries use water as coolant which causes thermal pollution. (b) deposing of boiling water into water bodies can lead to drop in oxygen levels which is harmful to aquatic life. Etc.

TYPES OF WATER POLLUTANTS:

1. Inorganic Pollutants – They include fine particles of different metals, chlorides, sulphates, oxides of iron, cadmium, acids and alkalis.

2. Organic Pollutants – They Include oils, fats, phenols, organic acids grease and several other organic compounds.

CAUSES OF WATER POLLUTION:

1. Municipal Waste Water: Water bodies contaminated with domestic waste and other materials such as paper, plastic, detergents, cloth etc, becomes municipal waste and is considered to be the main water pollutant. Most of the sewage receives no treatment before discharge, especially in developing countries like India and serves as a major source of water pollution. For ex: In Delhi, 120 crore litres of water are consumed per day, out of which 96 crore litres is drained into the Yamuna River making it contaminated.
2. Industrial Waste water: Industrial activities generate a wide variety of waste products, which are normally discharged into water courses. Major contributors are

the pulp and paper, chemicals, petrochemicals and refining, metal working, food processing, textile etc. The wastes, broadly categorised as heavy metals or synthetic organic compounds. For ex: Along the river Ganga, several chemical, textile, tanning, pulp and paper and other industries are located and all of them discharge their waste water directly or indirectly, into the river making it unsuitable for use.

3. Agricultural Wastes – it is caused by fertilizers, insecticides, pesticides, farm animal wastes and sediments. Fertilizers contain major plants nutrients mainly nitrogen and potassium which when discharged into water bodies can lead to hazards.

4. Radioactive wastes: Elements, such as uranium and radium, possess highly unstable atomic nuclei. This disintegration results in radiation emission which may be highly injurious. During nuclear tests, radioactive dust may encircle the globe at altitudes of 3,000 metres or more, which often comes down to the earth as rain and turns the water bodies unfit for consumption.

EFFECTS:

1.Rising growth of pathogens due to water pollution leads to water-borne diseases like cholera, diarrhoea, typhoid, dysentery etc.

2. Eutrophication which refers to the growth of algae on top of the water body which blocks sunlight from reaching the marine plants, due to which they are unable to perform photosynthesis.

3. Effects of water pollution has drastic effects on groundwater which poses a problem on the health conditions of the society.

MEASURES TO CONTROL:

1. Avoid the wastage of water.
2. Laws for industrial units should be implemented strictly so that polluted water is not disposed of directly into rivers and lakes.
3. Industrial effluents should be treated chemically before disposing them off in water bodies.
4. Over utilisation of pesticides and fertilizers should be avoided.

NOISE POLLUTION:

Noise pollution takes place when there is either an excessive amount of noise or an unpleasant sound that causes a temporary disruption in the natural balance.

TYPES OF NOISE POLLUTION:

Man-Made Noise:

This refers to the noise created due to man-made activities. It can be anything from noise from construction work, vehicular traffic, household noise, noise from pubs and bars etc. Noise range of 30db to 140 db.

Environmental Noise:

Environmental Noise refers to the kind of noise occurring from a range of environmental activities. For ex: Thunderstorms range of 140db.

CAUSES:

This includes Industrialization, Poor urban planning, social events, Transportation, Construction activities, Animal sounds etc.

EFFECTS:

Effects like Hearing problems, psychological issues, physical problems, sleeping disorders, negative effect on wildlife, cardiovascular issues etc.

MEASURES TO CONTROL:

- Establishing regulations that include preventive and corrective measures.
- The mandatory separation between residential zones and sources of noise, like airports.
- controlling the sound levels in clubs, bars, parties, and disc.

SOIL POLLUTION:

It is referred to as the presence of toxic chemicals in soil in higher concentration which can pose a risk to human health or the ecosystem.

CAUSES:

This includes industrial activity, agricultural activities, oil spills, acid rain, etc

EFFECTS:

Effects range from poor health conditions, lack of soil fertility leading to decreased agriculture, poisoning of underground water table, changes in soil structure etc.

MEASURES TO CONTROL:

It can be reduced by limiting the use of chemical fertilizers, promoting afforestation, recycling products, promoting natural manure etc.

RADIOACTIVE POLLUTION:

It occurs when there is a presence or depositions of radioactive materials in the atmosphere or environment after a radioactive disaster. Radioactive materials present in the environment emit hazardous ionizing radiation which may pose serious threats to plant and animal kingdom.

CAUSES:

Accidents in nuclear plants can directly emit large amounts of radiation into the environment turning the place inhabitable. For ex: Chernobyl nuclear disaster, Fukushima Daiichi disaster etc

Use of nuclear weapons as WMD and tests on radiation.

Cosmic rays from the outer space like potassium 40, radium 224 might lead to radiation.

Nuclear waste manhandling and disposal.

EFFECTS:

Radiation pollution leads to Genetic mutations by damaging the DNA strands in a person's body. It makes a person susceptible to cancer, Leukaemia, haemorrhage, premature aging and deaths, impaired new-borns etc.

Radiation makes the soil unfit for cultivation. Plants and animals exposed to radiation also undergo abnormal mutations like in humans leading to sudden deaths.

Radioactive wastes when discharged into water leads to decline of marine life.

MEASURES TO CONTROL:

This includes proper labelling and disposing of radioactive waste, adopting alternatives, proper storage, avoid man-handling etc.

OTHER TYPES OF POLLUTION:

Apart from these Thermal pollution, light pollution and industrial pollution are posing serious threats on the environment.

STEPS TAKEN AT NATIONAL AND GLOBAL LEVEL:

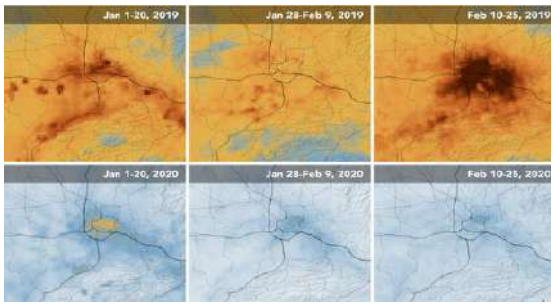
National level: According to recent reports of Central Pollution Control Board (CPCB), Delhi has recorded a 'very poor' air quality score of 345 so to improve conditions government has initiated several campaigns this includes Electric Vehicle policy, establishment of smog

towers to suck out polluted air, spraying of bio decomposers, anti-dust campaigns, ‘red light on Gaadi off’ campaign, Transplantation policy etc. Campaigns have been initiated all over India to plant trees, clean rivers like Ganga, Yamuna and to use renewable sources of energy as an alternative.

Global level: According to the RIO Earth summit 1992 conventions were produced dealing with climate change, biodiversity and a list of development activities called Agenda 21. Developed countries like USA, UK also launched separate plans aiming to reduce air pollution by 2020 for ex: the U.S. Environmental Protection Agency (EPA) addresses several issues, from setting limits on certain air pollutants to enforcing federal clean water and safe drinking laws. World health organization (WHO) has also proclaimed certain laws to reduce air pollution.

IMPACT OF COVID-19 ON ENVIRONMENTAL POLLUTION:

The worldwide disruption caused by the Covid-19 pandemic has resulted in numerous positive effects to the environment and climate. The global reduction in modern human activity such as the considerable decline in travel led to a large drop in air pollution and water pollution in many regions. For ex: In China, lockdowns and other measures resulted in a 25 percent reduction in carbon emission and 50 percent reduction in nitrogen oxides emission.



(pic: Wuhan, China NO2 levels source: wikipedia)

According to NASA scientists, this drop in NO_2 pollution began in Wuhan, China and slowly spread to the rest of the world. The drop was also very drastic because the virus coincided

with the same time of year as the lunar year celebrations in China. As well as in Italy there was a decline of nitrous oxide emission from cars, power plants etc due to lockdown. The Italian city of Venice also saw a significant decline in water pollution as boart trafficking reduced the sediments in the water settled in making the waterbodies much clearer. There was even a significant decline of sesimic noises upto 50% during lockdown in the most crowded cities like New York. Even the amount of poaching and illegal deforestion declined during this period. All these reports from diiferent countries sums up to the general drop of environmental pollution all over the world during the period of pandemic.

CONCLUSION:

Environment pollution is a global problem posing economic, socio cultural and environmental challenges. With the growing urbanisation through out the world (especially in developing countries) there has been a rapid surge in environmental pollution, decline of forests, increase of diseases etc.Therfore, organisations like WHO, EPA have been working on globally to educate common people on how to reduce environmental pollution these are:

(A) Use public transportation whenever possible and follow gasoline refueling instructions.

(B) Look for Energy Star label whenever buying any equipment.

(C) Use environment safe paints and consider using gas logs instead of wood.

(D) Use of non-toxic chemicals as cleaners, degreasers and reusing materials like drums etc.

(E) Reducing the use of water, proper disposal of domestic waste and reusing plastic.

All these precautions if maintained would certainly help in controlling environmental pollution and help in making a more healthy environment following sustainable development.

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জলদূষনের পরিণাম ও প্রতিকার

CU.ROLLNO.-202223-21-0004

CU.REGG.NO.-223-1111-0026-20

DEPARTMENT-BA HONOURS HISTORY

SUB-ENVS

PAPER-AECC2

SEMESTER- second Sem

ভূমিকা

Bbkjসাধারণত মানুষের কার্যকলাপের ফলে জলাশয় দূষিত হয়ে পড়লে, তাকে পানি দূষণ বা জল দূষণ বলে। উদাহরণস্বরূপ, জলাশয় বলতে হ্রদ, নদী, সমুদ্র, ভূগর্ভস্থ সিক্ত শিলাস্তর এবং ভৌমজলকেই বোঝায়। স্বাভাবিক পরিবেশে দূষণকারী পদার্থ উপস্থিত হলে জলদূষণ হয়। উদাহরণস্বরূপ, অপর্যাপ্তভাবে পরিশোধিত বর্জ্যজল যদি স্বাভাবিক জলাশয়ে জমা হয়, তবে তা জলজ বাস্তুতন্ত্রের পরিবেশগত অবনতি ঘটাতে পারে। এর ফলে, ভাটির দিকে বসবাসকারী মানুষের মধ্যে জনস্বাস্থ্যের সমস্যা দেখা দিতে পারে। তারা এই দূষিত জল পান করার কাজে, স্নানের কাজে অথবা সেচের কাজে ব্যবহার করতে পারে। জলবাহিত রোগের প্রকোপে সারা বিশ্বে যত মানুষ আক্রান্ত হয় বা মারা যায়, তাদের সিংহভাগই ঘটে জল দূষণের কারণে।

জলদূষণের কারণসমূহ

জলদূষণকে ভূ-পৃষ্ঠতলীয় জল বা ভৌমজল দূষণ – এই দুইভাগে বিভক্ত করা যায়। সামুদ্রিক দূষণ এবং পুষ্টি দূষণ – জল দূষণের এই দুটি উপসেট। জল দূষণের উৎস দুটি হতে পারে – হয় বিন্দু উৎস নতুবা অ-বিন্দু উৎস। বিন্দু উৎসে দূষণের একটিমাত্র চিহ্নিতযোগ্য কারণ থাকে, যেমন বেনো জল বা বর্জ্যজল পরিশোধক কারখানা। অ-বিন্দু উৎস হল আরো বেশি বিস্তৃত, যেমন কৃষিজ জল।অ-বিন বহু সময় ধরে ক্রমবর্দ্ধিত কাজের ফলেই দূষণ সৃষ্টি হয়। দূষিত জলাশয়ে থাকা অথবা এর সংস্পর্শে আসা সমস্ত গাছ এবং জীবই এর দ্বারা ক্ষতিগ্রস্ত হতে পারে। দূষণের ফলে একক প্রজাতিগুলো ধ্বংস হতে পারে এবং এরা যে স্বাভাবিক জৈব সংগঠনের অন্তর্গত তারও ক্ষতি হতে পারে।

জল দূষণের কারণ হিসেবে প্রচুর রাসায়নিক এবং রোগ-জীবাণুর কথা বলা যেতে পারে; তাছাড়া অনেক ভৌত স্থিতিমাপও রয়েছে। দূষকগুলো জৈব অথবা অজৈব পদার্থের হতে পারে। উচ্চ তাপমাত্রাও দূষিত জলের কারণ হতে পারে। তাপীয় দূষণের একটি সাধারণ কারণ হল তাপবিদ্যুৎ কেন্দ্র এবং শিল্পোৎপাদন কেন্দ্রে কুল্যান্ট হিসেবে জলের ব্যবহার। উচ্চ জলীয় তাপমাত্রা অক্সিজেনের মাত্রা কমিয়ে দেয় যার ফলে মাছ মারা যায় এবং খাদ্যশৃঙ্খলের উপাদানও পরিবর্তিত হয়, প্রজাতির বাস্তুতন্ত্র কমে আসে, এবং এর ফলে তাপের ফলে সৃষ্ট ব্যাকটিরিয়ার নতুন প্রজাতির উদ্ভব হয়।হয়।

জলের নমুনা বিশ্লেষণ করে জল দূষণ পরিমাপ করা হয়। ভৌত, রাসায়নিক এবং জৈব পরীক্ষা করা হতে পারে। সঠিক পরিকাঠামো এবং পরিচালনা পরিকল্পনার দ্বারাই জল দূষণকে নিয়ন্ত্রণ করা যেতে পারে। পরিকাঠামোর মধ্যে থাকতে পারে বর্জ্যজল পরিশোধক কারখানা। বর্জ্যনিকাশী পরিশোধক কারখানা এবং শিল্পজাত বর্জ্যজলের পরিশোধক কারখানা অশোধিত বর্জ্যজলের হাত থেকে জলাশয়গুলোকে রক্ষা করতে পারে। কৃষিখামারের ক্ষেত্রে কৃষিজ বর্জ্যজল পরিশোধন

এবং নির্মাণ স্থানে ভূমিক্ষয় রোধের ব্যবস্থাও জলদূষণ প্রতিরোধ করতে পারে। জল দূষণ রোধের আরেকটি উপায় হল প্রকৃতি-কেন্দ্রিক সমাধান স্রোতের গতি এবং এর পরিমাণ কমিয়ে শহরের নিকাশী ব্যবস্থার কার্যকরী নিয়ন্ত্রণ করা যায়। মার্কিন যুক্তরাষ্ট্রে, জল দূষণের জন্য সেরা পরিচালনা ব্যবস্থা হিসেবে জলের পরিমাণ কমানো এবং জলের মান উন্নত করার চেষ্টা করা হচ্ছে।

জল যদি মানুষবাহিত দূষক দ্বারা ক্ষতিগ্রস্ত হয়, তবে সেই জলকে দূষিত বলা হয়। এইসকল দূষকের ফলে এই জল হয় মানুষের ব্যবহারের যোগ্য হতে পারে না, যেমন জলপানের অযোগ্য হয়ে যায়, অথবা এই জলের জীবগোষ্ঠী ধারণের ক্ষমতাই নষ্ট হয়ে যায়,

যেমন মাছ। আগ্নেয়গিরি, শৈবাল পুষ্প, ঝড়, ভূমিকম্প ইত্যাদি প্রাকৃতিক ঘটনার ফলেও জলের গুণাগুণে এবং এর বাস্তুতান্ত্রিক অবস্থায় প্রভূত পরিবর্তন দেখা দেয়।

জল দূষণ একটি বিশ্বব্যাপী গুরুতর সমস্যা। এর জন্য সর্বস্তরে (আন্তর্জাতিক স্তর থেকে ব্যক্তিগত ভূগর্ভস্থ সিক্ত শিলাস্তর এবং কুয়ো) জলসম্পদ নীতির মূল্যায়ন এবং পুনর্মূল্যায়ন জরুরী। মনে করা হয়, বিশ্বে যত রোগ ও মৃত্যু হয়, তার মুখ্য কারণ হল জল দূষণ। ২০১৫ সালে ১৮ লক্ষ মানুষের মৃত্যুর জন্য দায়ী ছিল জল দূষণ।

বৈশ্বিক সামুদ্রিক পরিবেশগত সমীক্ষা নামক সংস্থার মতে জল দূষণ হল অন্যতম প্রধান একটি পরিবেশগত সমস্যা যেটা পরবর্তী দশকগুলোতে পৃথিবীতে প্রাণের অস্তিত্বকে সংকটে ফেলে দিতে পারে। ফাইটোপ্ল্যাঙ্কটন যেগুলো ৭০% অক্সিজেন উৎপন্ন করে এবং পৃথিবীর কার্বন-ডাই-অক্সাইডের একটি বড়ো অংশ শোষণ করে, জল দূষণ তাদের জন্য একটি অন্যতম সমস্যা। এই পরিস্থিতির মোকাবিলার জন্য সংস্থা থেকে বেশ

কয়েকটি পদক্ষেপ গ্রহণ করা হয়েছে, কিন্তু সেগুলো কার্যকরী হতে দশ বছর সময় ভারত এবং চীন এই দুই দেশে জল দূষণের মাত্রা অত্যন্ত বেশি। ভারতে প্রতিদিন আনুমানিক ৫৮০জন মানুষ জল দূষণজনিত রোগে (জলবাহিত রোগসমেত) মারা যায়। চীনের শহরের জলের প্রায় ৯০ শতাংশই দূষিত। ২০০৭ সালের হিসেবানুযায়ী, চীনের পাঁচ লক্ষ মানুষ নিরাপদ পানীয় জলের থেকে বঞ্চিত।[১৪]

উন্নয়নশীল দেশের এই চূড়ান্ত জল দূষণের পাশাপাশি, উন্নত দেশগুলোও কিন্তু দূষণজনিত সমস্যা নিয়ে লড়াই করে চলেছে। উদাহরণস্বরূপ, ২০০৯ সালের মার্কিন যুক্তরাষ্ট্রের জলের মান রিপোর্টে বলা হয়েছে যে যত মাইল প্রবাহের মূল্যায়ন করা হয়েছে তার ৪৪ শতাংশ, মূল্যায়িত হ্রদের একরের ৬৪ শতাংশ এবং উপসাগর ও মোহনার স্কোয়্যার মাইলের ৩০ শতাংশকে দূষিত বলে জানানো হয়েছে।

জলদূষণের প্রকারভেদ

সামুদ্রিক দূষণ:

সমুদ্রে দূষিত পদার্থের আগমনের একটি সাধারণ পথ হল নদীর জল। এর একটি উদাহরণ হল, নর্দমার জল এবং কারখানার বর্জ্য সরাসরি সমুদ্রে গিয়ে ফেলা।

উন্নয়নশীল দেশগুলোতেই বিশেষ করে এই ধরনের দূষণ দেখা যায়। বাস্তবিক, সারা বিশ্বের ১০টি সর্ববৃহৎ সমুদ্রে প্লাস্টিক দূষণকারী দেশকে বেশি থেকে কম এই ক্রমে সাজালে হয় – চীন, ইন্দোনেশিয়া, ফিলিপাইনস্, ভিয়েতনাম, শ্রীলঙ্কা, থাইল্যান্ড, মিশর, মালয়েশিয়া, নাইজেরিয়া এবং বাংলাদেশ; যেসকল নদীগুলোর মাধ্যমে সমুদ্র দূষিত হয় তারা হল ইয়াঙ্গটজে, সিন্ধু, পীতনদী, হাই, নীল, গঙ্গা, পার্ল, আমুর, নাইজের ও মেকং এবং "পৃথিবীতে সমুদ্রে যত প্লাস্টিক জমা হয়, তার ৯০শতাংশ এইসকল নদীগুলো দ্বারা বাহিত হয়"।

প্লাস্টিক আবর্জনা সমুদ্রের বড় বড় বলয়ের (ঘুর্ণি) মধ্যে আটকে পড়ে। প্লাস্টিক আবর্জনাগুলো সামুদ্রিক দূষণে সৃষ্ট বিষাক্ত পদার্থগুলোকে শোষণ করে নেয় যার ফলে সামুদ্রিক জীব এগুলো খেয়ে ফেললে তাদের শরীরেও বিষ প্রবেশ করতে পারে।[২০] এইসকল দীর্ঘজীবী পদার্থগুলো অনেক সময়েই শেষমেশ সামুদ্রিক পাখি এবং প্রাণীদের পেটে চলে যায়। এর ফলে তাদের হজমের পথ আটকে যায়, যার ফলে তাদের খিদে কমে যায় অথবা এর থেকে তারা অনাহারেও ভুগতে পারে।

মূল দূষক ছাড়াও, তার লব্ধ পরিস্থিতিরও অনেক ধরনের অপ্রত্যক্ষ প্রভাব থাকে। যেমন ভূপৃষ্ঠে জলের স্রোতে পলি ভেসে থাকলে জলস্তম্ভের মধ্যে দিয়ে সূর্যরশ্মি প্রবেশ করতে পারে না এবং এর ফলে জলজ উদ্ভিদের সালোকসংশ্লেষ প্রক্রিয়া ব্যাহত হয়।

ভৌমোজল দূষণ:

ভৌমজল এবং ভূপৃষ্ঠতলীয় জলের মধ্যেকার যোগাযোগটা কিছুটা জটিল। যার ফলে, ভৌমজল

দূষণকে ভূপৃষ্ঠতলীয় জল দূষণ বলা যায় না।[২১] প্রকৃতিগত কারণেই, ভূগর্ভস্থ সিক্ত শিলাস্তরের দূষিত হওয়ার প্রবণতা রয়েছে, কিন্তু এই দূষণের উৎস ভূপৃষ্ঠতলীয় জলাশয়ের প্রত্যক্ষ ক্ষতি নাও করতে পারে। বিন্দু বনাম অ-বিন্দু উৎসের পার্থক্য কিছু ক্ষেত্রে অপ্রাসঙ্গিক হতে পারে।

ভৌমজলের দূষণের বিশ্লেষণের ক্ষেত্রে মাটির বৈশিষ্ট্য এবং স্থানের ভূতত্ত্ব, জল ভূতত্ত্ব, জলবিদ্যা এবং দূষকের প্রকৃতির ওপর নজর দেওয়া হয়। ভৌমজলের দূষণের কারণের মধ্যে যেগুলো থাকে তা হল: সাধারণভাবে ঘটা (জিওজেনিক), স্থানটার শৌচব্যবস্থা, নিকাশি ব্যবস্থা, সার এবং কীটনাশকের

ব্যবহার, বাণিজ্যিক এবং কলকারখানার অবাঞ্ছিত বহির্গমন, হাইড্রলিক ফাটল, ল্যান্ডফিল লিচেট

দূষণ উৎসেরর বিভাগ

ভূপৃষ্ঠতলীয় জল এবং ভৌমজল দুটি পৃথক সম্পদ হিসেবে প্রায়শই চর্চিত এবং আলোচিত হয়, যদিও এদের মধ্যে আন্তর্যোগ রয়েছে।[২১] ভূপৃষ্ঠতলীয় জল মাটির মধ্যে দিয়ে চুঁইয়ে যায় এবং ভৌমজলে রূপান্তরিত হয়। বিপরীতক্রমে, ভৌমজলও ভূপৃষ্ঠতলীয় জলের যোগান দিতে পারে। ভূপৃষ্ঠতলীয় জল দূষণের উৎসকে সাধারণত দুই ভাগে বিভক্ত করা

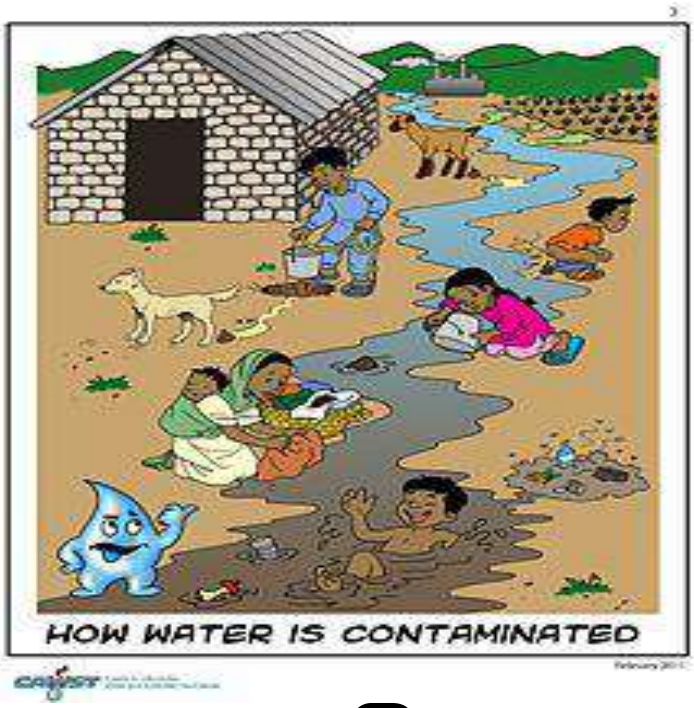
দূষক পদার্থ এবং তাদের উৎস:

জল দূষণকারী নির্দিষ্ট পদার্থগুলো রাসায়নিক, রোগ সংক্রামক জীবাণু, এবং ভৌত পরিবর্তন যেমন উচ্চ

তাপমাত্রা এবং বিবর্ণতার মত বিভিন্ন ধরনের হতে পারে। রাসায়নিক এবং অন্যান্য পদার্থ যাদের নিয়ন্ত্রণ করা হয়, সেসব পদার্থ প্রাকৃতিক হতে পারে (যেমন ক্যালসিয়াম, সোডিয়াম, লোহা, ম্যাঙ্গানিজ প্রভৃতি), কতারা জলের স্বাভাবিক উপাদান না কি দূষক। প্রাকৃতিক উপাদানের উচ্চ ঘনত্ব জলজ উদ্ভিদ ও প্রাণীর ওপরে ক্ষতিকর প্রভাব ফেলতে পারে।

অক্সিজেনের মাত্রা কমিয়ে দেওয়া পদার্থের মধ্যে প্রাকৃতিক বস্তু থাকতে পারে, যেমন উদ্ভিদের অংশ (উদাঃ পাতা এবং ঘাস), আবার মনুষ্যসৃষ্ট রাসায়নিক পদার্থও থাকতে পারে। অন্যান্য প্রাকৃতিক এবং অ্যানথ্রোপোজেনিক পদার্থ জলে টার্বিডিটি (মেঘাচ্ছন্নতা) সৃষ্টি করতে পারে যা আলো প্রবেশে বাধা দেয়, উদ্ভিদের বৃদ্ধি ব্যাহত করে এবং মাছের কিছু প্রজাতির ক্ষেত্রে ফুলকাকে আটকে দেয়।[২৪]

জলের ভৌত রাসায়নিক অবস্থার পরিবর্তনের জন্য দায়ী যেসকল বিষয় তা হল অম্লত্ব (পিএইচ মাত্রার পরিবর্তন), বৈদ্যুতিক পরিবাহীতা, তাপমাত্রা এবং ইউট্রোফিকেশন। ইউট্রোফিকেশনের মাধ্যমে একটি বাস্তুতন্ত্রে রাসায়নিক উপাদানগুলোকে বাড়িয়ে দেওয়া হয় যাতে বাস্তুতন্ত্রটির প্রাথমিক উৎপাদন ক্ষমতার বৃদ্ধি হয়। ইউট্রোফিকেশনের মাত্রার ওপর পরিবেশের নেতিবাচক প্রভাব নির্ভর করে যেমন এর ফলে অ্যানোক্সিয়া (অক্সিজেনের পরিমাণ কমে যাওয়া) হতে এবং জলের মান গুরুতরভাবে হ্রাস পেতে পারে যার ফলে মাছ এবং অন্যান্য প্রাণীকুলের ক্ষতি হয়।



রোগ সংক্রামক জীবাণু

রোগসৃষ্টিকারী অণুজীবগুলোকে রোগ সংক্রামক জীবাণু বা প্যাথোজেন বলা হয়। এইসকল জীবাণুগুলো মানবদেহে বা প্রাণীদেহে জলবাহিত রোগ সৃষ্টি করতে পারে।[২৫] কলিফর্ম ব্যাকটিরিয়া জলবাহিত রোগের প্রকৃত কারণ না হলেও এদেরকেই জল দূষণের একটি ব্যাকটিরিয় মানদণ্ড হিসেবে সাধারণভাবে ব্যবহার করা হয়। অন্যান্য যেসকল অণুজীব দূষিত ভূপৃষ্ঠতলীয় জলে পাওয়া যায় এবং যেগুলো মানব শরীরের ক্ষতিসাধন করে সেগুলো হল:

- বুরখোলডেরিয়া সিউডোমাল্লেই
- ক্রিপ্টোস্পোরিডিয়াম পারভাম
- গিয়ার্ডিয়া আয়ামব্লিয়া
- সালমোনেল্লা
- নোরোভাইরাস এবং অন্যান্য ভাইরাস

পরজীবী কৃমি, সিস্টোসোমা প্রকৃতিসহ[২৬][২৭]

রোগ সংক্রামক জীবাণু সেই নির্দিষ্ট স্থানটির শৌচব্যবস্থা (মলশোধন প্রকোষ্ঠ বা সেপটিক ট্যাঙ্ক, খাটা পায়খানা) অথবা অপর্যাপ্তরূপে শোধিত নিকাশী জলের থেকে অধিক মাত্রায় ছড়িয়ে পড়ে।[২৮] পুরোনো শহরের পুরোনো পরিকাঠামোর নিকাশী ব্যবস্থায় অবাঞ্ছিত বহির্গমনের (নল, পাম্প, ভালভের ফাটল) ফলে নর্দমার দূষিত জল বাইরে চলে আসতে পারে। কিছু শহরে সংযুক্ত নিকাশী ব্যবস্থা আছে যেগুলোর দূষিত জল ঝড় বৃষ্টির সময়ে অপরিশোধিত অবস্থাতেই বাইরে বেরিয়ে আসতে পারে।[২৯] নর্দমার দূষিত জলের পাঁকও (অধঃক্ষিপ্ত) জলাশয়কে দূষিত হয়।

গৃহপালিত পশু সংক্রান্ত কাজকর্ম যেখানে চলে সেসব জায়গা খারাপভাবে পরিচালিত হলেও রোগজীবাণুর সংক্রমণ হতে পারে।

জৈব, অজৈব এবং ম্যাক্রোস্কোপিক দূষণকারী পপদার্থ

__এইসকল দূষণকারী পদার্থগুলো জৈব এবং অজৈব পদার্থ হতে পারে। অনেক রাসায়নিক পদার্থও বিষাক্ত হয়।

নিউজিল্যান্ডের অকল্যান্ডের একটি শহরের ছোট নদীতে দূষণ কমানোর জন্য একটি আবর্জনা সংগ্রহের বৃদ্ধি।

জৈব জল দূষকের মধ্যে যেগুলো পড়ে, তা হল:

ডিটারজেন্টস্

রাসায়নিকভাবে জীবাণুমুক্ত পানীয় জলের মধ্যে থাকা জীবাণুধ্বংসকারী উপজাত পদার্থ, যেমন ক্লোরোফর্ম

খাদ্য প্রক্রিয়াকরণজাত বর্জ্য, যেগুলোর মধ্যে রয়েছে অক্সিজেনের চাহিদাযুক্ত পদার্থ, চর্বি, গ্রিজ

কীটনাশক এবং ভেষজনাশক, বিভিন্ন ধরনের অর্গ্যানোহ্যালাইডস এবং অন্যান্য রাসায়নিক যৌগ

পেট্রোলিয়াম হাইড্রোকার্বন, যেমন জ্বালানি (পেট্রোল, ডিজেল জ্বালানি, জেট জ্বালানি, এবং জ্বালানি তেল) এবং পিচ্ছিলকারক তেল (মোটর তেল), এবং বেনোজলের মধ্যে দিয়ে বয়ে আসা জ্বালানির দহন-পরবর্তী উপজাত পদার্থ[৩০]

উদ্বায়ী জৈব যৌগ, যেমন অনুপযুক্ত সঞ্চয়স্থান থেকে ছড়িয়ে পড়া কারখানার দ্রাবক।

ক্লোরিনযুক্ত দ্রাবক, এগুলো ঘন অ-জলীয় দশার তরল যা জলে ভালোভাবে দ্রবীভূত না হতে পারার জন্য এবং ঘনত্ব বাড়িয়ে তোলার কারণে জলাধারের তলায় গিয়ে সঞ্চিত হয়।

পলিক্লোরিনেটেড বাইফিনাইল (পিসিবি)

ট্রাইক্লোরোইথিলিন

পার্চক্লোরেট

ব্যক্তিগত স্বাস্থ্যবিধি দ্রব্য এবং প্রসাধনী দ্রব্যে উপস্থিত বিভিন্ন রাসায়নিক যৌগ

ড্রাগ দূষণ যার মধ্যে রয়েছে ওষুধ ড্রাগ এবং তাদের বিপাকজাত দ্রব্য। এসবের মধ্যে রয়েছে অ্যান্টিডিপ্রেস্যান্ট ড্রাগ অথবা গর্ভনিরোধক বড়ির মত হর্মোন ওষুধ। এসকল অণুগুলো এতই ক্ষুদ্র যে দামী ও উন্নত শোধক কারখানা ছাড়া এদেরকে মুক্ত করা বেশ জটিল।

অজৈব জল দূষণকারী পদার্থগুলোর মধ্যে রয়েছে:

শিল্পকারখানার বর্জ্য নিষ্কাশনের দ্বারা সৃষ্ট অম্লত্ব (বিশেষ করে তাপবিদ্যুৎ কেন্দ্রের সালফার ডাই-অক্সাইড)

খাদ্য প্রক্রিয়াকরণের বর্জ্য থেকে প্রাপ্ত অ্যামোনিয়া

শিল্পকারখানার উপজাত হিসেবে প্রাপ্ত রাসায়নিক বর্জ্য

নাইট্রেট এবং ফসফেট জাতীয় উপাদানযুক্ত সার যা কৃষিজমি থেকে এবং বাণিজ্যিক ও গৃহস্থ ব্যবহারের ফলেও বৃষ্টির জলের সাথে যুক্ত হয় মোটর গাড়ির ভারী ধাতু (শহরের বর্ষার জলের প্রবাহের মাধ্যমে এবং অম্ল খনির নর্দমা

কেওসোট সংরক্ষণকারী থেকে নিঃসৃত পদার্থের জলজ বাস্তুতন্ত্রে গিয়ে মেশা

নির্মায়মান অঞ্চল, বৃক্ষচ্ছেদন, ঝুম চাষ অথবা ভূমি নিষ্কাশন অঞ্চল থেকে প্রবাহিত জলের পলি (অধঃক্ষিপ্ত)

ম্যাক্রোস্কোপিক দূষণ – জল দূষণকারী দৃশ্যমান বড়ো বড়ো পদার্থ – যেগুলোকে শহরের ঝোড়ো জলের প্রেক্ষিতে ভাসমান বলা চলে, অথবা সামুদ্রিক জঞ্জাল যখন উন্মুক্ত সাগরে পাওয়া যায় এবং এইধরনের পদার্থগুলোকে নিম্নলিখিতভাবে অন্তর্ভুক্ত করা যায়:

মাটিতে মানুষের দ্বারা পরিত্যক্ত আবর্জনা (যেমন, কাগজ, প্লাস্টিক, অথবা নষ্ট খাবার), এর সাথে রয়েছে দুর্ঘটনাপ্রযুক্ত অথবা ইচ্ছাকৃতভাবে আবর্জনার স্তুপ তৈরি, যা বৃষ্টির জলের সাথে ধুয়ে যায় এবং ভূপৃষ্ঠতলীয় জলে উন্মুক্ত হয়।

নার্ডল, ছোট ছোট সর্বব্যাপী ছড়িয়ে থাকা জলের প্লাস্টিকের টুকরো।

পরিত্যক্ত ভাঙা জাহাজ।

জলদূষণ প্রতিকারের উপায়:

পৌরসভার বর্জ্যজলের শোধন:

উন্নত দেশের শহরে, পৌরসভার বর্জ্যজল (অথবা নিকাশী জল) কেন্দ্রীভূত নিকাশী জলের শোধনকারী কারখানা দ্বারা বিশেষভাবে পরিশোধিত হয়। ভালোভাবে পরিকল্পিত এবং পরিচালিত ব্যবস্থার মাধ্যমে (যেমন, মাধ্যমিক শোধনকারী পদক্ষেপ অথবা আরো উন্নত শোধন) ৯০ শতাংশ বা তার বেশি দূষণকারী পদার্থ নিকাশী জল থেকে দূর করা যায়।[৩৮] কোন কোন কারখানায় অতিরিক্ত ব্যবস্থা থাকে যাতে পুষ্টিকর উপাদান এবং রোগ সংক্রামক জীবাণু দূর করা যেতে পারে, কিন্তু এইসকল আরো উন্নত শোধনমূলক পদক্ষেপ ক্রমশই আরো বেশি ব্যয়বহুল হয়ে পড়ছে।

কেন্দ্রীভূত শোধনকারী কারখানার পরিবর্তে (অথবা পাশাপাশি) পরিবেশভিত্তিক সমাধানও ব্যবহার করা হচ্ছে।[৬]

যেসব শহরে শৌচালয়ের নর্দমার জল উপচে পড়ে অথবা সংযুক্ত নর্দমার জল উপচে পড়ে তারা সেইসব অশোধিত নির্গমন রোধ করতে এক বা একাধিক প্রকৌশলী ব্যবস্থা নেয়, যার মধ্যে রয়েছে:

একটি সবুজ পরিকাঠামোমূলক ব্যবস্থা গ্রহণ করা হয় যাতে সমগ্র ব্যবস্থাটির ঝড়ো জলের পরিচালন ক্ষমতা উন্নত হতে পারে এবং শোধনকারী কারখানার হাইড্রলিকের ওপর অতিরিক্ত চাপ কমাতে পারে।[৩৯]

অবাঞ্ছিত নির্গমন এবং বিকল যন্ত্রের মেরামত ও বদল।[২৯]

নিকাশী সংগ্রহ ব্যবস্থাটির সামগ্রিক হাইড্রলিক ক্ষমতাবৃদ্ধি (এটা অধিকাংশ ক্ষেত্রেই একটি ব্যয়বহুল

বিকল্প)।

নির্দিষ্ট স্থানের পয়ঃনিষ্কাশন ব্যবস্থা এবং নিরাপদরূপে পরিচালিত পয়ঃনিষ্কাশন ব্যবস্থা:

_যেসকল অঞ্চলে পৌরসভার শোধনকারী কারখানা নেই সেসকল জায়গায় অবস্থিত বাড়ির এবং ব্যবসায়ী অঞ্চলে ব্যক্তিগত সেপ্টিক ট্যাঙ্ক বা মলশোধনকারী প্রকোষ্ঠ থাকে যা সেই নির্দিষ্ট স্থানের বর্জ্যজলকে পূর্বেই শোধন করে দেয় এবং তা মাটিতে গিয়ে চুঁইয়ে

জমা হয়। ভুল পরিকল্পিত অথবা স্থাপিত সেপ্টিক ব্যবস্থা ভৌমজলের দূষণ ঘটাতে পারে। জয়েন্ট মনিটরিং প্রোগ্রাম ফর ওয়াটার সাপ্লাই অ্যান্ড স্যানিটেশনের একটি হিসেব অনুযায়ী, ২০১৭ সালে সমগ্র বিশ্বে প্রায় ৪৫ কোটি মানুষের কাছে নিরাপদভাবে পরিচালিত কোন স্যানিটেশন নেই।[৪০] স্যানিটেশনের অভাবে প্রায়শই জল দূষণ হয়, যেমন উন্মুক্ত মলত্যাগের অভ্যাসের মাধ্যমে: বৃষ্টি অথবা বন্যায় মানুষের মল মাটির তলায় চলে যায় যেখান থেকে সেগুলো ভূপৃষ্ঠতলীয় জলে জমা হতে থাকে। সাধারণ খাটা পায়খানাও বৃষ্টির জলে প্লাবিত হতে পারে। নিরাপদভাবে পরিচালিত স্যানিটেশন ব্যবস্থার ফলে এই ধরনের জল দূষণ রোধ করা যেতে পারে।[৪০]

কলকারখানার বর্জ্যজলের শোধন:

____কিছু শিল্পকারখানা থেকে বর্জ্যজল নিষ্কাশিত হয় যেগুলো গৃহস্থ বর্জ্যজলের মতই এবং নিকাশী জলের শোধনকারী কারখানা কর্তৃক পরিশোধিত করা যেতে পারে। যেসকল কলকারখানা থেকে বর্জ্যজলের সাথে উচ্চ ঘনত্বের জৈব পদার্থ (যেমন, তেল ও গ্রীজ),

বিষাক্ত দূষণকারী পদার্থ (যেমন, ভারী ধাতু, উদ্বায়ী জৈব যৌগ) অথবা জৈব উপাদান যেমন অ্যামোনিয়া নির্গত হয়, তাদের বিশেষ রকম শোধনকারী ব্যবস্থা প্রয়োজন হয়।[৪১] ছোটখাটো কলকারখানাগুলো একটি প্রাক-শোধনকারী ব্যবস্থা স্থাপন করে যার দ্বারা কিছু দূষণকারী পদার্থ বেরিয়ে যায় (যেমন, বিষাক্ত যৌগ), এবং তারপর এরা সেই অর্ধপরিশোধিত বর্জ্যজল পৌরসভার নিকাশী ব্যবস্থায় মুক্ত করে।[৪২][৪৩] যেসকল কলকারখানার বর্জ্যজলের পরিমাণ অত্যন্ত অধিক হয়, তারা নিজস্ব শোধনকারী ব্যবস্থা পরিচালনা করে। কিছু কলকারখানা তাদের নির্মাণ পদ্ধতির পুনর্পরিকল্পনা করে দূষণকারী পদার্থের দূরীকরণ অথবা হ্রাস করতে সফল হয়েছে; এই পদ্ধতিকে বলা হয় দূষণ রোধ।

তাপবিদ্যুৎ কেন্দ্র অথবা নির্মাণ কারখানা থেকে উৎপন্ন বর্জ্যজলের তাপ দূর করতে নিম্নলিখিত প্রযুক্তি ব্যবহার করা হয়:

শীতলকারী পুকুর, বাষ্পীভবন, পরিবহন ও বিকিরণের মাধ্যমে শীতল করার উদ্দেশ্যে কৃত্রিম জলাশয়ের নির্মাণ।

শীতলকারী টাওয়ার, যেগুলো বাষ্পীভবন অথবা তাপ স্থানান্তরের মাধ্যমে বর্জ্য তাপকে পরিবেশে স্থানান্তরিত করে

কোজেনারেশন, এমন একটি পদ্ধতি যেখানে বর্জ্য তাপ গৃহস্থ বাড়িতে অথবা কলকারখানায় তাপ ব্যবহারের জন্য পুনর্ব্যবহারযোগ্য করে তোলা হয়।[৪৪]

কৃষিজমির বর্জ্যজলের পরিশোধন:

মার্কিন যুক্তরাষ্ট্রে সবথেকে বেশি পরিমাণ কৃষি দূষণ অধঃক্ষিপ্ত পলি (মাটির গুঁড়ো) জমি থেকে ধুয়ে যাবার ফলে ঘটে থাকে।[২৪] কৃষকরা ভূমিক্ষয় রোধ করার মাধ্যমে এইধরনের ধুয়ে যাওয়া রোধ করতে পারেন এবং মাটিকে তাঁদের কৃষিক্ষেত্রে ধরে রাখতে পারেন। কনট্যুর প্লাওয়িং, ক্রপ মালচিং, ক্রপ রোটেশান, বহুবর্ষজীবী শস্যের চাষ এবং রিপারিয়ান বাফার স্থাপন করা প্রভৃতি হল ভূমিক্ষয় রোধের সাধারণ

কিছু উপায়। কৃষিক্ষেত্রে যেসকল সার উপাদান (নাইট্রোজেন ও ফসফরাস) প্রয়োগ করা হয় তা হল, বাণিজ্যিক সার, পশুর বর্জ্য, অথবা পৌরসভার বা কলকারখানার বর্জ্যজল (প্রবাহ) বা কাদামাটি ছড়িয়ে দেওয়া। এইসকল সার উপাদানগুলো শস্যের শেষাংশ, সেচ জল, বন্য প্রাণী এবং পরিবেশগত সঞ্চয়ের মাধ্যমেও প্রবাহে মিশতে পারে।m কৃষকরা সার উপাদান ব্যবস্থাপনা পরিকল্পনা করে সারের অতিরিক্ত প্রয়োগ কমাতে পারেন এবং সার উপাদান দূষণের সম্ভাবনাকে কমাতে পারেন। কীটনাশকের প্রভাব কমাতে, কৃষকরা সম্মিলিত কীট ব্যবস্থাপনা প্রযুক্তি ব্যবহার করতে পারেন (যার মধ্যে থাকতে পারে জৈব কীট দমন) যার ফলে কীটের ওপর নিয়ন্ত্রণও রাখা যাবে আর অন্যদিকে রাসায়নিক কীটনাশকের ওপর নির্ভরশীলতাও কমবে; এতে জলের গুণমান বজায় রাখা সম্ভব হবে।[৪৭]

যেসকল খামারে অত্যন্ত বেশি পরিমাণে পশুর অথবা মুরগী সংক্রান্ত কাজকর্ম করা হয়, যেমন খামার কারখানা সেগুলোকে মার্কিন যুক্তরাষ্ট্রে কনসেন্ট্রেটেড্ অ্যানিমাল ফিডিং অপারেশনস্ অথবা ফিডলটস্ বলা

হয় এবং এগুলোকে বেশি পরিমাণে সরকারী নিয়ন্ত্রণের আওতায় আনা হয়েছে।[৪৮][৪৯] পশুর বর্জ্যের অধঃক্ষিপ্ত অংশকে অবায়বীয় হ্রদের মধ্যে রেখে শোধন করা হয় এবং তারপর স্প্রে করে বা চুঁইয়ে ফেলার মাধ্যমে ঘাসজমিতে উন্মুক্ত করা হয়। পশুর বর্জ্যের শোধনের জন্য অনেকসময় নির্মিত জলাভূমিও ব্যবহৃত হয়। কিছু পশুর বর্জ্যকে আবার খড়ের সাথে মিশিয়ে শোধন করা হয় এবং উচ্চ তাপমাত্রায় মিশ্রসারে রূপান্তরিত করে তাকে ব্যাকটিরিয়াগতভাবে নির্বীজ করে তোলা হয় এবং এভাবে খাঁটি সারে পরিণত করে মাটির উন্নতি করা হয়। এইসকল প্রযুক্তিকে "বিন্দু উৎস নিয়ন্ত্রণ" বলা হয়।

উপসংহার:

জলের ওপর নাম জীবন এই কথাটি খুবই প্রাসঙ্গিক সংগ্র জিবকুলকে বাঁচিয়ে রাখার জন্য জলের অবদান অনস্বীকার্য যে ছাড়া পৃথিবীর বুকে জিবকুলের অস্তিত্ব বজায় থাকতো না। কিন্তু মানবসভ্যতার অগ্রগতির সঙ্গে সঙ্গে সমগ্র পরিবেশের পাশাপাশি জল ব্যাপকভাবে দূষিত হচ্ছে যার জন্য দাই মানুষের বিবেচনাহিন ক্রিয়াকলাপ যা আগামী দিনে সমগ্র বিশ্বকে বিপদের

সম্মুখীন করবে। কিন্তু এই জলদুষণের পরিস্থিতিকে সামাল দেওয়ার উপায় একমাত্র মানবজাতির সচেতনতা।

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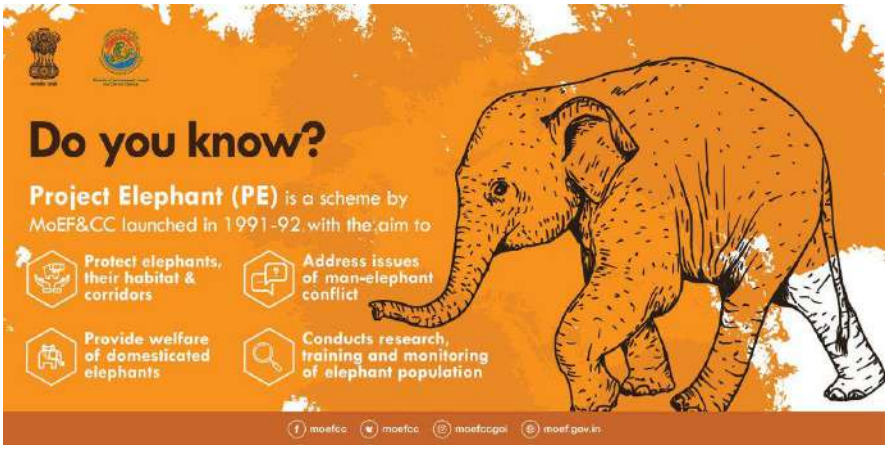
INTRODUCTION



Project elephant

The Asian elephant *(elephas maximus indicus)*, albeit being slightly smaller than the African elephant, is the largest land mammal on the Asian continent, found throughout Southeast Asia, including Myanmar, Thailand, Cambodia, and Laos. They weigh around 11,000 pounds (4989.5 kg), and their height is around 6.5-11.5 ft. (198-351cm). This social and extremely intelligent animal has unfortunately been listed as *Endangered* on the *International union for conservation of nature (IUCN) Red List*, since 1986, with their numbers having dropped by at least 50% over the last three generations, with a population fewer than 50,000. As the Asian elephants' threats of attrition was increasing,

Project Elephant (PE) was initiated by *the Government of India and Ministry of Environment and Forests* in the year 1992 as a Centrally Sponsored Scheme.

It aimed in assisting major elephant range state in the country, both financially and technically, and ensure long term survival of the elephants in their natural habitat. As we proceed, we will learn more about the causes of the rapid depletion of Asian elephant, and Project Elephant.

CAUSES FOR THE RAPID DECLINE OF ELEPHANTS

Habitat Loss

1. **Habitat loss:** The greatest threat to wild Asian elephants is habitat loss, leading to fragmentation. Throughout the decades, humans have cleared large areas of forest and have been rapidly urbanizing and industrializing them. Elephants have been pushed into hilly landscapes and less suitable living conditions, but even these less accessible habitats are being assaulted by poachers, loggers, and developers. The continuous is marked by increasingly broken up by dams, tea and coffee plantations, roads, and railway lines. These developments obstruct the seasonal migrations of elephant clans. Habitat fragmentation also divides elephant populations into small, isolated groups, which are then at risk of inbreeding.

Some biologists believe that there are no longer any wild Asian elephant populations large enough to avoid genetic deterioration over the long term.

2. **Elephant-human conflict:** Elephant-human conflict is a grave threat to their continued existence, the major reason being the loss of habitat. As their habitat shrinks, elephants move towards the areas with vast amount of crops, and because of their giant stature, they cause damage to crops, property, etc., amounting from a few thousand dollars to millions of dollars. Every year, 100 humans (in some years it may be 300 people) and 40-50 elephants are killed during crop raiding in India. This boils up hatred and resentment towards the land mammal, and farmers uses poison and gunfire in retaliation. Such conflicts not only cost the lives of the elephants, but also the humans, crops and property.

3. **Illegal poaching of Elephants:** Even though African elephants are hunted down more for their tusks, Asian elephants, especially males are a great risks as well. Ivory has been an object of great value since the earlier times, the demand for ivory in present times in Asian market has skyrocketed, therefore making illegal ivory trade extremely profitable.

In 1989, the *Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)*, a global agreement among governments to regulate or ban international trade in species under threat, banned the international trade in elephant ivory. However, there are still places where the trade is thriving, and unregulated domestic ivory markets in a number of countries fuel the illegal international trade. Not only that, the illegal market for poaching is also fueled by selling of elephants' skin, tail, hair and meat.

Capture of elephants for Tourism

4. **<u>Capture of elephants:</u>** Many young elephants are removed from the wild to supply tourist and entertainment industries. Capture of wild elephants, previously used for labor and now increasingly for tourism, has played a key role in the decline in wild populations

And is now considered a potentially significant threat to wild Asian elephants.

The report, *"Taken for a ride"* says that in India, most of the 3,500 elephants in captivity are used for some form of riding activity. It adds that around 116 elephants *"continue to endure abuse to entertain tourists at Amer Fort in Rajasthan"*. Elephants go through mental and physical strain during their captivity, and most young elephants couldn't live up to 5 years.

> *"All wild-caught and captive-bred elephants undergo cruel training in early years if they are to be used for activities such as riding and shows. In many cases, severe pain is inflicted to speed up the process, including stabbing with hooks or other tools to establish dominance over the elephant."*
>
> - *Taken for a ride.*

OBJECTIVES AND AIMS OF PROJECT ELEPHANT

Objectives of PE:

1. To conserve and protect elephant population and to ensure that any population remains healthy within their own safe ecosystem.

2. To conserve and protect the habitat of the elephant, and to reverse the deterioration of these habitats.

3. To take definite steps against illegal poaching and trade.

4. To create conditions, through eco-development activities, welfare measures and mitigation of elephant depredation for nurturing the traditional compassion and tolerance of the people living in and around elephant habitats.

5. To address elephant-human conflict, and educate people about the ecological significance of conserving the elephants and to revive the historical reverence and compassion for elephants.

6. To address the issue of elephants being captured and used as an object for entertainment and tourism.

7. To encourage, and create facilities for research related to the ecological significance of elephant and veterinary care of the animal.

Aims of PE:

1. Develop strategies to prevent unnatural causes of elephants' death in India.

2. To reduce and remove domestic livestock grazing, the pressure of humans and their activities in important elephant habitats.

3. To educate the public regarding elephant conservation.

4. To facilitate in proper veterinary care for good health and Nurturing of the elephants.

ACTIVITIES FOR PROJECT ELEPHANT

The Elephant range States have taken various activities to mitigate Man-Elephant conflict, improvement of Elephant Habitat, and conservation of the Elephants. Some of the activities are as follows:

(a) For better management of wild Elephants and their habitats, 28 Elephant Reserves have been established by the States.

(b) Habitat improvement and restoration of Elephant Corridors in Elephant Range States.

(c) Infrastructure improvement in Elephant Reserves for effective management of elephant population.

(d) Anti-depredation squads, anti-poaching squads and trekkers are engaged for protection of elephants.

(e) To restrict menace of elephants to human habitations, solar fencing, trenches and stone walling are being provided in the depredation prone localities.

(f) Studies on various issues such as man animal conflict, carrying capacity of elephant habitat are encouraged.

(g) Awareness programme took among the local villagers are taken to minimize conflict with wild elephants.

STRATERGIES OF PROJECT ELEPHANT

1. Project elephant is mainly implemented in 16 States / UTs, which includes Andhra Pradesh, Arunachal Pradesh, Assam, Jharkhand, Kerala, Nagaland, Meghalaya, Karnataka, Tamil Nadu, Uttar Pradesh, Orissa, Uttaranchal West Bengal Maharashtra and Chhattisgarh.

2. Training of mahouts and elephant managers

3. Evolving appropriate management of the designated 'Elephant Reserves' and other Elephant Habitats and conservation of the traditional migratory paths.

4. Improvement of the quality and security of the life of the human population who share any elephant habitat and its resources for daily living.

5. Management of problem elephants by domestication or adoption.

MONITORING OF ILLEGAL KILLING OF ELEPHANTS (MIKE)

Monitoring of illegal killing elephants, or MIKE is an international collaboration that measures the levels, trends and causes of elephant mortality. It has started in South Asia, and in 2003 after the conference of parties. The MIKE Programme was established by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) by Resolution 10.10 adopted at the tenth Conference of the Parties in 1997.

Objectives of MIKE:

-To measure the levels and trends in the illegal poaching of elephants. To ensure that complete protection is provided to the giant land mammal.

-Monthly data collection is to be taken from all MIKE regions and submitted to the sub-regional support office for South Asia programme located in Delhi.

LIST OF ELEPHANT RESERVES IN INDIA

Mayurjharna Elephant reserve

Zone	State	Elephant Reserves
North-Western Landscape	Uttrakhand	Shivalik Elephant Reserve
	Uttarpradesh	Uttar Pradesh Elephant Reserve
East-Central Landscape	West Bengal	Mayurjharna Elephant Reserve
	Jharkhand	Singhbhum Elephant Reserve

Kaziranga-Karbi Anglong-Intanki Landscape	Assam	Kaziranga-Karbi Anglong Elephant Reserve Dhansiri-Lungding Elephant Reserve
	Nagaland	Intanki Elephant Reserve
North Bengal- Greater Manas Landscape	Assam	Chirang-Ripu Elephant Reserve
	West Bengal	Eastern Dooars Elephant Reserve
Meghalaya Landscape	Meghalaya	Garo Hills Elephant Reserve Khasi-hills Elephant Reserve
Brahmagiri- Nilgiri-Eastern Ghats Landscape	Karnataka	Mysore Elephant Reserve
	Kerala	Wayanad Elephant Reserve Nilambur Elephant Reserve
	Tamil Nadu	Coimbatore Elephant Reserve Nilgiri Elephant Reserve
	Andhra Pradesh	Rayala Elephant Reserve
Annamalai- Nelliyampathy- High Range Landscape	Tamil Nadu	Annamalai Elephant Reserve
	Kerala	Anamudi Elephant Reserve
Periyar- Agasthyamalai Landscape	Kerala	Periyar Elephant Reserve
	Tamil Nadu	Srivilliputhur Elephant Reserve

WHAT CAN WE DO TO PROTECT THE ELEPHANTS

1. *Support the ban of ivory trade:* As previously mentioned, male elephants are exclusively hunted down for their tusks. Even though there is a ban on new ivory, there are still markets which sell antique ivory. More than 55 elephants per day are gruesomely getting killed by poachers for their tusks.

2. *Choose Elephant-friendly wood and coffee:* The coffee and timber which is often grown from the plantations and forests, which once belonged to the elephant's habitat. From next time, make sure to look for Forest Stewardship Council (FSC) certified timber and certified fair trade coffee while purchasing the products.

3. *Choose Ethical tours:* Elephants are usually captured from the forests, held in captive, abused and was used for tourism. Choose ethical elephants tours that allow you to come in contact with the elephants in their ecosystem, and not cause any harm to them.

4. *Adopt elephants:* There are wildlife organizations, which lets you adopt elephants. By doing that, you are helping in funding or the elephant's healthcare, protection in the wild and overall conservation of these giants.

5. *Educate yourselves:* Many are not educated in the conservation of the elephants, how the rapid decline of these mammals. Take the initiative to educate yourselves in these matters and help educate others around you.

CONCLUSION

World Elephant Day is celebrated on August 12 is an international annual event, dedicated to the preservation and protection of the world's elephants. According to recent reports, the elephant population in India is demonstrating a stable trend across elephant reserves in India. The population of elephants in the year 2012, was estimated at 31,368 while it had fallen to 27312 in 2017. The elephant population of India was 27,682 in 2007. The average population throughout the period was about 26700. Throughout India, there are people who often adopt these mammals, which is very beneficial for their preservation. There are improvements of Elephant-Human conflict within the region. The government of India in 2010 has declared Elephants as the National Heritage animal of India. The process of achieving the goals of PE might be slow, but by being aware of these projects may help us, as citizens, to be a part of ensuring best possible treatment to our Giant.

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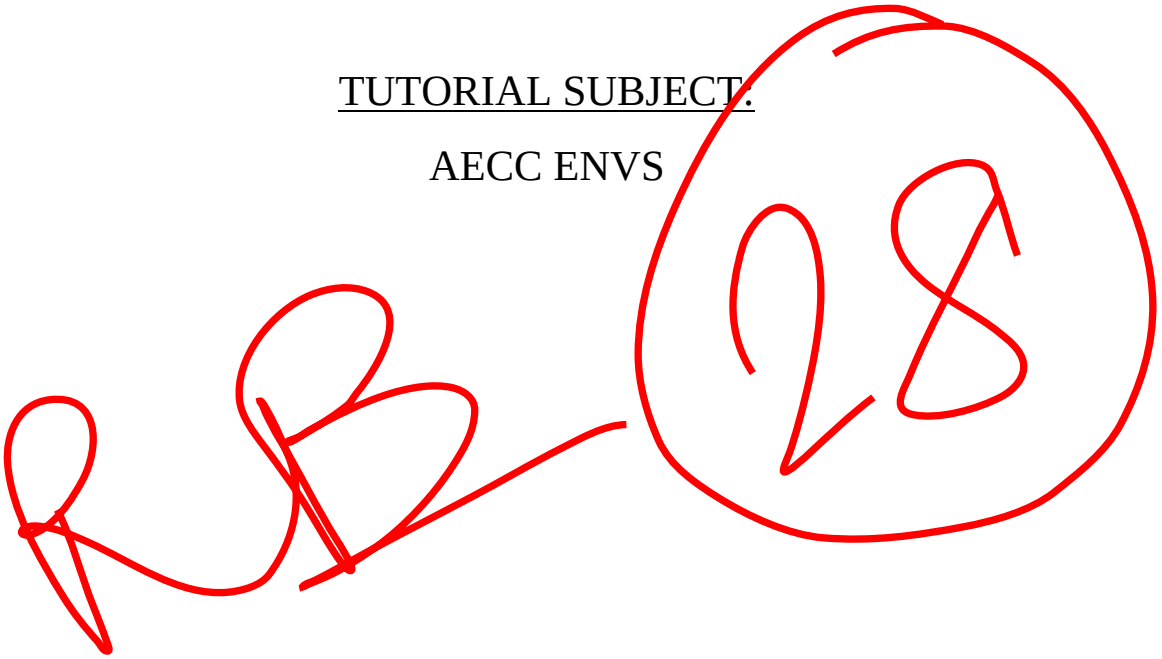
AECC ENVS



AECC ENVS TUTORIAL TOPIC

ECOLOGICAL RESTORATION

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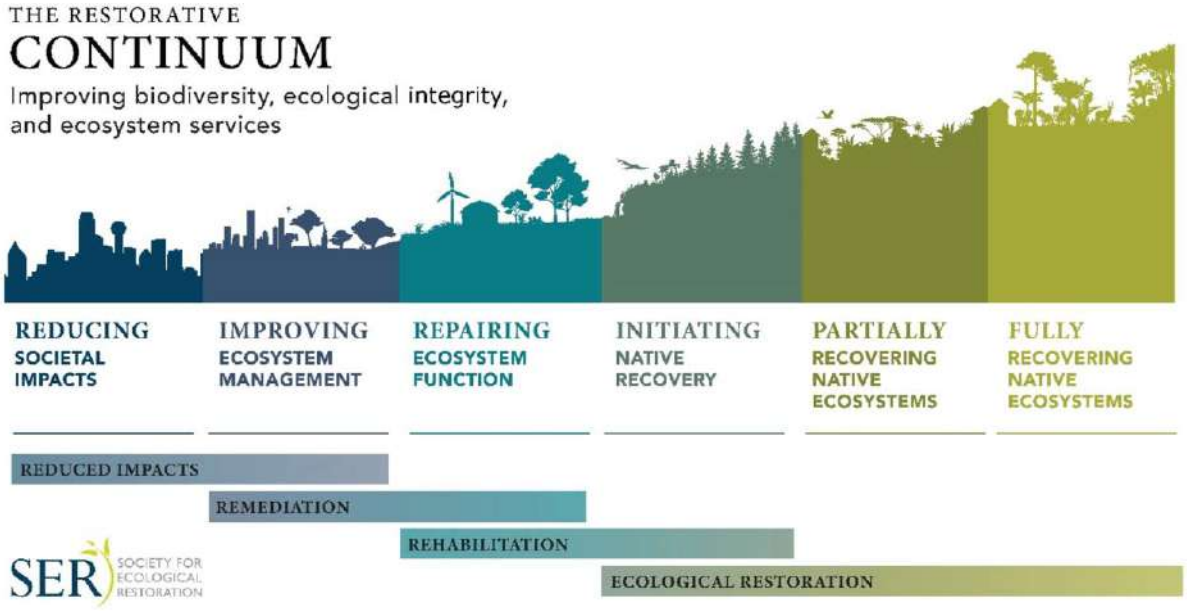
I would like to express my special thanks of gratitude to my teachers and as well as the Scottish Church college committee for giving me the opportunity to work on this Environmental Science tutorial. I want to especially thank my teachers for guiding me and helping me complete this AECC ENVS tutorial.

My completion of this tutorial could not have been accomplished without the support of my parents and friend who helped me throughout the process- thank you all!

INTRODUCTION:

The rise of ecological restoration as a valuable process in conserving biological diversity has largely come about through the need to restore damaged and degraded land arising from agricultural and industrial activity. Early and ground-breaking work in the discipline has been made largely by scientists and land managers engaged in restoring large areas of heavily degraded land to something functional. As the discipline has matured, more searching questions about goals of restoration have been asked and definitions sought from the community or ecosystem perspective. The end users of this information are most commonly planners and developers, but increasingly ambitious conservation objectives are being set.



[INTERNATIONAL PRINCIPLES AND STANDARDS FOR THE PRACTICE OF ECOLOGICAL RESTORATION]

When we think of restoration, the repair of a painting may come to mind, and what we may perceive of this is the act of returning the object to its pristine condition. This is essentially what we might aspire to in ecological restoration, even though in practice we will inevitably have to settle for less. A definition used by the Society for Ecological Restoration is *'the process of repairing damage caused by humans to the biodiversity and dynamics of indigenous ecosystems'*. This reflects the idea that humans are the cause of damage (thus excluding natural catastrophes) and that it is an attempt to return systems back to something that existed prior to the damaging event.

The value of ecological restoration lies in its emphasis on positive action to repair damage rather than the negative image of some conservation activities of fighting a desperate battle to save a few remaining fragments. The incentive for ecological restoration can be viewed as falling in to three separate categories; material, existential and heuristic:

1. The material reason is to restore ecosystem processes to benefit ourselves. The underlying assumption is that economies rely on a balance between developed lands and natural areas. It costs money to make polluted water drinkable but natural sources can provide it free of charge. If development impinges on the ability of natural areas to provide basic services, economic well-being declines and quality of life suffers. This imbalance already characterises most national economies and thus there is a case for restoration.

2. Existential reasons stem from the idea that restoration strengthens the relationship of human beings with the rest of nature by providing an opportunity for positive personal participation. When restoration is conducted as a collective effort, the process unites the participants with the restored ecosystem, they feel simultaneously empowered and responsible for their environment, stimulating long-term stewardship and sustainability.

3. Heuristic reasons for restoration arise from the opportunity for the study of ecosystem processes through attempting to reassemble component parts. This is essentially a trial and error process that can involve hypothesis construction and testing and is often referred to as restoration ecology: the scientific branch of ecological restoration.

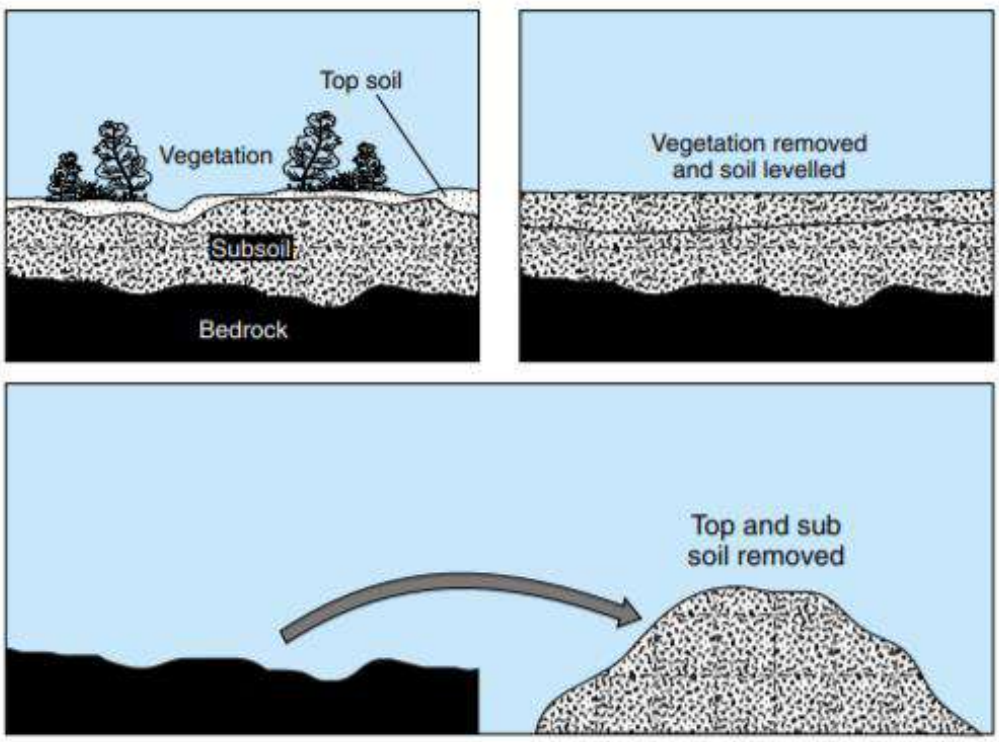
ELEMENTS OF PRACTICAL RESTORATION:

The size of the restoration task will depend on the scale of damage done and what fundamental elements of the living system remain.

THE SOIL:

How easy restoration will be, following damage to a terrestrial ecosystem, depends substantially on what has happened to the soil. Let us consider two extreme cases to illustrate this: first where the damage is simply the removal of all above-ground vegetation, such as following a short period of ploughing and cultivation; and second where the topsoil is also removed leaving only the subsoil or bedrock, such as in open-cast mining activity. In the former all the roots will be intact and many plants will regenerate rapidly; dormant seed will also germinate and ruderals may invade the bare soil and secondary succession

will quickly re-vegetate the area. In the latter case all of the roots and dormant seed will have been removed with the topsoil and its nutrients. Even if the subsoil will support some plant growth, the plants will have to come from surrounding areas and the resulting vegetation will be very different from the original.



[RESTORATION OF SOIL: The extent and difficulty of restoration depends on what has been done with the soil on the site. If the soil structure is intact it is easier to restore the vegetation than if the top soil has been removed]

There are many intermediate scenarios that are commonly met with, including disturbance of the soil over long periods of time, as in agricultural use, which changes the characteristics of the topsoil. Restoration efforts can involve reintroduction of topsoil if this is feasible. Another common problem is compaction of the soil surface making it difficult for plants to colonise. Some form of mechanical loosening of the soil may considerably improve colonisation rates. Many agricultural soils are rich in nutrients, following years of fertiliser application, in which case stripping off the topsoil to lower the nutrient status may be a preferred option.

DEVELOPMENT OF VEGETATION:

The development of the vegetation cover cannot be seen as separate from the development of the soil. In the same way that the characteristics of the soil will influence the plants that grow in it, the plants will affect the soil development.

[BEFORE AND AFTER RESTORATION OF CALIFORNIA'S ECOSYSTEM]

As stated above, if the soil is relatively intact and the period of disturbance short, the vegetation will quickly recover and, given time, may be very similar to that which was destroyed. However, in more extreme situations recovery of vegetation of any sort may be very slow. Consequently, in many cases, for reasons of soil conservation or aesthetics, some form of manual restoration is required to speed the process of re-vegetation and secondary succession. The most common way of speeding up the process is by bypassing the natural immigration and establishment phases of succession, which may be very slow if the site is isolated from potential colonisers and sufficiently degraded to make establishment difficult and slow. The relative immigration rates of different species are largely determined by the type of propagule used (e.g. spores or seeds), their size and mode of dispersal. Some species that are a natural part of the community and important for natural succession, may take a very long time to colonise, particularly if the source site is some distance away. A good example of this is the legumes, such as clover, which are important for their nitrogen-fixing capability, but which have comparatively large seeds. In such cases establishment can be achieved through collection of seed from a donor site and sowing or drilling the seed mix using established agricultural methods. If seed is taken from donor sites care must be taken to match that site with the receptor site, so that the appropriate species are trans-located. Some species in

the seed mix may be undesirable, such as alien weeds (Gilbert & Anderson 1998). In some cases the soil may be very poor in nutrients making establishment of plants very slow even though potential colonisers are abundant. Some fertilisation may be necessary to kick-start the succession when the soil is left in a nutrient poor condition. However, the level of application of fertiliser can be critical to the type of vegetation that results. Too high a level of nutrients made lead to a species-poor competitive sward of vigorous grasses. It is then difficult to reduce the nutrient levels to increase species diversity.

The concept of safe sites for seedling establishment in restoration programmes has been developed by Urbanska (1997). This involves identification of environments which are favourable to seedling germination and establishment. In practice this means identification of microenvironments which enable successful establishment. This may include such aspects as competitor-free space, low grazing pressure and presence of nurse species that aid establishment and survival. Clear knowledge of these factors will inform the restoration process and help set objectives.

THE POLLINATOR COMMUNITY:

The reproduction and spread of many plant species will depend on the presence of specific pollinator species, usually insects but sometimes birds or bats. For example, spring-flowering species may require early flying insects, such as queen bumble bees, for pollination. These have a small foraging range and specific habitat requirements for their nests. If there is no similar vegetation nearby then the pollinators will also be absent. Initial restoration may have to rely on more generalist plant–pollinator interactions. Synchrony of flowering and pollinator activity is also a potential problem and Handel (1997) has advocated creating sequentially flowering plant communities to ensure a pollen source throughout the summer, increasing the probability that some fraction will be visited by local pollinators producing a positive feedback on future pollination success. This may require a compromise between restoration of old and creation of new communities.

SEED DISPERSAL:

In many communities the role of seed dispersers will be vital to the achievement of natural patterns of plant distribution. A whole range of animals act as dispersers, many of which will have been lost along with the original plant community. Birds and mammals commonly disperse seed as it passes through their gut to be deposited in a readily available source of nutrients. Mechanisms to bring back essential seed dispersers into the community will have to be

identified at an early stage in some restoration programmes. This has been identified as particularly important in tropical forest restoration.

HERBIVORES:

The dynamics of many plant communities are dependent on the selective action of herbivores. Potentially dominant plant species may be kept in check by grazing, and the disturbance caused may provide extra niches for other species. Herbivores, from ants to elephants, cause heterogeneity at many scales that enable greater plant diversity to persist by maintaining a balance between early and late successional species. The successful restoration of vegetation communities may therefore be dependent on the successful reintroduction of the native herbivores.

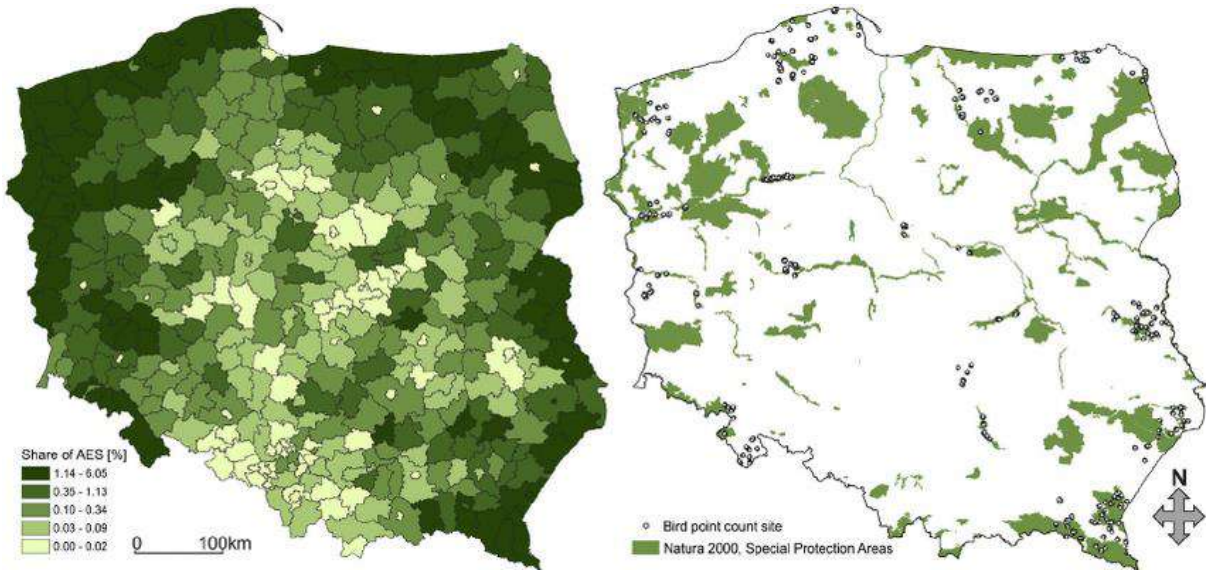
WHERE SHOULD RESTORATION TAKE PLACE?

Many conservation methods relating to effects of fragmentation, reserve design and landscape-scale conservation can be applied to the question of where to restore habitat within a larger damaged landscape. In many areas where fragmentation has occurred there are reasonable records of what has recently been lost; however, restoration usually has to be strategic and is limited in resources, so one wants to restore an area that will be most effective in enhancing the viability of other fragments. In the case of heathland areas of Dorset, UK, Webb (1997) advocates a landscape-based approach which uses conservation principles to formulate a list of possible actions. The most important actions were thought to be:

1. Reconnecting small patches to form larger ones
2. Infilling areas surrounding existing patches to minimise edge effects
3. Creation of corridors or stepping stones where existing patches are isolated.

In addition, more specialised goals may be to restore patches large enough to maintain viable populations of key endangered species such as the Dartford Warbler (*Sylvia undata*), a heathland specialist, or to restore whole water catchment areas, which would contain a gradation of vegetation from dry to wet heath. On the basis of the earlier chapters, these all seem like sensible ideas, but do they work. Here, as in other restoration schemes it is vital that sufficient monitoring is carried out after the restoration is complete to be able to test the hypothesis that the action has been effective.

AGRI-ENVIRONMENT SCHEMES



[COVERAGE OF AGRI-ENVIRONMENT SCHEMES DEDICATED TO THE PROTECTION OF BIRDS IN 380 COUNTIES OF POLAND (FOR 2013, LEFT) AND SPECIAL PROTECTION AREAS TOGETHER WITH THE DISTRIBUTION OF 585 SITES WHERE THE BIRD COUNTS WERE CONDUCTED IN 2013-14 (RIGHT)]

Agriculture has rightly been blamed for much of our habitat and species loss in the developed world. The drive for ever greater and more efficient production of food has ignored the impact on our ecosystems. Recently, governments in the European Union have recognised that subsidising farmers to overproduce crops through the Common Agricultural Policy (CAP), has a direct cost in terms of environmental degradation. This has resulted in some reform of the CAP, reducing subsidies and, in many countries, designating Environmentally Sensitive Areas (ESAs) where farmers are encouraged by grant aid to manage their land in an environmentally sensitive way. In many areas this involves taking some land out of intensive crop production and restoring more traditional farming practices that maintain higher levels of diversity and some of the rarest species. At the heart of this scheme is the assumption that land that has been intensively farmed can be restored relatively easily to high biodiversity semi-natural habitats. This will then increase the area and connectivity of these habitats to the benefit of the landscape and wildlife. It is a new approach to conservation, because it attempts to integrate the practice of agriculture with conservation of semi-natural landscapes.

In the UK there are currently 43 ESAs, designated between 1986 and 1994, covering 15% of the agricultural land area. Most ESAs concentrate on the restoration of grassland landscapes and over 8000 farmers have signed up to the scheme, covering 33% of the land area of ESAs. Not all of the resulting management agreements involve restoration, but many involve specific agreements to restore grassland where arable crops have recently been grown. This type of ecological restoration scheme appears very positive in theory, but there is limited scientific evidence, as yet, supporting the view that restoration of high-value habitats is feasible and is occurring. Gilbert & Anderson (1998) draw a distinction in this context between 'ecological' and 'political' habitat creation/restoration. The former activity attempts to restore a functioning ecosystem and its component biodiversity, the latter is undertaken for show, to create public interest for short-term political gain. As stated earlier only appropriate monitoring will sort the good scheme from the bad.

HABITAT CREATION

The creation of new habitats that may be quite different from the original natural habitat has a questionable role in conservation. Some would argue that this is not conservation at all. Being a human construct, newly created habitat does not have the continuity of form and 'naturalness' that is normally of high value in conservation. However, the new habitat may have an amenity value and provide new space for valued plants and animals. Is there perhaps also a scientific argument for habitat creation? The process certainly suffers from all the drawbacks of habitat restoration and more; there is no evidence that we can create habitat approaching the same diversity as equivalent natural communities, except perhaps in certain circumstances where natural succession quickly takes over, such as in some wetland and aquatic habitats. Habitat creation is also rarely documented to the standards required to test a specific hypothesis that would enable us to judge its relative success. Despite this there may be circumstances in which strategic creation of a habitat may be beneficial to species in the surrounding landscape. A possible example is where communities in small water bodies (ponds and lakes) are threatened due to habitat destruction. These habitats are naturally fragmented and many species inhabiting such places survive as a type of meta-population or patchy population, where loss of individual ponds will threaten persistence in all the others. Strategic creation of ponds in such landscapes could therefore improve chances of persistence. However, these should be monitored carefully to ensure that they are not acting as sinks at the expense of established ponds.

It is difficult to define the boundaries between creation and restoration and appropriate creation of strategic sites can play a part in restoring a landscape, through planting of new woodland or hedgerow for example. Gilbert & Anderson (1998) put forward a process for designing new habitat that includes consideration of the context in which it is taking place. Within this framework they identify a number of key stages as follows:

1. Objectives: it is crucial to be clear about the desired end point of the work and what you are trying to achieve.

2. Site context and integration: the objectives should be firmly embedded in the context of the surrounding landscape. Are the objectives appropriate for the area and what will the project add to the conservation value of the landscape as a whole?

3. Site survey: the site should be fully surveyed to understand its current ecology. What already exists of value and how is your action going to affect this? For example, planting a new woodland could be reducing the area of valuable grassland. Are their particular features of the site, such as nutrient levels, which may pose significant problems in the achievement of your objectives?

4. Practical work: once these considerations have been fed back into the process of setting objectives and appropriate modifications made to the project the practical process can begin. These will be so specific to the project that no generalisations can be made here.

5. Long-term management: once the initial creation process is complete the maintenance of the site will probably require regular management, such as mowing or coppicing; a plan therefore needs to be drawn up with appropriate consideration of resources and expense.

6. Long-term monitoring and dissemination: a clear plan needs to be put in place to monitor key aspects of the site in such a way that the achievement of the objectives can be tested. This will involve formulating hypotheses and the monitoring programmes to test them. The results should then be made generally available (preferably published) so that the conservation community can learn from the process and improve techniques appropriately.

Few habitat creation efforts have followed the above guidelines and even fewer have achieved their objectives. Weighing up the evidence, habitat creation would seem to be on the periphery of mainstream conservation, it may be useful in certain circumstances if the required objectives are achievable, but

should not, as in restoration, be used as an excuse for destruction of natural habitat.

THE GOOD AND THE BAD OF ECOLOGICAL RESTORATION AS CONSERVATION PRACTICE

Ecological restoration can be carried out at all scales and small-scale projects are now quite common. The process provides opportunities for local involvement (thinking globally, acting locally), doing something positive, learning by the process and the possibility of individuals and communities rediscovering the complexity and value of the natural world. These opportunities are increasing in the developed world through de-intensification of agriculture, abandonment of agricultural land, and the availability of post-industrial sites, often in close proximity to large centres of population. In the developing world restoration of degraded land offers further opportunities for preservation of land based cultural traditions of indigenous peoples, including environmental knowledge. In essence, getting people involved in the 'health' of their local environment will make them less inclined to degrade it and more inclined to conserve it and use it more sustainably.

[NORTH-WEST CHINA'S WATER SUPPLY WAS HEAVILY IMPACTED BY VEGETATION RESTORATION]

The constraints on ecological restoration are: the costs; the limits of what ecological restoration can do (these are very severe limits at the present time); and the danger of overly optimistic mitigation. The last is perhaps the most

serious, because compensatory mitigation is frequently offered as part of development plans to limit environmental damage. The development of the practice of ecological restoration brings with it the danger that the opportunity of mitigation will increasingly be used to excuse environmentally damaging development. This problem is compounded because many environmental consultancies that are developing expertise in ecological restoration, can profit from compensatory mitigation, and some may be all too willing to claim that damage can be expertly repaired when they actually have no evidence that this is true.

HABITAT TRANSLOCATIONS:

One of the commonest forms of mitigation for damage is habitat translocation. This most commonly involves the removal of turfs of vegetation and top soil from the area to be developed and its translocation to a prepared area (usually nearby). This is increasingly frequent in the densely populated regions of Western Europe, where space for residential and commercial development is now at a premium. In a recent survey by Bullock (1998) of 24 UK translocation efforts he found that changes in the community were always encountered and many of these were major, resulting from disturbance during translocation, environmental differences between the receptor and the donor sites, poor aftercare and poor management. On current evidence, habitat translocations rarely achieve their conservation goals and are certainly not an adequate alternative to in situ conservation.

CONCLUSION

The concept of restoring damaged items of value is regarded as a positive action and can be applied to components of the natural environment in a similar way to works of art. With a little encouragement and awareness-raising, this can be very much a bottom-up movement, and if properly directed can be used as a significant tool towards the goal of reinstating the vital relationship between society and its environment on which it so fundamentally depends. *But conservation must come first*. The possibility of ecological restoration should not be used as an excuse to allow more development that will further damage remaining natural and semi-natural systems.

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DEPARTMENT & SEM: HISTORY – II

SUBJECT: ENVS

TOPIC: WATER POLLUTION

CONTENT

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INTRODUCTION

Over two thirds of Earth's surface is covered by water; less than a third is taken up by land. As Earth's population continues to grow, people are putting ever-increasing pressure on the planet's water resources. In a sense, our oceans, rivers, and other inland waters are being "squeezed" by human activities—not so they take up less room, but so their quality is reduced. Poorer water quality means **water pollution**.

We know that pollution is a human problem because it is a relatively recent development in the planet's history: before the 19th century Industrial Revolution, people lived more in harmony with their immediate environment. As industrialization has spread around the globe, so the problem of pollution has spread with it. When Earth's population was much smaller, no one believed pollution would ever present a serious problem. It was once popularly believed that the oceans were far too big to pollute. Today, with around 7 billion people on the planet, it has become apparent that there are limits. Pollution is one of the signs that humans have exceeded those limits.

MEANING OF WATER POLLUTION

In nature, water is in its pure form. Impurities get added to it as it percolates beneath the surface of the earth and also when it is used for human activities. Water pollution can be defined as the presence in water, of some foreign substances or impurities in such quantity so as to constitute a health hazard by lowering the water quantity and making it unfit for use.

Water pollution is a state of deviation from the pure condition, where by its normal function and properties are affected.

SIGNS OF WATER POLLUTION

- Bad taste of drinking water.
- Offensive odors from lakes, rivers and ocean beaches.
- Unchecked growth of aquatic weeds in water bodies.
- Decrease in number of fish in fresh water, river water, sea water.
- Oil and grease floating on water surface.
- These disturb the normal uses of water for public water supply:
  Recreation and aesthetics;
  Fish, other aquatic life and wild life,
  Agriculture,
  Industry,

MAJOR SOURCES OF WATER POLLUTION

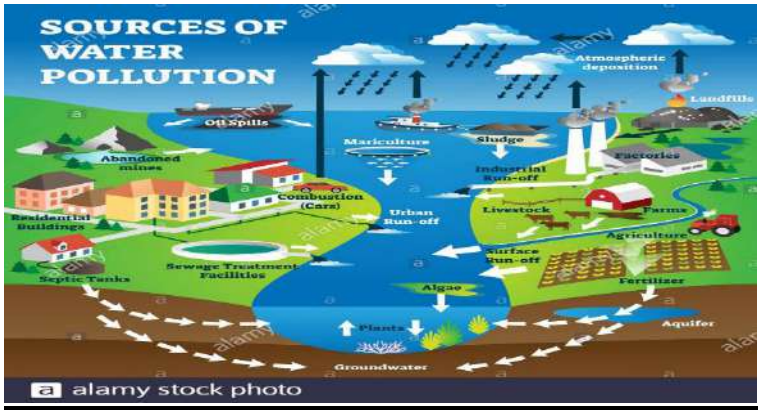

Fig: sources of water pollution

There are two major sources of water pollution, namely:

- Point sources:

Those resources which can be identified at a single location are known as point sources. For instance, the flow of water pollutants through regular channels like sewage system, industrial effluents etc. contaminate the ground water and cause water pollution.

The water pollution caused by point sources can be minimized if all domestic sewage, industrial effluents, cattle field and livestock wastewater etc. are all centrally collected, treated up to requisite acceptable level and reused for different beneficial purposes.

- Diffused sources:

  Those resources whose location cannot be easily identified are called diffused sources. In this case, the pollutants scattered on the ground ultimately reach the water sources and cause water pollution, for instance, agriculture (pesticides, fertilizer), mining, construction etc.

  The water pollution caused by diffused sources like agriculture can be controlled by changing the cropping pattern, tillage particles and advanced farm management practices which do not contaminate the water bodies.

COMMON SOURCES OF WATER POLLUTION

- **Sewage:**

  A main source of pollution is raw or partially treated sewage discharged into rivers, lakes and streams. The discharge of huge quantities of municipal and domestic wastes and sewage pollute many water bodies. Sewage consists of the excreta of animals. It is rich in organic matter and nitrogen compounds.

  If used as a fertilizer in moderate concentrations, animal excreta can enrich the soil. But if sewage is allowed to accumulate in lakes and rivers, it can have serious effects on an ecosystem. Sewage increase the biological productivity and interferes with many uses of the water body. Water containing toxic substances damage biological activity and kill useful organisms.

- **Industrial Wastes:**

  Various types of industrial wastes are continuously poured in streams, rivers and lakes. The industries that cause pollution are printing, electroplating, soap manufacture, food products, rubbers and plastics, chemical, textiles, steel, sugar factories, glass manufacture etc. If industrial wastes are not released directly into water bodies, they can also percolate through the soil and pollute the ground water. The paper mill wastes are concentrated with a number of inorganic substances. The coak works and plastic wastes have much phenolic compounds. Metal finishing plants release heavy metals and cyanides. Caustic soda and chlorine factories release heavy metals such as cadmium, chromium, copper, lead, nickel, zinc and mercury.

  All these metals are capable of binding with enzymes and interfering with normal cell metabolism. In some cases, these metals concentrate through the food chain levels that result in heavy metal poisoning is called itai-itai in japan because it is a painful disease that can be fatal.

Fig: Industrial water pollution

- **Fertilizer pollution:**
  Adding large amount of inorganic fertilizers to crop fields result in the nutrient enrichment of streams, rivers and lakes. A major part of fertilizer become available for excessive algal growth. This is more true for nitrogenous fertilizers than phosphatic ones.
  Nitrate in agriculture drainage contaminate drinking water. Nitrite poisoning or mrthemoglobinemia occurs in infants and farm animals by indigesting water or food containing high level of nitrate.
  Bacteria normally found in the water are able to convert nitrate ions fertilizers and organic wastes to nitrite. The concentration of nitrates and nitrites are reduced naturally bacteria in water and soil.

- **Insecticides:**
  The excessive use of pesticides cause water pollution, by penetrating through soil and getting dissolved in soil water. Some of them like DDT, DDE, DDD, Dielrin and polychlorinated biphenyls are washed down with rain water and find their way to sea through rivers and streams. These toxic substances accumulate in the bodies of aquatic organisms and cause a great harm to them.

- **Herbicides, Cleaning Agents & Food Additives:**
  Like insecticides, herbicides, cleaning agents, food additives, industrial materials, adhesives and many other synthetic materials containing new chemicals constantly introduced into water. Each year, approximately 70,000 kinds of organic chemicals are placed on the market that ultimately make their way through environment to the water.
  Presence of these chemicals at increasing levels is of great concern because of their known toxicity, mutagenicity and carcinogenicity. Herbicides like monuron, simazine, 2-A-D and 2-4-5-T which are used to clear railroad and highways, weed control in agriculture and forest management are harmful for both plants and animals.

- **Radioactive Pollution:**

  Many radioactive isotopes escape to water reservoirs, rivers and seas from nuclear power reactors. They enter the food chain in ecosystem. These wastes may accumulate in the bodies of aquatic animals like fishes causing harm to them as well as animals which eat them.

  Cesium is known to accumulate in body muscles, strontium in bones and iodine in thyroid. Radioisotopes are said to cause cancer, malformation of body at birth, organ abnormalities etc.

- **Oil Pollution:**

  Oil is a major pollutant in the sea. Oil spillages from tankers act as a toxic substance and affects the aquatic organisms. Surprisingly, the effect of oil on phytoplankton appears to be slight, but oil pose serious threat to marine animals especially fishes and birds.

- **Inert Suspensions:**

  Fine practices of dust, clay, soil, ores are other pollutants of water. Poisons such as acids, alkalis, phenols, cyanides, copper, lead, zinc, mercury, insecticides and fungicides pollute water.

  Inorganic reducing agents such as sulphides and sulphites and ferrous salts are active under reducing conditions.

  Oil from spills and washing of automobiles sometimes pollutes our water.

  Considerable pollution is caused by such industries as leather tanneries, beet sugar refining and meat packaging. About two thirds of all degradation of water can be attributed to various manufacturing activities, transportation and agriculture.

- **Thermal Pollution:**

  Various industries require water cooling. Thermal pollution is the discharge of hot water into river and estuaries from power stations. This raises the temperature of the water, thereby increasing the metabolic rate and oxygen consumption of microorganisms. This makes it all the more difficult for fish to survive.

- **Mining Wastes:**

  Mining causes water pollution in the form of acid drainage from coalmines, debris and saw weeds from hydromining methods.

Fig: wastes material from coal mining

Earth moving construction projects, deforestation and flood result in the production of silt in streams and lakes. This may interrupt or prevent the reproduction of fish by smothering eggs laid on the bottom.

EFFECTS OF WATER POLLUTION

- **On human health**

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

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

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

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

- **On the environment**

  In order to thrive, healthy ecosystems rely on a complex web of animals, plants, bacteria, and fungi—all of which interact, directly or indirectly, with each other. Harm to any of these organisms can create a chain effect, imperilling entire aquatic When water pollution causes an algal bloom in a lake or marine environment, the proliferation of newly introduced nutrients stimulates plant and algae growth, which in turn reduces oxygen levels in the water. This dearth of oxygen, known as eutrophication, suffocates plants and animals and can create "dead zones," where waters are essentially devoid of life. In certain cases, these harmful algal blooms can also produce neurotoxins that affect wildlife, from whales to sea turtles.

Fig: Effects of water pollution on marine life

Chemicals and heavy metals from industrial and municipal wastewater contaminate waterways as well. These contaminants are toxic to aquatic life—most often reducing an organism's life span and ability to reproduce—and make their way up the food chain as predator eats prey. That's how tuna and other big fish accumulate high quantities of toxins, such as mercury.

Marine ecosystems are also threatened by marine debris, which can strangle, suffocate, and starve animals. Much of this solid debris, such as plastic bags and soda cans, gets swept into sewers and storm drains and eventually out to sea, turning our oceans into trash soup and sometimes consolidating to form floating garbage patches. Discarded fishing gear and other types of debris are responsible for harming more than 200 different species of marine life.

SOLUTION TO PREVENT WATER POLLUTION

There is no easy way to solve water pollution; if there were, it wouldn't be so much of a problem. Broadly speaking, there are three different things that can help to tackle the problem—education, laws, and economics—and they work together as a team.

Education

Making people aware of the problem is the first step to solving it. In the early 1990s, when surfers in Britain grew tired of catching illnesses from water polluted with sewage, they formed a group called Surfers Against Sewage to force governments and water companies to clean up their act. People who've grown tired of walking the world's polluted beaches often band together to organize community beach-cleaning sessions. Anglers who no longer catch so many fish have campaigned for tougher penalties against factories that pour pollution into our rivers. Greater public awareness can make a positive difference.

Laws

One of the biggest problems with water pollution is its transboundary nature. Many rivers cross countries, while seas span whole continents. Pollution discharged by factories in one country with poor environmental standards can cause problems in neighbouring nations, even when they have tougher laws and higher standards. Environmental laws can make it tougher for people to pollute, but to be really effective they have to operate across national and international borders. This is why we have international laws governing the oceans, such as the 1982 UN Convention on the Law of the Sea (signed by over 120 nations), the 1972 London (Dumping)

Convention, the 1978 MARPOL International Convention for the Prevention of Pollution from Ships, and the 1998 OSPAR Convention for the Protection of the Marine Environment of the North East Atlantic. The European Union has water-protection laws (known as directives) that apply to all of its member states. They include the 1976 Bathing Water Directive (updated 2006), which seeks to ensure the quality of the waters that people use for recreation. Most countries also have their own water pollution laws. In the United States, for example, there is the 1972 Clean Water Act and the 1974 Safe Drinking Water Act.

Economics

Most environmental experts agree that the best way to tackle pollution is through something called the **polluter pays principle**. This means that whoever causes pollution should have to pay to clean it up, one way or another. Polluter pays can operate in all kinds of ways. It could mean that tanker owners should have to take out insurance that covers the cost of oil spill cleanups, for example. It could also mean that shoppers should have to pay for their plastic grocery bags, as is now common in Ireland, to encourage recycling and minimize waste. Or it could mean that factories that use rivers must have their water inlet pipes downstream of their effluent outflow pipes, so if they cause pollution they themselves are the first people to suffer. Ultimately, the polluter pays principle is designed to deter people from polluting by making it less expensive for them to behave in an environmentally responsible way.

Our clean future

Life is ultimately about choices—and so is pollution. We can live with sewage-strewn beaches, dead rivers, and fish that are too poisonous to eat. Or we can work together to keep the environment clean so the plants, animals, and people who depend on it remain healthy. We can take individual action to help reduce water pollution, for example, by using environmentally friendly detergents, not pouring oil down drains, reducing pesticides, and so on. We can take community action too, by helping out on beach cleans or litter picks to keep our rivers and seas that little bit cleaner. And we can take action as countries and continents to pass laws that will make pollution harder and the world less polluted. Working together, we can make pollution less of a problem—and the world a better place.

CONCLUSION

Water pollution is a global issue and world community is facing worst results of polluted water. Major sources of water pollution are discharge of domestic and agriculture wastes, population growth, excessive use of pesticides and fertilizers and urbanization. Bacterial, viral and parasitic diseases are spreading through polluted water and affecting human health. It is recommended that there should be proper waste disposal system and waste should be treated before entering in to river. Educational and awareness programs should be organized to control the pollution.

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- https://www.alliedacademies.org/articles/water-pollution-and-human-health

CONSERVATION OF WILDLIFE

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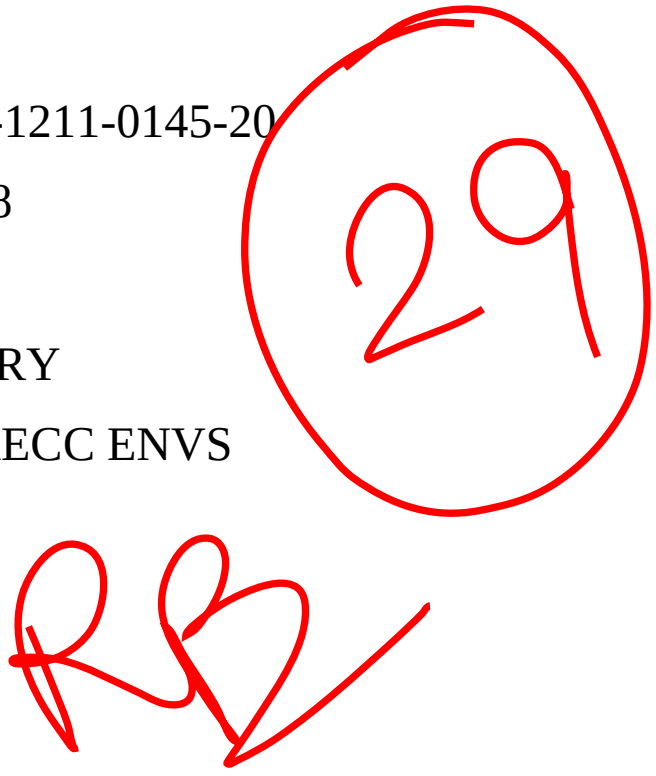

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INTRODUCTION

Wildlife conservation aims to protect plants and ensure the survival of animal species as the human population encroaches on their resources and to educate people on living sustainably with other species. The human population has grown considerably over the past 200 years, to more than seven billion people today, and it continues to grow rapidly. The growth and development endangers the habitats and existence of various types of wildlife around the world, particularly animals and plants that replaced for land and development, or used for food or other human purposes. Over the last four decades human activities have greatly pushed some animal species to near extinction with an estimated loss of about 10,000 species per year accounting for the loss of half of the world's wildlife population. Humans have used an effected fish and wildlife since the dawn of our species. The industrial age further increase human demands on the landscape to the detriment of many fish and wildlife populations. However, we had visionaries who saw the land and its creatures as assets and above all as marvels to save. These defenders of our natural world have provided a foundation for the broad and deep respect for wildlife that is woven into other modern organisations and agencies that carry on in the spirit to coordinate projects to preserve the wildlife habitat.

As said by Paul Oxton,"Only when the last of the animal horns, tusks, skin and bones have been sold, will mankind realise that money can never buy back our lifestyle". Hence, in a bid to counteract this, wildlife conservation should be mandatory as it comes with numerous benefits for both animals and humans.

CHAPTER 1

MAJOR CAUSES FOR THE LOSS OF BIODIVERSITY

1. **Destruction of Habitat**- the natural habitat over the years is being destroyed by man for his settlement, agriculture, mining, industries, highway construction, dam building etc. As a result, the species must either adapt to the changes in the environment, move elsewhere or may succumb to predation, starvation or disease and eventually die.
2. **Hunting**- Wild animals are hunted for the commercial utilisation of their products such as hides and skin, tusk, fur, meat, pharmaceuticals, cosmetics, perfumes and decorative purposes. In Africa, in recent years 95% of the Black Rhino population have been eradicated by poachers for their horn. In the last one decade, over one-third of Africa's elephant has been killed to collect 3,000 tonnes of ivory. In 1987, the Indian Govt. also banned the trade in Indian ivory. In 1962, nearly 70,000 whales were slaughtered, however, international trade in whale products id banned now.
3. **Exploitation of Selected Species**- Exploitation of medicinally important plants has resulted in their disappearance from many of their natural habitat. The pitcher plants, Nepenthes Khasiana, Drosera species., Gnetum species., Psilotum species, Isoetes species., are ruthlessly sought and collected for teaching and laboratory work.in the category of overexploited plants may also be placed a number of orchids producing world's most showy flowers. In India, an estimated 50-60 thousand varieties of rice were cultivated before independence, most of which are being dropped in favour of a few high yielding varieties.
4. **Habitat Fragmentation**- It is one of the most serious causes of erosion of biodiversity. Fragmentation leads to artificially created 'terrestrial lands'. An example of loss of biodiversity as the result of fragmentation is that of the Western forest of Ecuador, which were largely undisturbed till 1960, where newly constructed network of roads led to rapid human settlements and clearance of much of the forest area, have been fragmented into small patches of one to few square kilometres.
5. **Collection for Zoo and Research**- Animals and plants are collected throughout the world for zoos and biological laboratories for study and research in science and medicine. For example, primates such as monkeys and chimpanzees are sacrificed for research as they have anatomical, genetic and physiological similarities to human beings.
6. **Introduction of Exotic Species**- the introduction of Nile perch from north in Lake Victoria, Africa's largest lake, has driven almost half of the 400 original fish species of the lake top near extinction. Both Eucalyptus and Casuarina are plants introduced in India from Australia.
7. **Pollution**- It alters the natural habitat. Water pollution is injurious to the biotic components of estuary and coastal ecosystems. Toxic wastes entering the water bodies disturb the food chain and sop the aquatic ecosystems. The coral reefs are being threatened by pollution from industrialisation, oil transport, and offshore mining along the coastal areas.

8. **Control of Pests and Predators**- Predator and pest control measures, generally kill predators that are a component of balanced ecosystem and may also indiscriminately kill non- target species.
9. **Natural Calamities**- Such as floods, draught, forest fires, earth- quakes, volcanic eruptions, epidemics etc. sometimes take a heavy toll of plant and animal life. Floods are frequent in moist tropical regions of the world which inundate much of the ground vegetation, trap a large number of animals while leading away soil nutrients. Forest fires in densely wooded localities often reduce to ashes a large number of plant and animal species and so do earthquakes. Volcanic eruptions may at times completely destroy plant and animal life in the surrounding areas.
10. **Other Factors**- (a) Distribution range- the smaller the range of distribution, the greater the threat of extinction, (b) Degree of Specialisation- the more specialised an organism is, the more vulnerable it is to extinction, (c) position of the organism in the food chain—the higher the organism in food chain, the more susceptible it becomes, (d) Reproductive rate- Large organisms tend top produce fewer off springs at widely intervals.

CHAPTER 2

STEPS TAKEN BY INDIAN GOVERNMENT TO PROTECT BIODIVERSITY

The Government of India has initiated few schemes that are worked upon to protect the biodiversity and minimise the mortality of critically endangered, and threatened animals. Here are the few steps that Government of India has taken for the wildlife protection:

- In the Wildlife Protection Act of 1972, GOI created Protected Areas like National Parks, Sanctuaries, Conservation Reserves and Community Reserves for the wildlife and imposed punishments on those indulged in illegal act of hunting.
- Wetland(Conservation and Management) Rules 2010 have been formulated to protect wetlands in India. The Central Government of India has also initiated the scheme, National Plan for Conservation of Aquatic Eco-System that lends assistance to the states for the sound management of all wetlands.
- In order to control the illegal trade of wildlife and that of endangered species, Wildlife Crime Control Bureau has been established.
- Special organisations like Wildlife Institute of India, Bombay Natural History society and Salim Ali Centre of Ornithology and Natural History are formed to conduct research on conservation of wildlife.
- To check the reduced population of Gyps vulture in India, Government of India has banned the veterinary use of diclofenac drug.
- For replenishing the endangered species, the Central Government first initiated Integrated Development of Wildlife Habitat Scheme and later modified it by including a new component, Recovery of Endangered Species which included animals like Hangul/stag deer in Jammu and Kashmir, Vultures in Punjab, Haryana and Gujarat, Snow Leopard in Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Arunachal Pradesh etc.
- The State Governments have been asked to strengthen the field formations and increase patrolling in and around the Protected Areas.
- GOI intensified anti-poaching activities and initiated special patrolling strategy for monsoon season. It also formed the anti-poaching squad.
- In order to strengthen tiger conservation, National Tiger Conservation Authority is constituted by Government of India.
- A special Tiger Protection Force(STPF) has also been constituted and is deployed in Karnataka, Maharashtra and Odisha.
- E-Surveillance has been started in Kaziranga National Park in Assam and borders of Ratapani Wildlife Sanctuary in Madhya Pradesh.

WILDLIFE CONSERVATION INTIATIVES BY THE INDIAN GOVERNMENT

The Indian government did take effective initiatives to conserve wildlife in the country, and amongst it, most commendable initiatives is the Wildlife Protection Act of 1972, which prohibits trade of rare and endangered species.

Important Wildlife Protection Projects by Indian Government:

- **PROJECT TIGER**

Emblem of National Tiger Conservation Authority

One of the most successful wildlife conservation ventures 'Project Tiger' which was initiated way back in 1972, has not only contributed to the conservation of tigers but also of the entire ecosystem. This project is sponsored by Ministry of Environment Forest and Climatic Change. In the case of Sansar Chand vs. State of Rajasthan(2010), the appellant was arrested in 1974 for poaching tigers and smuggling their body parts to various countries, particularly China. The acts of poaching, killing, maiming, etc. of any animal are offences under Section 428 and section 429 of the Indian Penal Code, 1860. The aim of the project is the protection of tigers from extinction, by ensuring that there is a practicable population of the species in their natural habitats.

Measures taken for Conservation of Tigers under the Wildlife Act, 1972.

Legal Measures

1. The project was converted into a statutory authority by providing enabling provisions in the Wildlife Protection Act, 1972. A National Tiger Conservation Authority has been constituted under Section 38L of the Act. The Tiger and other Endangered Species Crime Control Bureau has also been established under Section 38Zof the Act.
2. The punishment for offences related to tiger reserves and its core areas has been enhanced.
3. Several treaties have been signed with neighbouring countries such as Nepal, China, Bangladesh for controlling trans-boundary illegal wildlife trade and tiger conservation.

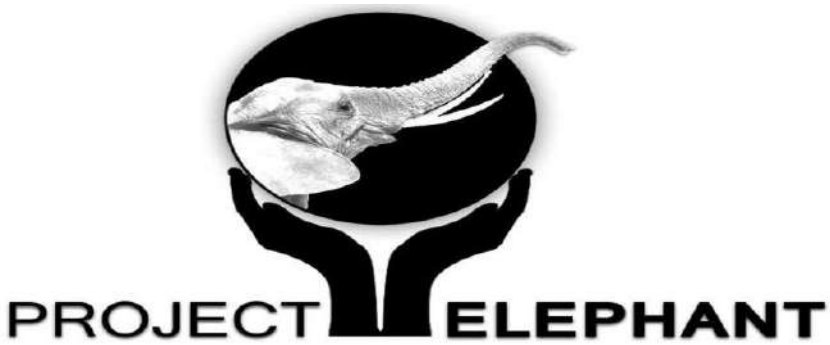
Administrative measures

1. Anti-poaching activities have been strengthened, especially monsoon patrolling. This involves deploying anti-poaching squads.
2. A National Tiger Conversation Authority has been constituted and a special Tiger Conservation Force has also been constituted.

Financial measures

Monetary measures include the provision of financial and technical help via Centrally sponsored Schemes through the project itself and Integrated Development of Wildlife Habitats.

- **PROJECT ELEPHANT**



Elephants are "Ecosystem Engineers"

It was launched in 1992 and is a centrally sponsored scheme. Elephants face the threat of attrition, as opposed to extinction faced by Tigers. The project aims at assisting the management and protection of elephants in the states which have free ranging populations of wild elephants. The Elephants' Preservation Act, 1879 has also been formulated for the protection of elephants across the country. India has over 27,000 elephants but only 65% of the elephant corridors are in protected areas.

The objectives of the project are:

1. Protection of Elephants, Elephant Corridors and their Habitats;
2. Prevention of Man-Animal Conflicts; and ensuring the welfare of domesticated elephants.

In Balram Kumawat vs. Union of India and Ors.(2003), the appellants had imported mammoth fossils, which is said to be an extinct species. They indulged in trading mammoth ivory, citing that it was not banned under the Wildlife Act or CITIES. In M/s ivory Traders and Ors. Vs Union of India and Ors.(1997),the petitioners were ivory traders. They imported mammoth ivory from Russia and Hong Kong. They pleaded that they were affected by the Wildlife Amendment Act, 1991.

Measures for Protection of Elephants:

- Monitoring of Illegal killing of Elephants Program(MIKE)- It began in 2003 in South Asia.
- Haathi Mere Saathi- It was launched by the ministry of Environment and Forest in collaboration with Wildlife Trust of India.
- Project Hangul- In the 1970's the Jammu and Kashmir Government in association with the International Union for Conservation of Nature(IUCN) and World Wildlife Fund (WWF) designed a project for the protection and conservation of the Kashmir Red Stag and its habitat. This project later was known as Project Hangul.

❖ CROCODILE CONSERVATION PROJECT

Reptiles represent some of the oldest living species on this planet hence it is high time we start caring for them as well

The species of crocodilians was threatened in India due to the increasing number of indiscriminate killings. They were poached for commercial purposes, which led to a drastic decline in their population. Due to this, Project Crocodile was introduced in 1975. The primary focus was on breeding and rearing in captivity. Due to the implementation of this project, there is an increase in the population of crocodiles, which has saved them from extinction. The protected areas include National Chambal Sanctuary and Katerniaghat Wildlife Sanctuary.

❖ UNDP SEA TURTLE PROJECT

Slow to run but fast to run out

With an objective to conserve the Olive Ridley turtles, the UNDP Sea Turtle Project was initiated by Wildlife Institute of India, Dehradun as the Implementing Agency in November 1999. The project is for 10 coastal state in India especially Odisha where it has contributed towards the preparation of a map of breeding sites of Sea Turtles; identification of breeding places and habitats along the coastline, and migratory routes taken by Sea Turtles. The project also helped in the development of guidelines to safeguard the turtle mortality rate and for tourism in sea turtle areas.

Apart from these projects, GOI has been handling projects like Vulture Conservation and India Rhino Vision(IRV)2020.

CHAPTER 3

REASONS WHY WE NEED TO SAVE WILDLIFE TODAY

1. Promotes Pollination and Continuity of Native Plant Species- Small animals particularly bees, insects, butterflies, and birds play an important role in food production. Conservation of these animals, therefore, aid in pollution. Since they depend on nectar from flowers, they are vital in crop production, inter-cropping, and promoting the continuity of native plant species.
2. Medicinal Value- Plants being the major sources of medications, some animals are also vital in the production of medications. For example, the venom from cobra is an important ingredient in making the medications for leprosy while lobsters can be used as antifungals.
3. Aesthetic benefits- it has been reported that people who spend most of their time outdoors hunting, watching wild animals or taking a stroll in natural habitats are more likely to suffer from stress and other stress related complications. Conserving wildlife means enjoying nature at its best.
4. Preserves Heritage and Culture- Conserving wildlife means conserving heritage and traditional culture. Some places are known for their flora and fauna in relation to the native practices and ways of livelihood, which means that failing to conserve the environment, will lead to loss of their land and native heritage.
5. Can Enhance Food Security- The most fundamental roles of Wildlife Conservation to humans is to enhance food security. By protecting natural habitats from degradation and forests against deforestation, the availability of a variety of food products would rise. It helps in research for promoting cultural diversity.
6. Protects the livelihoods and knowledge of indigenous people- The people living around the forest areas and natural ecosystems such as lakes and rivers depend on these resources for their livelihood such as harvesting timber and firewood for construction and cooking respectively fish for survival, traditional medicines, fruits, vegetables and food for survival. Therefore, the conservation of wildlife resources can help in protecting livelihoods and indigenous people together with traditions.

CHAPTER 4

MOST ENDANGERED WILD ANIMAL SPECIES OF INDIA

1. **Greater One-Horned Rhinoceros**

Excessive hunting and agricultural development reduced its range drastically

It is listed as one of the most vulnerable species by the International Union for Conservation of Nature. The animal can be found in India and Nepal, particularly in the foothills of the Himalayas. Poaching of horns is an important reason for the decline of the one-horned Rhinoceros.

2. **Nilgiri Tahr**

A Nilgiri Tahr is estimated to be only around 2000-3000

It is a threatened mountain ungulate clinging on to the tropical rainforest of the Western Ghats. Considered as the state animal of Tamil Nadu, the Nilgiri Tahr is facing a major threat in the Western Ghats.

3. Bengal Tigers

Bengal Tigers are estimated to be left only around 2,500

It is considered as the national animal of both the major countries of India and Bangladesh, the Bengal Tiger is justifiably considered as 'Big Cat'. Tigers are fast vanishing due to human interference and poaching cases.

4. Asiatic Lion

Recently, an outbreak of Babesiosis caused by a protozoan parasite has reportedly caused the death of several lions in Gujarat's Gir National Park

Gujarat in India is home to a large population of Asiatic Lion. The 1400 sq.km Sasan Gir Wildlife Sanctuary in Gujarat is the last royal refuge of the Asiatic lion. Only 200 or so Asiatic lions exist in the wild.

5. Lion Tailed Macaque

Lion-Tailed Macaque is extremely important for seed dispersal

Running along the west coast of India, the mountains of Western Ghats are home to a rare species, Lion Tailed Macaque can be found in the tiny, isolated pockets of the tropical forest in the Western Ghats. With only 2,900 species in zoo and wildlife reserves, the Lion Tailed Macaque is one of the most endangered animals in the world.

6. Snow Leopard

One Snow Leopard has reportedly been killed and traded almost everyday

Profoundly found in the steep and rocky regions of the Himalayas, the snow leopard is the descendent of the wild cat and panther families. There are 6,000 snow leopards in the world, but its population is gradually declining.

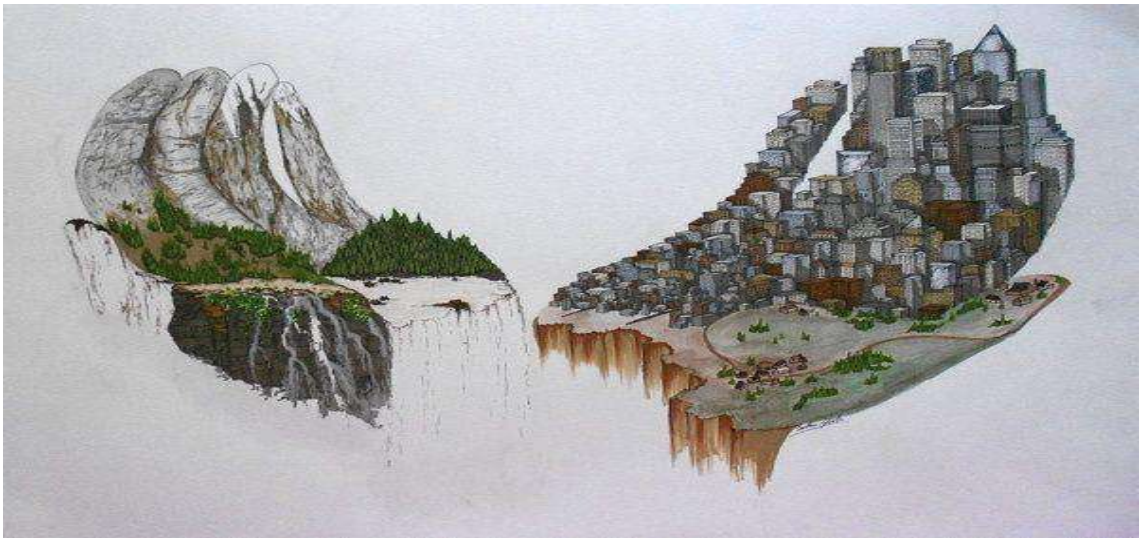
7. Gharial

Gharials has been listed as critically endangered on the IUCN Red List since 2007

It is one of the three crocodilians found in India the longest of all living crocodilians. The holy river Ganges is one of the most habitat of the Gharial in India, the king of rivers also found in Chambal, Irrawaddy and Brahmaputra rivers.

CHAPTER 5

THE RELATIONSHIP BETWEEN THE HUMANS AND NATURE



Economy without ecology means managing the human nature relationship without knowing the delicate balance between humankind and the natural world

Habitat loss is the leading cause of endangered species worldwide; almost every species faces the loss of their habitat. The most significant contribution to habitat loss is urban, commercial, agricultural, and coastal development. It is followed by contamination from pollution and pesticides, and environmental factors like climate change and global warming. Tourism is another issue, which includes recreational use of habitats and an influx of residents and visitors to an area. Loss of genetic variation is another serious issue, because without variation, a species is unable to adapt to the environment and therefore, will be at greater risk for extinction. Other factors that affect their population size are disease, hunting, tourism, predation, competition, and the pet trade. When a population becomes extremely small, it also becomes much more susceptible to environmental factors. We, as the human race are solely responsible for the significant amount of damage done to the wildlife. We humans are a part of each of the specific causes that is leading to extinction of wildlife.

CONCLUSION

It can be concluded that the conservation of wildlife is very important to maintain stability in the ecosystem. The expansion of human activities into habitats of these species has led to considerable damage in the environment. The implementation of wildlife laws has to be more strict. An attempt has been made through the above mentioned projects for reducing the harm caused and to prevent future disruptions. The human being as the most intelligent species on the earth has to take care that our actions and omissions do not harm wildlife. The extinction of wildlife can pose extreme dangers to the entire planet. When one crucial part of the ecosystem is eliminated, the entire planet suffers. The most important question that arises here is how can we humans contribute towards saving wildlife? So our first step should be supporting these organisations that invest significant time and resources into researching and conserving wildlife. Educating ourselves and others is also a very important step to shed light on these serious issues and raise awareness of the human impact on wildlife. Other lifestyle changes include buying and recycling sustainable products, not purchasing plastic, avoiding companies that are known polluters. We also reduce our personal footprint by walking more and driving less and reducing water consumption. The future is in our hands, and it is our own sake, but for the sake of generations to come. The facts are clear: immediate action is necessary to keep this planet alive. The choice is ours, of whether or not we want to make our personal impact on the world a personal one.

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ENVS

OZONE DEPLETION

Department of History

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Kolkata

2021

Introduction

What is ozone layer?

Ozone layer is a layer in the earth's stratosphere at an altitude of about 10 km (6.2 miles) containing a high concentration of ozone, which absorbs most of the ultraviolet radiation reaching the earth from the sun. The ozone layer or ozone shield is a region of Earth's stratosphere that absorbs most of the Sun's ultraviolet radiation. It contains a high concentration of ozone (O3) in relation to other parts of the atmosphere, although still small in relation to other gases in the stratosphere. The ozone layer is 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.

- **What is ozone layer depletion?**

Ozone layer depletion is the gradual thinning of the earth's ozone layer in the upper atmosphere caused due to the release of chemical compounds containing gaseous bromine or chlorine from industries or other human activities. 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 the ozone layer depletion. Such compounds are known as Ozone Depleting Substances (ODS).

The ozone-depleting substances that contain chlorine include chlorofluorocarbon, carbon tetrachloride, 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.

- **Effects of ozone depletion:**

- Human Health Effects

Breathing ground-level ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma. Ozone also can reduce lung function and inflame the lining of the lungs. Repeated exposure may permanently scar lung tissue.

- Environmental Effects

Ozone damages vegetation and ecosystems by inhibiting the ability of plants to open the microscopic pores on their leaves to breathe. It interferes with the photosynthesis process by reducing the amount of carbon dioxide the plants can process and release as oxygen. Elevated levels of ozone lead to reduced agricultural crop and commercial forest yields, reduced growth and survivability of tree seedlings, and increased susceptibility to diseases, pests and other stresses such as harsh weather.

- Effects on Animals

Direct exposure to ultraviolet radiations leads to skin and eye cancer in animals.

- Effects on Marine Life

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 lower food chain are also affected.

- **Solutions to Ozone Layer Depletion:**

The depletion of the ozone layer is a serious issue and various programs have been launched by the government of various countries to prevent it. However, steps should be taken at the individual level as well to prevent the depletion of the ozone layer.

Following are some points that would help in preventing this problem at a global level:

- Avoid Using Pesticides

Natural methods should be implemented to get rid of pests and weeds instead of using chemicals. One can use eco-friendly chemicals to remove the pests or remove the weeds manually.

- Minimize the Use of Vehicles

The vehicles emit a large amount of greenhouse gases that lead to global warming as well as ozone depletion. Therefore, the use of vehicles should be minimized as much as possible.

- Use Eco-friendly Cleaning Products

Most of the cleaning products have chlorine and bromine releasing chemicals that find a way into the atmosphere and affect the ozone layer. These should be substituted with natural products to protect the environment.

- Use of Nitrous Oxide should be Prohibited

The government should take actions and prohibit the use of harmful nitrous oxide that is adversely affecting the ozone layer. People should be made aware of the harmful effects of nitrous oxide and the products emitting the gas so that its use is minimized at the individual level as well.

CHLOROFLUOROCARBONS (CFCs)

Chlorofluorocarbons (CFC) are gases used for various purposes including solvents, refrigerants and aerosol sprays. They are organic chemicals and contain carbon, (sometimes hydrogen,) chlorine, and fluorine. They were much used in the middle 20th century, replacing chemicals that were toxic or flammable or had traits that were generally harmful to human health.

Chlorofluorocarbons are used in a variety of applications because of their low toxicity, reactivity and flammability. Every permutation of fluorine, chlorine and hydrogen-based on methane and ethane has been examined and most have been commercialized.

Furthermore, many examples are known for higher numbers of carbon as well as related compounds containing bromine. Uses include refrigerants, blowing agents, propellants in medicinal applications and degreasing solvents.

The strength of CFC absorption bands and the unique susceptibility of the atmosphere at wavelengths where CFCs (indeed all covalent fluorine compounds) absorb creates a “super” greenhouse gas (GHG) effect from CFCs and other unreactive fluorine-containing gases such as perfluorocarbons, HFCs, HCFCs, Bromo fluorocarbons. Use of certain chloroalkanes as solvents for large-scale application, such as dry cleaning, have been phased out, for example, by the IPPC directive on greenhouse gases in 1994 and by the volatile organic compounds (VOC) directive of the European Union in 1997. Permitted chlorofluoro alkane uses are medicinal only. According to scientific communities, the hole in the ozone layer has begun to recover as a result of CFC bans. India is one of the few countries that are pioneers in the use of non-Ozone Depleting technologies and have a low Global Warming Potential (GWP).

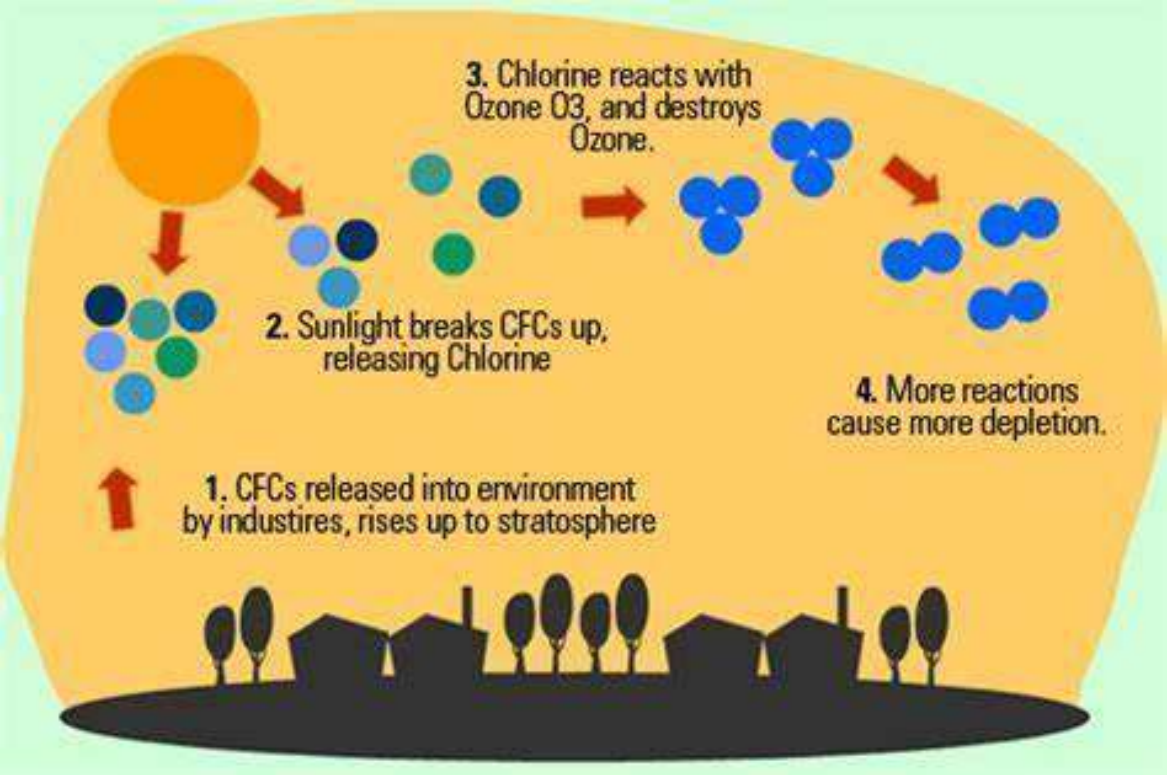
- **Uses of CFCs?**

Because of the special characteristics such as inflammability and non-toxicity of CFCs encouraged its production and consumption particularly in developed countries, after the 1960's. The modern lifestyle of the second half of the 20th century had been made possible by the use of CFCs. Man-made CFCs however, are the main cause of stratospheric ozone depletion. The most common uses of CFCs are:

- Refrigerants for refrigerators, automobiles and air-conditioners
- Cleaning agents for semi-conductors and precision parts
- Foaming agents for insulating materials and packing cushions
- Propellants for aerosol sprays

- **How does CFC effect the ozone layer?**

CFCs are released from refrigeration, propellant and cleaning devices and processes. Once they are in the Earth's lower atmosphere, they tend to persist for years due to their stable chemical makeup. Their lengthy lifespan allows some CFCs to ultimately reach the upper stratosphere. Once in the stratosphere, ultraviolet light from the sun breaks CFC molecular bonds, releasing chlorine atoms. Free chlorine atoms then undergo a series of chemical reactions that destroy the ozone layer by thinning its concentration. The destruction of ozone requires atomic chlorine produced by sunlight: Sunlight also drives the following reactions:



Finally, a reduced ozone layer allows stronger and more harmful wavelengths of light to enter the Earth's atmosphere.

- **Steps to reduce CFCs emissions?**

- Household Products

Most modern household products do not contain CFCs, but some may. Many aerosols, cleaning solvents and foam blowing agents (such as fire extinguishers) used to contain CFCs and occasionally still do. The United Nations Environment Program releases a list of chemical products that contain substances that deplete the ozone layer, as well as alternative products that do not harm the ozone layer. The U.S. Environmental Protection Agency also has a searchable database containing environmental information for products.

- Safe Appliance Disposal

Refrigerators and freezers, especially those manufactured before 1995, often contain CFCs. Air-conditioning units and dehumidifiers may also contain hydrochlorofluorocarbons, which deplete the ozone layer. Safe disposal of old appliances prevents CFCs and HCFCs from being released into the environment. You may be able to a find free or inexpensive safe disposal service by contacting your local utility company. If the appliance still works, you may be able to find a bounty program that will pick up the appliance free of charge and safely redistribute it to somebody who can use it. A more expensive but still safe option involves hiring an EPA-certified technician to remove any dangerous refrigerants from the appliance and then paying for disposal through a local recycling program or garbage dump.

- Industrial Efforts

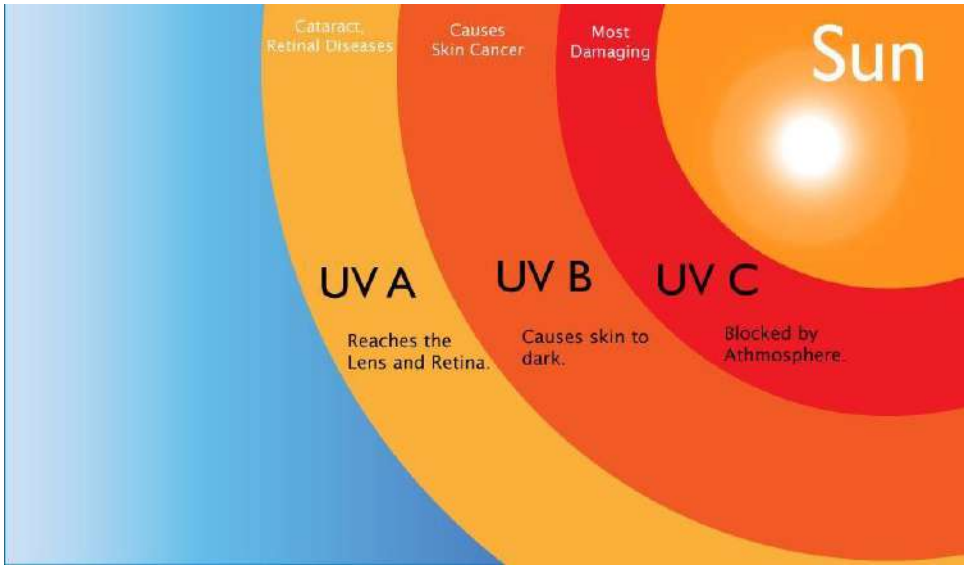
CFCs are currently more common in industrial products than household products. If you own a business or work in the manufacturing industry, search the EPA and United Nations Environment Program databases for safe CFC-free products. Employees can also recommend safe products to employers and make others aware of the negative effects of ozone-depleting substances. If you sell items manufactured elsewhere, choose items made without the use of CFCs whenever possible.

- Policy Changes

Encourage legislation that reduces CFC emissions. The National Resources Defense Council also recommends writing to companies that you or your business patronize to encourage them to reduce use of CFCs and other ozone-depleting substances. Let them know the reasons behind your concern, such as ozone depletion and increased skin cancer risk, and then explain that you are making an effort to purchase products without harmful chemicals. Purchasing power can greatly affect ingredients in products and chemicals used in manufacturing.

UV EXPOSURE

Ultraviolet (UV) radiation is a form of electromagnetic radiation that comes from the sun and man-made sources like tanning beds and welding torches. Radiation is the emission (sending out) of energy from any source. There are many types of radiation, ranging from very high- energy (high-frequency) radiation – like x-rays and gamma rays – to very low-energy (low- frequency) radiation – like radio waves. UV rays are in the middle of this spectrum. They have more energy than visible light, but not as much as x-rays.



UV radiation is divided into 3 main groups:

- UVA rays have the least energy among UV rays. These rays can cause skin cells to age and can cause some indirect damage to cells' DNA. UVA rays are mainly linked to long-term skin damage such as wrinkles, but they are also thought to play a role in some skin cancers.
- UVB rays have slightly more energy than UVA rays. They can damage the DNA in skin cells directly, and are the main rays that cause sunburns. They are also thought to cause most skin cancers.
- UVC rays have more energy than the other types of UV rays. Fortunately, because of this, they react with ozone high in our atmosphere and don't reach the ground, so they are not normally a risk factor for skin cancer. But UVC rays can also come from some man-made sources, such as arc welding torches, mercury lamps, and UV sanitizing bulbs used to kill bacteria and other germs (such as in water, air, food, or on surfaces).

- **How are people exposed to UV radiation?**

- Sunlight

Sunlight is the main source of UV radiation, even though UV rays make up only a small portion of the sun's rays. Different types of UV rays reach the ground in different amounts. About 95% of the UV rays from the sun that reach the ground are UVA rays, with the remaining 5% being UVB rays. The amount of UV exposure a person gets depends on the strength of the rays, the length of time the skin is exposed, and whether the skin is protected with clothing or sunscreen.

- Man-made sources of UV rays

People can also be exposed to man-made sources of UV rays. These include:

- Sunlamps and sunbeds (tanning beds and booths): The amount and type of UV radiation someone is exposed to from a tanning bed (or booth) depends on the specific lamps used in the bed, how long a person stays in the bed, and how many times the person uses it. Most modern UV tanning beds emit mostly UVA rays, with the rest being UVB.
- Phototherapy (UV therapy): Some skin problems (such as psoriasis) are helped by treatment with UV light. For a treatment known as PUVA, a drug called a psoralen is given first. The drug collects in the skin and makes it more sensitive to UV. Then the patient is treated with UVA radiation
- Black-light lamps: These lamps use bulbs that give off UV rays (mostly UVA). The bulb also gives off some visible light, but it has a filter that blocks most of that out while letting the UV rays through. These bulbs have a purple glow and are used to view fluorescent material. Bug-zapping insect traps also use "black light" that gives off some UV rays, but the bulbs use a different filter that causes them to glow blue.
- High-pressure xenon and xenon-mercury arc lamps, plasma torches, and welding arcs: Xenon and xenon-mercury arc lamps are used as sources of light and UV rays for many things, such as UV "curing" (of inks, coatings, etc.), disinfection, to simulate sunlight (to test solar panels, for example), and even in some car

headlights. Most of these, along with plasma torches and welding arcs, are mainly of concern in terms of workplace UV exposure

- **Health issues related to UV radiation?**

In addition to skin cancer, exposure to UV rays can cause other health problems:

- UV rays, either from the sun or from artificial sources like tanning beds, can cause sunburn.
- Exposure to UV rays can cause premature aging of the skin and signs of sun damage such as wrinkles, leathery skin, liver spots, actinic keratosis, and solar elastosis.
- UV rays can also cause eye problems. They can cause the cornea (on the front of the eye) to become inflamed or burned. They can also lead to the formation of cataracts (clouding of the lens of the eye) and pterygium (tissue growth on the surface of the eye), both of which can impair vision.
- Exposure to UV rays can also weaken the immune system, so that the body has a harder time fending off infections. This can lead to problems such as reactivation of herpes triggered by exposure to the sun or other sources of UV rays.
- Some people are more sensitive to the damaging effects of UV radiation. Some medications can also make you more sensitive to UV radiation, making you more likely to get sunburned. And certain medical conditions can be made worse by UV radiation.

- **How to avoid getting UV rays?**

It's not possible (or healthy) to avoid sunlight completely, but there are ways to help ensure you're not getting too much sun:

- If you're going to be outside, simply staying in the shade, especially during midday hours, is one of the best ways to limit your UV exposure from sunlight.
- Protect your skin with clothing that covers your arms and legs.
- Wear a hat to protect your head, face, and neck.
- Wear sunglasses that block UV rays to protect your eyes and the skin around them.
- Use sunscreen to help protect skin that isn't covered with clothing.

Conclusion

From this study it can be concluded that today's world is more serious about the ozone depletion because if the ozone layer depletes quickly than we will leave nothing for our future generation. Hence, to control the depletion of ozone layer we have to stop the use of CFCs. Scientists are doing their best to save the ozone layer by recommending the use of substitutes of CFCs which doesn't harmful for ozone. As a result, we can see positive result over this phenomenon. Scientists showed that, because of banned the using of CFCs which are the main cause of ozone depletion- the ozone depletion process has been decreasing from few years. Although the necessity of CFCs is supplementary, but it is our duty to save our planet by stop uses of CFCs or using non-harmful substitutes and to protect the ozone layer. The few studies that have addressed the biological changes in the skin induced by indoor tanning have shown that they are similar to those induced by sunlight. Many studies have substantiated the carcinogenic effects of UV radiation. Experimental studies in humans have shown that in the basal layers of the epidermis, where melanocytes are located, UVA induces more DNA damage than does UVB. Both UVA and UVB radiation can affect the immune system: while UVB induces immunosuppression at both the local and systemic levels, UVA does not induce systemic immune suppression. Exposure to tanning appliances has also been shown to induce changes in the skin immune system, including reduced skin test responses, changes in lymphocyte populations. We are cognizant of the importance of this issue for the health of light-skinned populations. The strength of the existing evidence suggests that policymakers should consider enacting measures, such as prohibiting minors and discouraging young adults from using indoor tanning facilities, to protect the general population from possible additional risk for melanoma.

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INTRODUCTION

Pollution is a ubiquitous problem in the present-day world, and it is rising continuously all around the globe. All kinds of pollution, such as water, land, sound, and air pollution has a profound impact on every living organism present on the earth. We inhale many toxins and pollutants along with oxygen while breathing, which can cause severe health problems and can even lead to an untimely death. Developing countries face more pollution-related health problems as compared to developed countries. However, students alongside scientists are working hard to protect our home planet from harmful pollution and its hazardous effects.

Fortunately, more and more people are working for environmental protection and conservation. Government and private organizations are working to reduce the factors that are damaging the nature we live in. Today's students are also more concerned about the harmful effects of the contaminated environment and seek to help in their own way. During school and college, the importance of a sound environment is taught to all scholars. They are also asked to work on projects and proceedings on environmental protection methods.

ENVIRONMENTAL POLLUTION

A **Natural Resource** may be defined as any material given to us by nature which can be transformed in a way that it becomes more valuable and useful.

ENVIRONMENTAL POLLUTION is the introduction of contaminants into the natural environment that cause adverse change.[1] Pollution can take the form of chemical substances or energy, such as noise, heat, or light. Pollutants, the components of pollution, can be either foreign substances/energies or naturally occurring contaminants. Pollution is often classed as point source or nonpoint source pollution.

Developmental activities such as construction, transportation and manufacturing not only deplete the natural resources but also produce large amount of wastes that leads to pollution of air, water, soil, and oceans; global warming and acid rains. Untreated or improperly treated waste is a major cause of pollution of rivers and environmental degradation causing ill health and loss of crop productivity.

POLUTION AND POLUTANT

Human activities directly or indirectly affect the environment adversely. A stone crusher adds a lot of suspended particulate matter and noise into the atmosphere. Automobiles emit from their tail pipes oxides of nitrogen, sulphur dioxide, carbon dioxide, carbon monoxide and a complex mixture of unburnt hydrocarbons and black soot which pollute the atmosphere. Domestic sewage and run off from agricultural fields, laden with pesticides and fertilizers, pollute water bodies. Effluents from tanneries contain many harmful chemicals and emit foul smell. These are only a few examples which show how human activities pollute the environment. Pollution may be defined as addition of undesirable material into the environment as a result of human activities. The agents which cause environmental pollution are called pollutants. A pollutants may be defined as a physical, chemical or biological substance unintentionally released into the environment which is directly or indirectly harmful to humans and other living organisms.

TYPES OF POLLUTION

Pollution may be of the following types:

- **Air pollution**
- **Noise pollution**
- **Water pollution**
- **Soil pollution**
- **Thermal pollution**
- **Radiation pollution**
- **Light pollution**

AIR POLLUTION

Air pollution is the presence of substances in the atmosphere that are harmful to the health of humans and other living beings, or cause damage to the climate or to materials. There are many different types of air pollutants, such as gases, particulates, and biological molecules. Air pollution is a result of industrial and certain domestic activity. An ever increasing use of fossil fuels in power plants, industries, transportation, mining, construction of buildings, stone quarries had led to air pollution. **Air pollution** may be defined as the presence of any solid, liquid or gaseous substance including noise and radioactive radiation in the atmosphere in such concentration that may be directly and indirectly injurious to humans or other living organisms, plants, property or interferes with the normal environmental processes. Air pollutants are of two types (1) suspended particulate matter, and (2) gaseous pollutants like carbon dioxide (CO2), NOx etc.

There is a certain percentage of gases present in the atmosphere. An increase or decrease in the composition of these gases is harmful to survival. This imbalance in the gaseous composition has resulted in an increase in earth's temperature, which is known as global warming.

TYPES OF AIR POLLUTANTS

There are two types of air pollutants:

PRIMARY POLLUTANTS

The pollutants that directly cause air pollution are known as primary pollutants. Sulphur-dioxide emitted from factories is a primary pollutant.

Secondary Pollutants

The pollutants formed by the intermingling and reaction of primary pollutants are known as secondary pollutants. Smog, formed by the intermingling of smoke and fog, is a secondary pollutant.

Causes of Air Pollution

Following are the important causes of air pollution:

Burning of Fossil Fuels

The combustion of fossil fuels emits a large amount of sulphur dioxide. Carbon monoxide released by incomplete combustion of fossil fuels also results in air pollution.

Automobiles

The gases emitted from vehicles such as jeeps, trucks, cars, buses, etc. pollute the environment. These are the major sources of greenhouse gases and also result in diseases among individuals.

Agricultural Activities

Ammonia is one of the most hazardous gases emitted during agricultural activities. The insecticides, pesticides and fertilizers emit harmful chemicals in the atmosphere and contaminate it.

Factories and Industries

Factories and industries are the main source of carbon monoxide, organic compounds, hydrocarbons and chemicals. These are released into the air, degrading its quality.

Mining Activities

In the mining process, the minerals below the earth are extracted using large pieces of equipment. The dust and chemicals released during the process not only pollute the air, but also deteriorate the health of the workers and people living in the nearby areas.

Domestic Sources

The household cleaning products and paints contain toxic chemicals that are released in the air. The smell from the newly painted walls is the smell of the chemicals present in the paints. It not only pollutes the air but also affects breathing.

Effects of Air Pollution

The hazardous effects of air pollution on the environment include:

Diseases

Air pollution has resulted in several respiratory disorders and heart diseases among humans. The cases of lung cancer have increased in the last few decades. Children living near polluted areas are more prone to pneumonia and asthma. Many people die every year due to the direct or indirect effects of air pollution.

Global Warming

Due to the emission of greenhouse gases, there is an imbalance in the gaseous composition of the air. This has led to an increase in the temperature of the earth. This increase in earth's temperature is known as global warming. This has resulted in the melting of glaciers and an increase in sea levels. Many areas are submerged underwater.

Acid Rain

The burning of fossil fuels releases harmful gases such as nitrogen oxides and sulphur oxides in the air. The water droplets combine with these pollutants, become acidic and fall as acid rain which damages human, animal and plant life.

Ozone Layer Depletion

The release of chlorofluorocarbons, halons, and hydro chlorofluorocarbons in the atmosphere is the major cause of depletion of the ozone layer. The depleting ozone layer does not prevent the harmful ultraviolet rays coming from the sun and causes skin diseases and eye problems among individuals.

Air Pollution Control

Following are the measures one should adopt, to control air pollution:

Avoid Using Vehicles People should avoid using vehicles for shorter distances. Rather, they should prefer public modes of transport to travel from one place to another. This not only prevents pollution, but also conserves energy.

Energy Conservation A large number of fossil fuels are burnt to generate electricity. Therefore, do not forget to switch off the electrical appliances when not in use. Thus, you can save the environment at the individual level. Use of energy-efficient devices such CFLs also controls pollution to a greater level.

Use of Clean Energy Resources The use of solar, wind and geothermal energies reduce air pollution at a larger level. Various countries, including India, have implemented the use of these resources as a step towards a cleaner environment.

Other air pollution control measures include:

1. By minimizing and reducing the use of fire and fire products.
2. Since industrial emissions are one of the major causes of air pollution, the pollutants can be controlled or treated at the source itself to reduce its effects. For example, if the reactions of a certain raw material yield a pollutant, then the raw materials can be substituted with other less polluting materials.
3. Fuel substitution is another way of controlling air pollution. In many parts of India, petrol and diesel are being replaced by CNG – Compressed Natural Gas fueled vehicles. These are mostly adopted by vehicles that aren't fully operating with ideal emission engines.
4. Although there are many practices in India, which focus on repairing the quality of air, most of them are either forgotten or not being enforced properly. There are still a lot of vehicles on roads which haven't been tested for vehicle emissions.

5. Another way of controlling air pollution caused by industries is to modify and maintain existing pieces of equipment so that the emission of pollutants is minimized.
6. Sometimes controlling pollutants at the source is not possible. In that case, we can have process control equipment to control the pollution.
7. A very effective way of controlling air pollution is by diluting the air pollutants.
8. The last and the best way of reducing the ill effects of air pollution is tree plantation. Plants and trees reduce a large number of pollutants in the air. Ideally, planting trees in areas of high pollution levels will be extremely effective.

NOISE POLLUTION

The word noise is derived from a Latin word **'Nausea'** which means sickness in which one feels the need to vomit. **Noise is the unpleasant and undesirable sound which leads to discomfort in human beings. The intensity of sound is measured in decibels (dB)**. The faintest sound which can be heard by the Human ear is 1 Db. Due to increasing noise around the civilizations, noise pollution has become a matter of concern. Some of its major causes are vehicles, aircraft, industrial machines, loudspeakers, crackers, etc. Some other appliances also contribute to noise pollution like television, transistor, radio, etc. when used at high volume.

TYPES OF NOISE POLLUTION

Following are the three types of pollution:

- Transport Noise
- Neighbourhood Noise
- Industrial Noise

Transport Noise

It mainly consists of traffic noise which has increased in recent years with the increase in the number of vehicles. The increase in noise pollution leads to deafening of older people, headache, hypertension, etc.

Neighbourhood Noise

The noise from gadgets, household utensils etc. Some of the main sources are musical instruments, transistors, loudspeakers, etc.

Industrial Noise

It is the high-intensity sound which is caused by heavy industrial machines. According to many researches, industrial noise pollution damages the hearing ability to around 20%.

CAUSES AND SOURCES OF NOISE POLLUTION

Following are the causes and sources of noise pollution:

- **Industrialisation:** Industrialisation has led to an increase in noise pollution as the use of heavy machinery such as generators, mills, huge exhaust fans are used, resulting in the production of unwanted noise.
- **Vehicles:** Increased number of vehicles on the roads are the second reason for noise pollution.
- **Events:** Weddings, public gatherings involve loudspeakers to play music resulting in the production of unwanted noise in the neighbourhood.
- **Construction sites:** Mining, construction of buildings, etc add to the noise pollution.
- Unnecessary usage of fireworks
- Industrial noise

EFFECTS OF NOISE POLLUTION ON HUMAN HEALTH

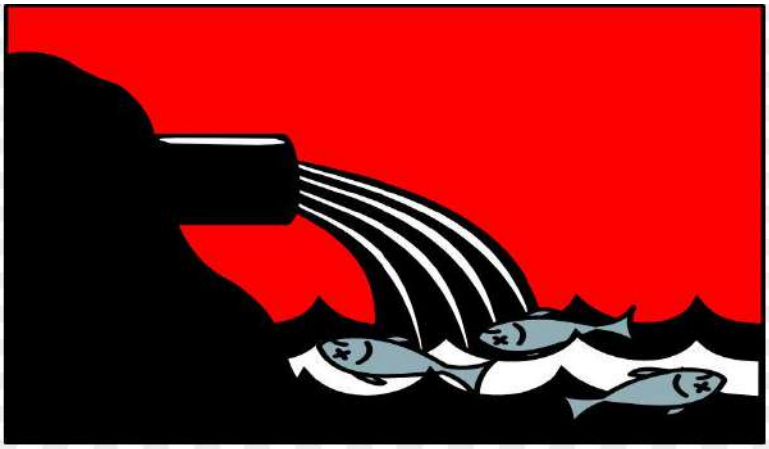
Noise pollution can be hazardous to human health in the following ways:

- **Hypertension:** It is a direct result of noise pollution which is caused due to elevated blood levels for a longer duration.
- **Hearing loss:** Constant exposure of human ears to loud noise that are beyond the range of sound that human ears can withstand damages the eardrums, resulting in loss of hearing.
- **Sleeping disorders:** Lack of sleep might result in fatigue and low energy level throughout the day affecting everyday activities. Noise pollution hampers the sleep cycles leading to irritation and an uncomfortable state of mind.
- **Cardiovascular issues:** Heart-related problems such as blood pressure level, stress and cardiovascular diseases might come up in a normal person and a person suffering from any of these diseases might feel a sudden shoot up in the level.

PREVENTION OF NOISE POLLUON

Some noise pollution preventive measures are provided in the points below.

- Honking in public places like teaching institutes, hospital, etc. should be banned.
- In commercial, hospital, and industrial buildings, adequate soundproof systems should be installed.
- Musical instruments sound should be controlled to desirable limits.
- Dense tree cover is useful in noise pollution prevention.
- Explosives should be not used in forest, mountainous and mining areas.



WATER POLUTION

Water pollution is the contamination of water bodies (like oceans, seas, lakes, rivers, aquifers, and groundwater) usually caused due to human activities. Water pollution is any change in the physical, chemical or biological properties of water that will have a detrimental consequence of any living organism.

Drinking water, also called Potable Water, is the water that is considered safe enough for human and animal consumption. This is water that is generally used for drinking, cooking, washing, crop irrigation, etc. These days chemicals, bacteria, and other pollutants are even affecting our drinking water.

Sources of Water Pollution

Some of the most commonly occurring water pollutants are

- Domestic Waste
- Industrial effluents
- Insecticides and pesticides
- Detergents and Fertilizers

Some of the water pollution that is caused is by *Direct Sources*, such as factories, waste management facilities. refineries etc, that directly release waste and harmful by-products into the nearest water source without treating them. *Indirect sources* include pollutants that enter the water bodies via groundwater or soil or via the atmosphere as acid rain.

EFFECTS OF POLLUTION OF WATER

1. Diseases: In humans, drinking or consuming polluted water in any way has many disastrous effects on our health. It causes typhoid, cholera, hepatitis and various other diseases.
2. Destruction of Ecosystems: Ecosystems are extremely dynamic and respond to even small changes in the environment. Water pollution can cause an entire ecosystem to collapse if left unchecked.
3. Eutrophication: Chemicals in a water body, encourage the growth of algae. These algae form a layer on top of the pond or lake. Bacteria feed on this algae and this decreases the amount of oxygen in the water body, severely affecting the aquatic life there.
4. Effects the food chain: Disruption in food chains happens when toxins and pollutants in the water are consumed by aquatic animals (fish, shellfish etc) which are then consumed by humans.

PREVENTION

The best way to prevent large-scale water pollution is to try and reduce its harmful effects. There are various small changes we can make to protect ourselves from a scary future where water is scarce.

1. Save Water: Conserving water is our first aim. Water wastage is a major problem globally and we are only now waking up to the issue. Simply small changes you can make domestically will make a huge difference.
2. Better treatment of sewage: So treating waste products before disposing of it in a water body helps reduce water pollution on a large scale. Agriculture or other industries can reuse this wastewater by reducing its toxic contents.
3. Use environmentally friendly products: By using soluble products that do not go on to become pollutants, we can reduce the amount of water pollution caused by a household.

SOIL POLLUTION

Soil pollution refers to the contamination of soil with anomalous concentrations of toxic substances. It is a serious environmental concern since it harbours many health hazards. For example, exposure to soil containing high concentrations of benzene increases the risk of contracting leukaemia.

It is important to understand that all soils contain compounds that are harmful/toxic to human beings and other living organisms. However, the concentration of such substances in unpolluted soil is low enough that they do not pose any threat to the surrounding ecosystem. When the concentration of one or more such toxic substances is high enough to cause damage to living organisms, the soil is said to be contaminated.

The root cause of soil pollution is often one of the following:

- Agriculture (excessive/improper use of pesticides)
- Excessive industrial activity
- Poor management or inefficient disposal of waste

The challenges faced in soil remediation (decontamination of soil) are closely related to the extent of soil pollution. The greater the contamination, the greater the requirement of resources for remediation.

THE POLLUTANTS THAT CONTAMINATE SOIL

Some of the most hazardous soil pollutants are xenobiotics – substances that are not naturally found in nature and are synthesized by human beings. The term ‘xenobiotic’ has Greek roots – ‘Xenos’ (foreigner), and ‘Bios’ (life). Several

xenobiotics are known to be carcinogens. An illustration detailing major soil pollutants is provided below.

What are the Processes that Cause Soil Pollution?

Soil pollution can be broadly classified into two categories –

- Naturally caused soil pollution
- Anthropogenic soil pollution (caused by human activity)

Natural Pollution of Soil

In some extremely rare processes, some pollutants are naturally accumulated in soils. This can occur due to the differential deposition of soil by the atmosphere. Another manner in which this type of soil pollution can occur is via the transportation of soil pollutants with precipitation water.

An example of natural soil pollution is the accumulation of compounds containing the perchlorate anion (ClO_4^-) in some dry, arid ecosystems. It is important to note that some contaminants can be naturally produced in the soil under the effect of certain environmental conditions. For example, perchlorates can be formed in soils containing chlorine and certain metals during a thunderstorm.

Anthropogenic Soil Pollution

Almost all cases of soil pollution are anthropogenic in nature. A variety of human activities can lead to the contamination of soil. Some such processes are listed below.

- The demolition of old buildings can involve the contamination of nearby soil with asbestos.
- Usage of lead-based paint during construction activities can also pollute the soil with hazardous concentrations of lead.
- Spillage of petrol and diesel during transportation can contaminate soils with the hydrocarbons found in petroleum.
- Activities associated with metal casting factories (foundries) often cause the dispersion of metallic contaminants into the nearby soils.
- Underground mining activities can cause the contamination of land with heavy metals.
- Improper disposal of highly toxic industrial/chemical waste can severely pollute the soil. For example, the storage of toxic wastes in landfills can result in the seepage of the waste into the soil. This waste can go on to pollute groundwater as well.
- Chemical pesticides contain several hazardous substances. Excessive and inefficient use of chemical pesticides can result in severe soil pollution.
- Sewage produced in urbanized areas can also contaminate soil (if not disposed of correctly). These wastes may also contain several carcinogenic substances.

Other forms of waste that can pollute soil include nuclear waste, e-waste, and coal ash.

WHAT ARE THE NEGATIVE CONSEQUENCES OF SOIL POLLUTION?

Soil pollution harbours a broad spectrum of negative consequences that affect plants, animals, humans, and the ecosystem as a whole. Since children are more susceptible to diseases, polluted soil poses a greater threat to them. Some important effects of soil pollution are detailed in this subsection.

Effects on Human Beings

Soil contaminants can exist in all three phases (solid, liquid, and gaseous). Therefore, these contaminants can find their way into the human body via several channels such as direct contact with the skin or through the inhalation of contaminated soil dust.

The short term effects of human exposure to polluted soil include:

- Headaches, nausea, and vomiting.
- Coughing, pain in the chest, and wheezing.
- Irritation of the skin and the eyes.
- Fatigue and weakness.

A variety of long-term ailments have been linked to soil pollution. Some such diseases are listed below.

- Exposure to high levels of lead can result in permanent damage to the nervous system. Children are particularly vulnerable to lead.
- Depression of the CNS (Central Nervous System).
- Damage to vital organs such as the kidney and the liver.
- Higher risk of developing cancer.

It can be noted that many soil pollutants such as petroleum hydrocarbons and industrial solvents have been linked to congenital disorders in humans. Thus, soil pollution can have several negative effects on human health.

Effects on Plants and Animals

Since soil pollution is often accompanied by a decrease in the availability of nutrients, plant life ceases to thrive in such soils. Soils contaminated with inorganic aluminium can prove toxic to plants. Also, this type of pollution often increases the salinity of the soil, making it inhospitable for the growth of plant life.

Plants that are grown in polluted soil may accumulate high concentrations of soil pollutants through a process known as bioaccumulation. When these plants are consumed by herbivores, all the accumulated pollutants are passed up the food chain. This can result in the loss/extinction of many desirable animal species. Also, these pollutants can eventually make their way to the top of the food chain and manifest as diseases in human beings.

Effects on the Ecosystem

- Since the volatile contaminants in the soil can be carried away into the atmosphere by winds or can seep into underground water reserves, soil pollution can be a direct contributor to air and water pollution.
- It can also contribute towards acid rain (by releasing huge quantities of ammonia into the atmosphere).
- Acidic soils are inhospitable to several microorganisms that improve soil texture and help in the decomposition of organic matter. Thus, the negative effects of soil pollution also impact soil quality and texture.
- Crop yield is greatly affected by this form of pollution. In China, over 12 million tons of grain (worth approximately 2.6 billion USD) is found to be unfit for human consumption due to contamination with heavy metals (as per studies conducted by the China Dialogue).

HOW CAN SOIL POLLUTION BE CONTROLLED?

Several technologies have been developed to tackle soil remediation. Some important strategies followed for the decontamination of polluted soil are listed below.

- Excavation and subsequent transportation of polluted soils to remote, uninhabited locations.
- Extraction of pollutants via thermal remediation – the temperature is raised in order to force the contaminants into the vapour phase, after which they can be collected through vapour extraction.
- Bioremediation or phytoremediation involves the use of microorganisms and plants for the decontamination of soil.
    - Mycoremediation involves the use of fungi for the accumulation of heavy metal contaminants

THERMAL POLLUTION

Thermal pollution is the degradation of water quality by any process that changes ambient water temperature. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers.

Today's environmental pollution is a global phenomenon which has become a major concern for people all over the world since it has severe long term consequences. When we heard the term pollution, then we think about the concepts like carbon emission, personal pollution, and waste. However, the thermal pollution is a real and persistent problem in modern industrialized society.

The term **thermal pollution** has been used to indicate the detrimental effects of heated effluent discharge by various power plants. It denotes the impairment of quality and deterioration of aquatic and terrestrial environment by various industrial plants like thermal, atomic, nuclear, coal-fired plants, oil field generators, factories, and mills

The sources of Thermal Pollution-

1. Nuclear Power Plant

2. Coal-fired power Plant

3. Industrial Effluents

4. Domestic Sewage

5. Hydro-electric power

6. Thermal Power Plant

The discharged effluents of these sources have a higher temperature than the intake water that reduces the concentration of oxygen from the water which causes the deleterious effects on the marine ecosystem.

The harmful effects of the thermal pollution are:-

1. Reduction in dissolved Oxygen

The pollutant from various industrial plants are heated decreases the concentration of oxygen with an increase in the temperature of water.

2. Change in water properties

The decrease in density, viscosity and solubility of gases in water increases the setting speed of suspended particles which seriously affect the food supplies of aquatic organism.

3. Increase in toxicity

The concentrated pollutant causes the rise in the temperature of water which increases the toxicity of the poison present in water. The toxicity in water will increase the death rate in marine life.

4. Disruption of Biological activities

Temperature changes disrupt the entire marine ecosystem because changes in temperature causes change in physiology, metabolism and biological process like respiration rate, digestion, excretion and development of an aquatic organism.

How biochemical cycles stabilises the biosphere?

5. Damage of biotic organism

Aquatic organisms like juvenile fish, plankton, fish, eggs, larva, algae and protozoa which pass through screens and condenser cooling system are extremely sensitive to abrupt temperature changes. They are habitual of warmer water may suddenly

face increase or decrease in temperature of water bodies and thus die because of sudden changes in the temperature of water.

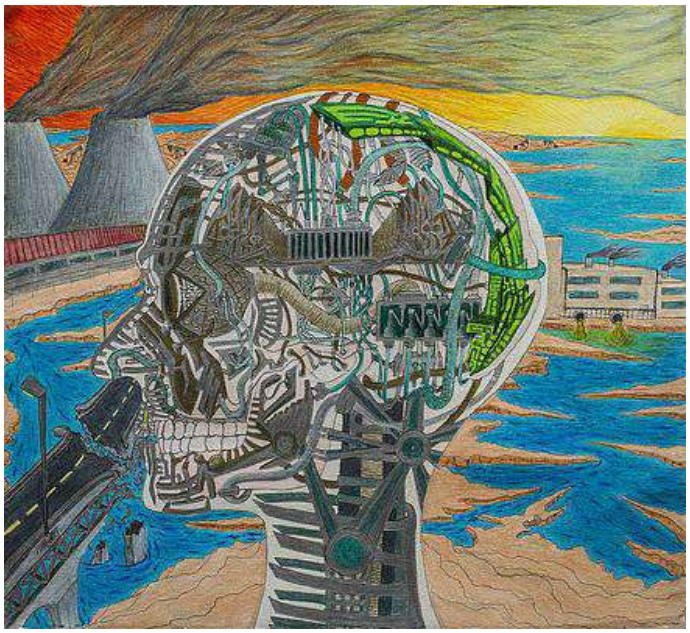
HOW CAN THERMAL POLLUTION BE PREVENTED?

The following measures can be taken to prevent or control high temperature caused by thermal pollution:

1. Heated water from the industries can treated before discharging directly to the water bodies.

2. Heated water from the industries can be treated by the installation of cooling ponds and cooling towers.

3. Industrial treated water can be recycled for domestic use or industrial heating. Hence, we can say any kind of pollution may directly or indirectly affect humans because the loss of biodiversity causes changes that affect all the aspects of the environment.



RIADIATION POLLUTION

The radioactive pollution is defined as the physical pollution of living organisms and their environment as a result of release of radioactive substances into the environment during nuclear explosions and testing of nuclear weapons, nuclear weapon production and decommissioning, mining of radioactive ores, handling and disposal of radioactive

waste, and accidents at nuclear power plants. Nuclear tests are carried out to determine the effectiveness, yield, and explosive capability of nuclear weapons. The proportion of radioactive pollution is 15% of the total energy of the explosion. Radioactive pollution of water, water sources, and air space is the result of radioactive fallout from the cloud of a nuclear explosion. Radionuclides are the main sources of pollution; they emit beta particles and gamma rays, radioactive substances.

LIGHT POLLUTION

WHAT IS LIGHT POLLUTION?

The definition of light pollution, also known as photopollution or luminous pollution, is the excessive, misdirected or invasive use of artificial outdoor lighting. Mismanaged lighting alters the color and contrast of the nighttime sky, eclipses natural starlight, and disrupts circadian rhythms (the 24-hour processes of most organisms), which affects the environment, energy resources, wildlife, humans and astronomy research. The threat of light pollution continues to grow as the demand for artificial light increases each year.
Photopollution is not a new phenomenon. Over the last 50 years, as countries became affluent and urbanized, demand for outdoor lighting increased and light pollution sprawled beyond the city limits and into suburban and rural areas. This form pollution is now prevalent in Asia, Europe, and North America, particularly in cities like Los Angeles, New York and Washington D.C.

However, the most light-polluted spot in the world is Hong Kong, China. In March 2013, the University of Hong Kong named the city the most light polluted in the world. A study by the university found the night sky in Tsim Sha Tsui, an urban neighborhood in southern Kowloon, Hong Kong, to be 1,200 times brighter than a normal urban city sky. Luminous pollution of this magnitude is on the rise worldwide. In a 2010 article from the *Ecology and Society Journal*, Hölker and others stated the use of artificial lighting increases by 20% each year, depending on the region, and noted there is an urgent need for light pollution policies that surpass energy efficiency to include humans, animals and the environment.

CAUSES OF LIGHT POLLUTION

Luminous pollution is caused by using outdoor lights when and where they are not necessary. Poorly designed residential, commercial, and industrial outdoor lights also contribute significantly to light pollution. Unshielded light fixtures emit more than 50% of their light skyward or sideways. In many instances, only 40% of the light emitted actually illuminates the ground.It is estimated that nearly 30% of outdoor lighting is wasted due to this poor design. In the United States alone, wasted lighting accounts for 1.7 million tons of carbon dioxide and $2.2 billion in wasted electricity each year

EFFECTS OF LIGHT POLLUTION

Luminous pollution has dire effects on our environment and resources of energy as well as wildlife ecology and astronomical research. Light pollution also affects the quality of life and safety of humans. Here are some of known side effects of light pollution.

Environment

The International Dark-Sky Association (IDA), a non-profit organization that raises awareness of light pollution, estimates that excessive nighttime lighting releases more than 12 million tons of carbon dioxide, the most serious greenhouse gas, into the atmosphere each year. It would take nearly 702 million trees to absorb the carbon dioxide produced by wasted light.
Light pollution may also contribute to other forms of pollution. According to a 2010 study by the National Oceanic and Atmospheric Association, photopollution increases air pollution by suppressing a naturally occurring radical that cleans the air at night. Nitrate radical, a form of nitrogen oxide, breaks down vehicle and factory emissions at night. The nightly process prevents the emissions from becoming smog, ozone pollution, or other harmful irritants. The process only takes place at night because sunlight destroys nitrate radical. However, artificial lights from buildings, cars, and streetlights, although 10,000 times dimmer than sunlight, also affect nitrate radical and slow down the cleansing process by 7%. Artificial light also increase the chemicals for ozone pollution by 5%.

Wildlife

Luminous pollution affects the feeding, sleeping, mating, and migration cycles of all wildlife. Wildlife can also experience disorientation of time when there is too much artificial light at night.

- **Mammals** - Mammals such as bats, raccoons, coyotes, deer, and moose can experience difficulty foraging for food at night due to over illumination. They risk exposure to natural predators and increased mortality due to night vision impairment. They also experience a decline in reproduction that leads to a shrinking population.
- **Birds** - Birds such as owls and nighthawks use moonlight and starlight to hunt and migrate at night. Artificial lights sources can overwhelm natural light sources, causing birds to be drawn to or fixated on the artificial lights. This results in birds deviating from their intended migration route, flying until they experience exhaustion and

collapse, and becoming prey to other animals. Marine birds such as albatrosses are known to collide with lighthouses, wind turbines, and drilling platforms at sea due to their bright lights. In North America alone, 100 million birds die annually in collisions with illuminated buildings and towers.

- **Amphibians** - Sky glow affects amphibians such as frogs, toads, and salamanders in marshes and wetlands. The orange haze confuses and disorients them, which causes a decrease in feeding and mating. It also impairs natural instincts that protect amphibians against natural predators and the elements.
- **Reptiles** - Reptiles such as sea turtles are greatly affected by light pollution. Female turtles nest on dark, remote beaches, but bright coastal lights prevent them from finding safe nesting areas for their eggs. This leads the female turtles depositing their eggs in an unsafe area or the ocean. Sea turtle hatchlings instinctively crawl toward the brightest part on the beach, which for many centuries was the moonlight and starlit ocean; however, excessive lighting on the beach or near the shore confuses the hatchlings and causes them wander away from the ocean. The hatchlings may be eaten by predators, run over by vehicles, drown in swimming pools, or die from dehydration or exhaustion. Artificial lights may also disorient other nocturnal reptiles.
- **Insects** - Insects such as moths are naturally attracted to light and may use all their energy to stay near a source of light. This interferes with mating and migration as well as makes them vulnerable to natural predators, which reduces their population. This also affects all species that rely on insects for food or pollination.

Astronomy

Light pollution alters our view of the sky and stars, but no group of people is more affected by this phenomenon than astronomers. Light spill and sky glow interferes with astronomical equipment, and makes viewing faint celestial bodies difficult even with the aid of a telescope.

Astronomy is one of the oldest sciences in human history, and has made countless contributions to technology, economy and society with applications like personal computers, communication satellites, mobile phones, Global Positioning Systems (GPS), solar panels, and Magnetic Resonance (MRI) scanners.Today, astronomy helps us determine the Sun's effect on Earth's climate, and identify any potential threats to Earth from space. In order to conduct observation and research, astronomers require dark skies.

Humans

Humans, like plants and wildlife, are regulated by circadian rhythms, the physical, mental and behavioral changes that occur in a 24-hour cycle. The circadian clock regulates physiologic activities such as brain wave patterns, hormone production, and cell regulation. The rhythms respond to the light and darkness around an organism. Disrupting these rhythms can result in a variety of health problems, including sleep disorders, anxiety, depression, diabetes, cancer (particularly breast and prostate cancer), cardiovascular disease, immunological disorders, and obesity.

Melatonin, the naturally occurring hormone that regulates the sleep and wake cycle, is acutely affected by light pollution. The hormone is activated by darkness and repressed by light. Melatonin deficiency can result in anxiety and mood disorders, insomnia, and elevated estrogen/progesterone ratio.

In 2009, the American Medical Association (AMA) unanimously supported the reduction of light pollution, and advocated the development of energy-efficient outdoor lighting to reduce glare and energy waste.

TYPES OF LIGHT POLLUTION

Photopollution occurs in a variety of forms, including light trespass, glare, sky glow, and light clutter. One source of light can result in multiple forms of pollution. Here is how you can identify each form of light pollution.

1. Light Trespass

Light trespass, also known as spill light, occurs when a light fixture casts illumination beyond the property lines, unintentionally illuminating other homes, businesses, or areas. Spill light is the most subjective form light pollution because there are no guidelines to determine when, where, or how much light is unwanted. A common example of spill light is light from a streetlight coming through a window and illuminating a bedroom, light from outdoor wall lights that direct light up towards the sky rather than towards the ground, or light from a neighbor's floodlight or security light shining over the fence and illuminating your property.

2. Glare

Glare is the visual sensation one experiences when stray light, light in the visual field, is greater than the light to which the eyes are adapted. Glare, depending on the intensity, can result in reduced contrast, color perception, and visual performance.

3. Sky Glow

Sky glow originates from natural and man-made sources; however, poorly designed and targeted artificial lights are the main cause of sky glow. Sky glow occurs when light is emitted directly into the atmosphere, accidently or purposefully, where it is scattered by dust and gas molecules, creating a dome-like orange glow that covers the night sky. The glow reduces the contrast between the stars and the galaxies in the sky, making celestial objects difficult to see even with a telescope. Light domes also affect the polarization of moonlight, which nocturnal animals use to navigate.

4. Light Clutter

Light clutter is the excessive grouping of bright lights that cause confusion and distract from oncoming or surrounding objects. Light clutter is visible on roads surrounded by unshielded street lights and brightly lit advertisements or signs. This creates a hazardous environment for drivers and pilots because it competes with traffic and navigation signals. Clutter contributes to other forms of light pollution, including light trespass, glare, and sky glow.

HOW TO MEASURE LIGHT POLLUTION

Measuring light pollution is an intricate process because the natural atmosphere is not completely dark due to airglow and scattered light. To obtain an accurate measurement, scientists use satellite images of Earth at night to determine the number and intensity of the light sources, and calculate the total sky brightness.

Amateur and professional astronomers can also use a Sky Quality Meter, a handheld device that measures sky brightness, to document and compare different areas. Mobile apps like Dark Sky Meter and Loss of Night allow anyone to measure sky brightness.

Another way to gauge light pollution is the Bortle Scale, a nine-level rating system that measures sky quality by providing observable standards. John E. Bortle, a retired fire chief and amateur astronomer, devised the rating system in 2001 as a means to help amateur astronomers evaluate the darkness of an observation site and compare sites. The scale ranges from one, an excellent dark-sky site, to nine, an inner-city sky, and specifies observable criteria for each cl

REDUCTION OF LIGHT POLLUTION

Reducing light pollution implies many things, such as reducing sky glow, reducing glare, reducing light trespass, and reducing clutter. The method for best reducing light pollution, therefore, depends on exactly what the problem is in any given instance. Possible solutions include:

- Utilizing light sources of minimum intensity necessary to accomplish the light's purpose.
- Turning lights off using a timer or occupancy sensor or manually when not needed.
- Improving lighting fixtures, so they direct their light more accurately towards where it is needed, and with fewer side effects.
- Adjusting the *type* of lights used, so the light waves emitted are those that are less likely to cause severe light pollution problems. Mercury, metal halide and above all first generation of blue-light LED road luminaires are much more polluting than sodium lamps: Earth's atmosphere scatters and transmits blue light better than yellow or red light. It is a common experience observing "glare" and "fog" around and below LED road luminaires as soon as air humidity increases, while orange sodium lamp luminaires are less prone to showing this phenomenon.
- Evaluating existing lighting plans, and re-designing some or all the plans depending on whether existing light is actually needed.

CONCLUSION

Pollution is everywhere — from the highest reaches of our atmosphere to the darkest depths of our oceans. Together, But together, we can stop it. we can BeatPollution.

Of course, pollution isn't a new phenomenon - nor is action to counter it. A number of international conventions and national laws are already tackling the problem, and some of them - including efforts to repair the ozone layer and the phasing out of a number of toxic chemicals and pesticides - have been very successful.

. We need to adopt different models advocated by international initiatives like Montreal Protocol, Paris Climate Agreement , Aichi Biodiversity Targets etc.and scale up our efforts . We also need to dramatically step up our ambitions. Although no international agreement explicitly recognizes the right to a healthy environment, many countries around the world have chosen to do so

Pollution touches all parts of the planet and it's the largest environmental cause of disease and premature death in the world today. It affects our health through the food we eat, the water we drink and the air we breathe.

Gender, environment and development are thoroughly enmeshed: pollution not only has a negative impact on the environment, it also creates unequal pressures and health consequences for women and men, girls and boys and vulnerable groups to which they belong. Narrowing down gender gaps through gender-sensitive actions on pollution would increase society's productivity and reduce poverty and hunger appreciably. Addressing pollution thus reduces the burden of disease, helps the environment, improves quality of lives, especially of women and children, reduces the impacts on human health and human capital and avoids income and productivity losses. By acting to prevent, better manage and reduce pollution at the regional, national and local levels, governments and stakeholders put themselves on a path to meeting the Sustainable Development Goals (SDGs), a prime responsibility of all countries in the world. In addition, acting on pollution constitutes an important contribution to achieving the SDGs and the 2030 Agenda for Sustainable Development

The move towards a pollution-free planet is a collective responsibility. The implementation plan looks to different States, as well as to development partners, United Nations agencies, faith-based groups, non-governmental organizations, local authorities and communities, businesses, the financial institutes, Judiciary, media and also people at large.

The strategy to combat pollution should be multipronged, a concern for everybody, part of every economic or investment decision and should aim at Sustainable development. Some of the imperatives can be as under :

1. Knowledge is the power and should be ensured through Science for evidence-based policy and action

2. Implementation of action plan through enhancement of capacity capacity, provision of incentives and adopting integrated policies
3. Infrastructure to be developed through technologies, innovation and circularity (sustainable consumption and production/resource efficiency)

D. Building up of Awareness at every level through outreach, communication, education and consumer information

E. Leadership to be ensured in mobilization of stakeholders, leaders and partners to address different forms of pollution

F. Development of global multilateral environmental agreements and protocols.

Pollution is everybody's concern and it needs each one of us to join hands to combat it.

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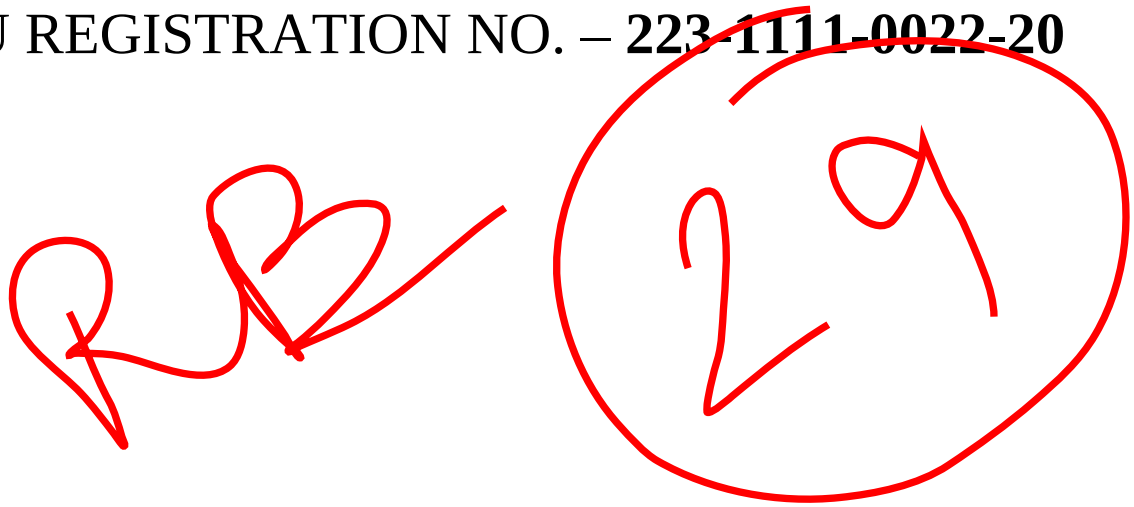

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Pollution in the Ganges

Introduction

Ganga is one of the largest rivers in Asia and India, with its large length and basin sustaining agriculture and civilization for millennia. The river is also a part of Hindu worship, with millions of devotees taking a plunge in its holy waters to receive blessings. The Ganga, while being a sacred river, revered by the Hindus from time immemorial is also routinely defiled through the discharge of sewage, industrial effluents, plastics and corpses, making the Ganga one of the world's most polluted rivers too.

1. A map of the Ganges. From: https://farm1.staticflickr.com/349/32241653071_14da5f7c08_b.jpg

The Ganga emerges from the Gangotri Glacier at Goumukh in Uttarakhand as a small river by the name of Bhagirathi. The Bhagirathi is joined by another river by the name of Alaknanda that originates from the Bhagirath-Kharak and Satopanth glaciers about 100 km South-East of Goumukh. At Devprayag in the lower Himalayas, the Alaknanda and Bhagirathi rivers merge to give birth to the

Ganga. The Ganga goes on to travel from the Lower Himalayas to the Lower Indo- Gangetic Plains before finally draining into Bay of Bengal, giving birth to the largest Delta in the World. The Ganges traverses through the states of Uttarakhand, Uttar Pradesh, Bihar and finally West Bengal. The Ganga splits into two at Farakka to join the Brahmaputra in Bangladesh, giving birth to a larger river by the name of Padma. Ganga's 2715 kilometers journey feeds a large portion of North India with fresh alluvial soil which is vital for agriculture. The Indo-Gangetic plains' fertility can be attributed to the Ganga and her tributaries. Of late, the Ganges has been continuously polluted from the 1900s by using the river as a sewage canal for industrial effluents and urban sewage.

With rising industrialization and urbanization, the discharge of industrial effluents and urbanization has increased, leading to the Ganga's waters becoming quite toxic and inhospitable in most sections of its course. The Ganges is dying under the weight of modern India.

In this essay we shall discuss the Causes of Pollution in the Ganges, the Impact of Pollution in the Ganges and Government initiatives taken to revive the river from its current noxious state.

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Causes of Pollution

Industrial Pollution

It is estimated that around one-fourth of the total volume of wastewater discharged in river Ganga are from industrial sources. However, its contribution to pollution is much greater, due to the higher concentration of pollutants. To quote[1] – "Any industry, having the effluent BOD (Biochemical oxygen demand) load of 100 kg/day or more and/or is involved in the manufacture and use of hazardous substances, is classified as grossly polluting". Industries that meet the measure described above were made mandatory to install Effluent Treatment Plants (ETP) to treat the wastewater before discharging it into the river. The largest source of industrial pollution source is from Uttar Pradesh, which accounts for nearly 55% followed by Haryana, Madhya Pradesh, Rajasthan, West Bengal and others. The major industries located along the river are tanneries, carpets, locomotives and industry located in Kanpur, Varanasi and Allahabad respectively. The tributaries of the rivers are also surrounded by a large number of small-scale industries, power plants, heavy industries and distilleries. There is

[1] Roy, M., & Shamim, F. (2020). Research on the impact of industrial pollution on River Ganga: A Review. *International Journal of Prevention and Control of Industrial Pollution*, *6*(1), 43-51.

also a massive number of small-scale industries located in residential areas of almost all the cities, towns and villages, which directly discharge their effluents into the river.

2: Industrial effluents being discharged into the Ganges. From:https://www.thestatesman.com/wp-content/uploads/2019/12/QT-Water-pollution.jpg

The discharge of sewage into the Ganga is responsible for three-fourth of its pollution with approximately 3000 million litres per day of sewage generated in the towns along the Ganga. This volume is too large for the self-rehabilitation capacity of the river.

*

Sewage and Wastewater

The Ganga basin accounts for some 25% of India's land surface and involves about 33% of its population. The Ganga receives domestic and industrial wastewaters from hundreds of cities and towns during its 2,525- km journey from its source to the ocean through the three major Indian states of Uttar Pradesh, Bihar, and West Bengal. Cities lining the banks of the river often discharge semi-treated sewage into the river, contributing to the toxicity of the river. Approximately 3000 million litres of sewage is discharged into the Ganga on a daily basis.

Cities lining the banks of the Ganga sometimes even discharge untreated sewage into the Ganga. Government initiatives aimed towards building sewage treatment plants haven't been greatly successful, with just a few sewage treatment plants propped up compared to the hundreds that were supposed to be built in accordance to the Ganga Action Plan (GAP). Sewage treatment plants are regularly overworked, thanks to the rising number of residents moving into cities in search for better economic opportunities – leading to greater urbanization.

*

Religious Causes

3: A ghat in Varanasi burning bodies. From: https://i.dailymail.co.uk/i/pix/2015/09/25/12/2CB9D64A00000578-3248208-Manikarnika_Ghat_the_primary_cremation_ghat_in_Varanasi_is_the_m-a-5_1443179983142.jpg

It is well known that the Ganges is a sacred river for the Hindus. For millennia the ashes of the dead have been dumped into the Ganges from the many *ghats* lining the banks of the Ganga. Varanasi in particular is considered a "holy city" where, if one dies, can achieve *moksha*, and is delivered from the cycle of life and death. Almost up to 80 corpses were cremated on the ghats in Varanasi per day, before the Pandemic. Now, the number is in the hundreds. *Tirth Purohits*, those who ritually cremate the bodies, ask the kin of the deceased to gather flowers, fabric and firewood to commence the ceremony. After the corpse is cremated, the ashes are plunged into the river, along with any other remains. The ashes, while they virtually pose no threat to the purity of the river, when combined with the

dumping of the "other remains" such as fabric add to the impurities present in the rivers. Moreover, the corpses of those who were killed by disease (such as cholera or leprosy) are not cremated completely, but rather half burnt, or sometimes not cremated at all, and are thrown into the river wrapped in cloth. These corpses spread disease and contaminate the river further.

The problem of corpse dumping got so worse that the authorities began to train thousands of flesh-eating turtles to clear the river of decomposing dead bodies. However, the plan to release thousands of flesh-eating turtles to feast on decomposing dead bodies failed. To quote Atlas Obscura's article: "What Became of India's Corpse-Eating Turtles?"[2] –

"So, what happened? Well, the plan didn't really work. It was plagued by corruption and mismanagement, and though plenty of forethought was put into raising the turtles, not so much attention was paid to seeing that they survived in the wild after their release, and as a result, they were poached and killed in large numbers. As Richard D. Connerney wrote in his book, The Upside-Down Tree, "In lieu of effective policies that would prevent the dumping of half-burned bodies into rivers and streams, India had turned to this innocent turtle to solve its problems." Ultimately, thousands of turtles died or disappeared, and the Ganges remains a toxic soup today."

*

Other causes

The Ganges, while contaminated with industrial effluents, sewage and decomposing corpses, is also subjected to human waste, such as excreta or urine, often done in the open without any social stigma. Moreover, plastic products are regularly thrown into the river without any punishment whatsoever, becoming a standard practice for many throughout India. Any picture of the Ganges from the banks of cities will point out the tonnes of plastic wastes floating in the water, collecting in the banks as large heaps that are thrown into the river again by Municipal corporations. There seems to be a complete lack of civic sense when it comes to garbage disposal, as the "sacred rivers" of India are routinely abused by India's own citizens due to the inconvenience one might encounter if one is asked to properly dispose of garbage.

Moreover, the populous finds it easier to relieve themselves of nature's call into already contaminated rivers than finding proper toilets to attend nature's call.

[2] Leckert, O. (2015, December 8). What Became of India's Corpse-Eating Turtles? Atlas Obscura. https://www.atlasobscura.com/articles/what-became-of-india-s-corpse-eating-turtles

While this wouldn't have been problematic in the pre-urbanization era, as the Ganga could restore itself quickly thanks to its strong DO (Dissolved Oxygen) retention capacity, human waste adds to the contamination of the Ganges today, as the Ganges, as discussed above, is subjected to an unimaginable number of pollutants.

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The Impact of Pollution

With the staggering amount of contamination present in the river, there is not a doubt that the river's extensive aqua-life has been adversely affected to a large degree. With the large presence of chromium, lead, iron, mercury, nickel and copper metals present in the waters thanks to the factories discharging untreated wastewater, the waters of the Ganges have turned neurotoxic. The consumption of untreated water can lead to seizures, cerebral problems, neurological defects and also, death.

4: Plastic waste lining the banks of the Ganges in Varanasi. From: https://i.pinimg.com/originals/59/0f/56/590f56942d0ff3e0bc957f0a2ea04ccf.jpg

Ganga was reputed to have a rich ecosystem thanks to its high DO (Dissolved Oxygen) capacity, which had helped the Ganges develop a rich ecosystem, which was systematically destroyed by continuous contamination over a long span. The ganga now supports only a few species of life, such as catfish (Siluriformes), tadpoles and other resilient forms of life. Otherwise, the Ganga's putrid waters are festered with trillions of parasites and bacterium that, if we consume (with water for drinking) with, will result in disease. The river is widely reported to be a host of coliform bacteria, which is an indication of a gigantic amount of faecal

matter present in the water. Those who take dips in the Ganga from the *ghats* of Varanasi or Allahabad often complain of skin infections, rashes and itching, which is bound to happen if one makes physical contact with a river so toxic.

Moreover, the soil present near the banks of the river have been rendered devoid of any nitrogenous content and have turned poisonous, unsupportive of even weed, let alone crops. The Ganges supports hundreds of hectares of agricultural land, a poisoned river would mean a poisoned land and crop shortages that would result in famines.

***

Ganga Action Plan

The Ganga Action Plan was launched by the former Prime Minister, Rajiv Gandhi on 14th January 1986 with the aim to clean up the Ganges and restore it to its former glory. However, the Ganges remains toxic, if not more toxic, after 35 years since the conception of the Ganga Action Plan.

The Ganga Action Plan would see greater investment into the building of sewage treatment plants (STP) along the banks of the river to treat the sewage being discharged from the cities, filtration plants installed in factories that discharge wastewater into the river and pollution fines or complete shutdowns of factories that fail to filter their wastes before the wastewater is discharged into the Ganga. The Ganga Action Plan was a top down, technocratic program that involved bureaucratic coordination and administrative supervision, which ultimately failed due to escalating costs, government mismanagement, and corruption. While a few Sewage Treatment Plants (STPs) have been built, these STPs are often understaffed or scarcely maintained, leading to malfunctions or shutdowns of the plants. The Ganga Action Plan was ultimately a failure, with costs overrun, administrative mismanagement, and the age-old Indian problem – corruption.

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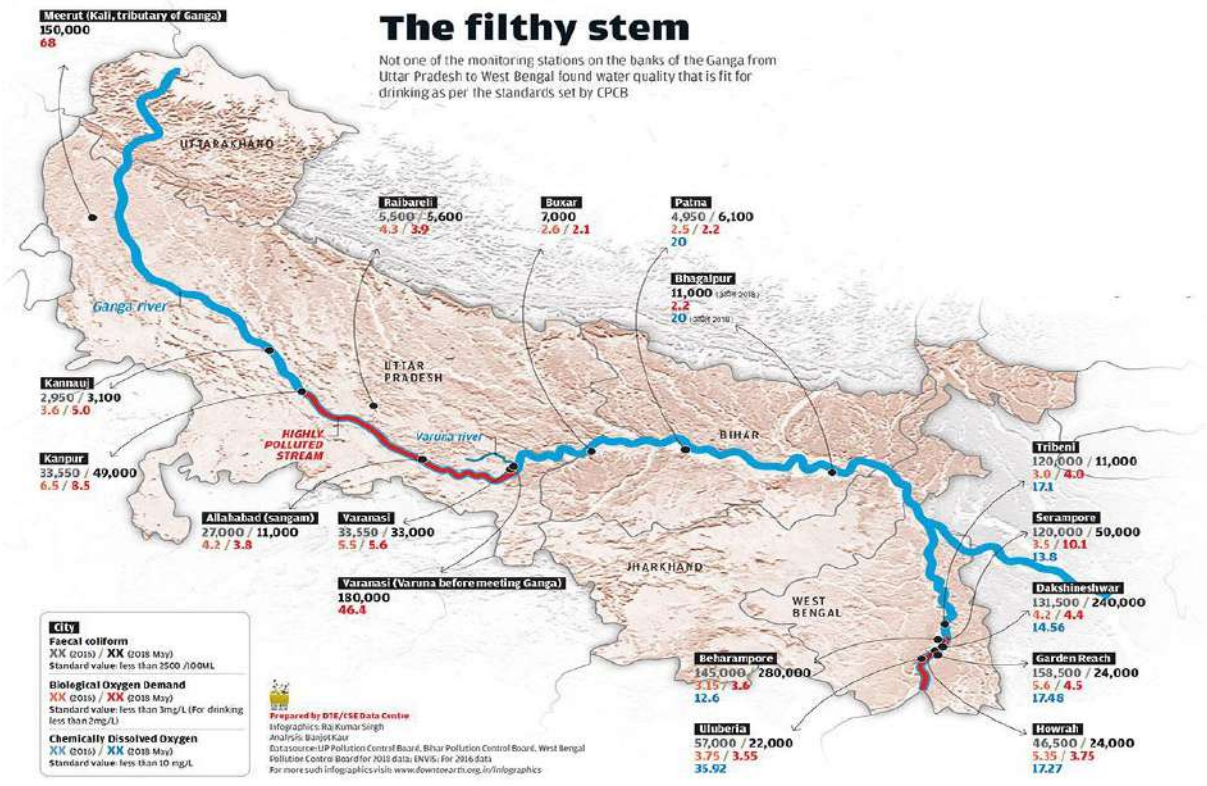
Namami Ganga

A renewed effort in 2014 to clean the Ganga was begun by the current Prime Minister, Narendra Modi, to clean the Ganga by 2019. The deadline has now been extended, but the plan seems to approaching the same dead-end as the Ganga Action Plan of 1986 had encountered. The National Mission for Clean Ganga (NMCG) saw the establishment of a whole Union Ministry – the National Ganga Council (NGC), whose head is the Prime Minister himself. The NGC would have on board the chief ministers of five Ganga basin states – Uttarakhand, Uttar

Pradesh (UP), Bihar, Jharkhand and West Bengal, along with several Union ministers and it was supposed to meet once every year. State Ganga committees were formed that would implement the programmes approved by the Union Ministry.

The NMCG bureaucratically was highly empowered, but it has, like the Ganga Action Plan, also been accused of mismanagement, delays, escalating costs and corruption. Sewage Treatment Plants are also unable to keep up with the volume of daily sewage discharged by the cities. To quote[3] - "The government has said that the new projects are delayed because land acquisition and other related activities were taking a lot of time. However, poor performance in rehabilitating old STPs does not stand the test of time scarcity."



5. A map showing the levels of pollution throughout the Ganges. From: https://cdn.downtoearth.org.in/library/large/2018-10-15/0.56719100_1539602035_20-21-20181031-dteenglish.jpg

Moreover, the sewage network of cities like Kanpur (Kanpur has been vehemently accused time and again for being a major contributor to pollution in the Ganga) have not been fully built. This has led to raw, untreated wastewater entering the Ganga from domestic households and industrial plants, with metals like chromium forming a visible layer at the top of the water. Not to mention,

[3] Kaur, B. (2018, October 15). Namami Gange: 5 reasons why Ganga will not be clean by 2020. DownToEarth. https://www.downtoearth.org.in/coverage/pollution/namami-gange-5-reasons-why-ganga-will-not-be-clean-by-2020-61891

plastics dumped directly into the river mingle with the other toxic containments to form sludge.

Sludge can be best described as murky muddy water. The sludge present in the Ganga is quite toxic and dangerous, with the sludge being formed with a mixture of industrial effluents, faecal matter, plastics and sewage.

While the government did put extensive effort to build toilets in villages populating the banks of the river (called Ganga Grams), it seems to have forgotten to build functional toilets. To quote[4] - The river has another persistent problem that is going to be more pronounced. "I have a toilet in my home but the two pits under are overflowing with waste. How do I use it?" says Rashid Ali of Chhapri village in Allahabad district. He and his family are back to defecating in the open near the Ganga. Other villagers also narrate similar issues and say the construction of toilets has compounded their problems because the overflowing toilets have also made their homes dirty. The damning indictment is supported by many people living in cities along the banks of the Ganga.

The Namami Ganga promises quite a lot for the restoration of the scared river, but it fails to deliver. While the programme is still ongoing, the Government seems to have given up on it a long time ago. The NMCG exists, but mostly on paper.

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Conclusion

Ganga, the sacred river that gave birth to civilisations and empires in India is now dying under the weight of a modern India. While ambitious plans such as the Ganga Action Plan and Namami Ganga have been launched, these plans have routinely failed to deliver due to escalating costs, mismanagement and corruption. Moreover, the Government in both programmes pushed for a top-down technocratic approach, that alienated the local populous from a programme designed for the "collective good". While there is no shortage of journalism and academic studies into the pollution of the Ganges, the populous still lacks genuine concern into the health of the Ganges.

Factories and cities must have proper sewage networks that can divert the flow of wastewater into Sewage Treatment Plants before the sewage is discharged into

[4] Kaur, B. (2018, October 15). Namami Gange: 5 reasons why Ganga will not be clean by 2020. DownToEarth. https://www.downtoearth.org.in/coverage/pollution/namami-gange-5-reasons-why-ganga-will-not-be-clean-by-2020-61891

the Ganga. Moreover, already existing sewage treatment plants must be maintained with more built to keep up with volume of wastewater.

There also is a great divide between science and faith. The *tirth purohits*, and sages of Varanasi are vehemently against any alteration in the ritual cremation and plunging of ashes and bodies into the river. In a field survey[5], the boatmen, *and tirth purohits* blame the government for its failures to clean the Ganga, but to some degree, the boatmen and *tirth purohits* are also guilty of polluting the Ganga, along with the rest of us.

The long-held belief by the Hindus of attaining *moksha* by dying in the holy city of Varanasi and having their ashes plunged into the Ganges cannot be wiped out, however, the authorities can ensure proper cremation of all corpses in the *ghats*. Those corpses which cannot be cremated in the *ghats* can be taken to crematoriums for proper cremation.

6. The Ganges in Varanasi. From: https://static.businessworld.in/article/article_extra_large_image/1490162739_HeOB6m_varanasi-shutterstock.jpg

A grassroot movement must begin, to counter the recurring top-down technocratic approach taken by our government to clean the Ganges. The local populous must be integrated into the project of saving the Ganga – only then can a campaign aimed towards cleaning the Ganga have a sustained base of support and enthusiasm. Ganga had been declared a national river in 2008, but that hasn't

[5] Alley, K. (1994). Ganga and Gandagi: Interpretations of Pollution and Waste in Benaras. Ethnology, 33(2), 127-145. doi:10.2307/3773893

truly reflected in our national priorities. A campaign for a clean Ganga is ultimately in our hands.

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TITLE- AIR POLLUTION

CU ROLL NO. - 202223-21-0008

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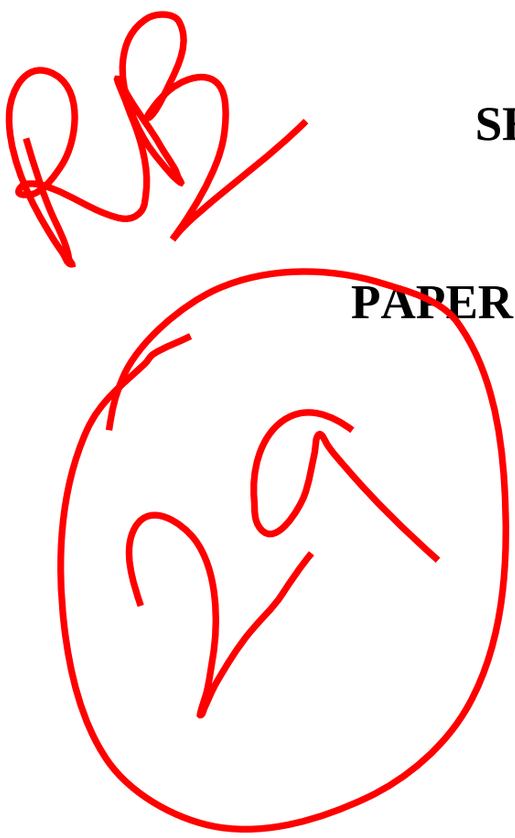
DEPARTMENT OF HISTORY(B.A HONOURS)

SEMESTER - 2nd

PAPER NAME- AECC ENVS



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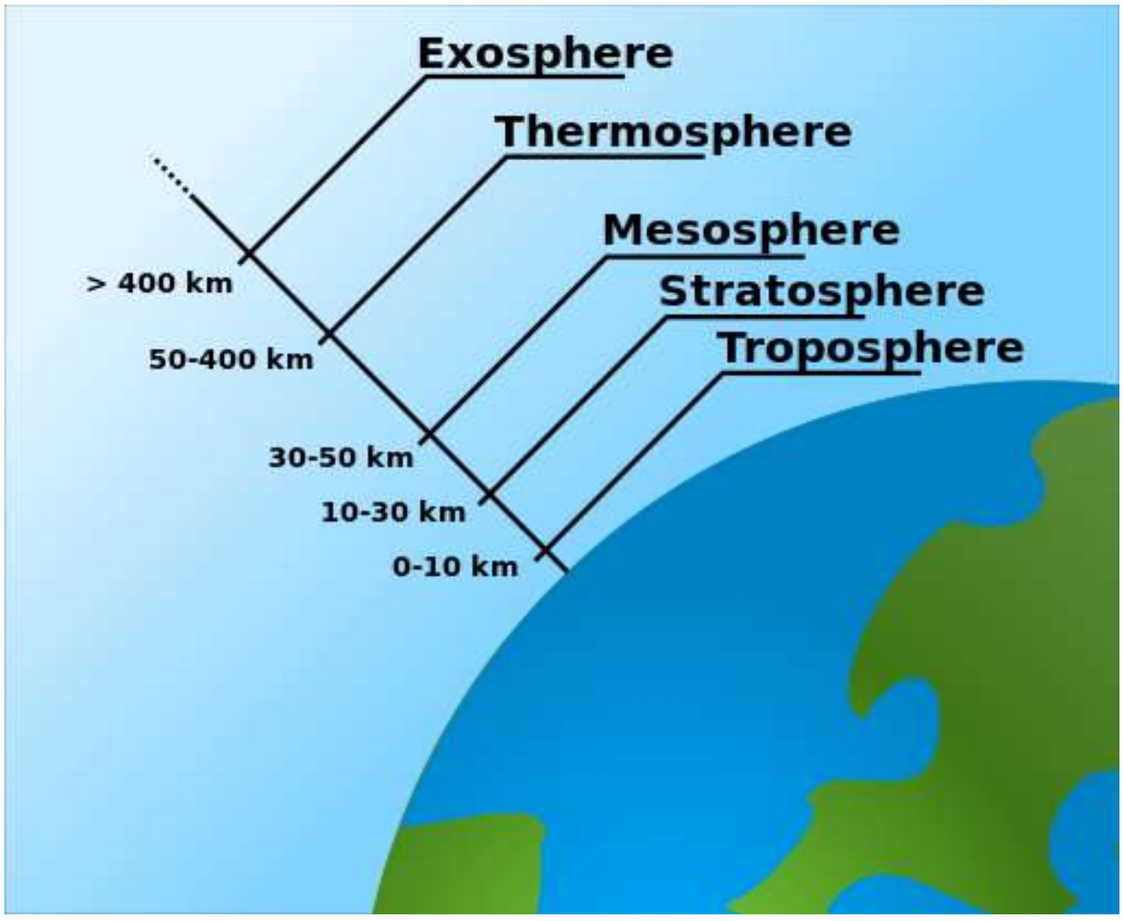
INTRODUCTION

Air is essential for life itself; without it we could survive only a few minutes. It constitutes immediate physical environment of living organisms. It is a mixture of various gases like nitrogen, oxygen and carbon dioxide, and others in traces; along with water vapor perceptible as humidity and suspended solids in particulate form.

We are all aware that our environment is not what it used to be. Our elders talk about the clean water and fresh air that was available in their times. Now the media regularly reports on the falling quality of the environment. We ourselves feel the impact of the falling quality of air and water in our lives. The number of people suffering from diseases of the respiratory system, for example, is steadily rising.

We can survive for some time without food, but we cannot survive even for a few minutes without air. This simple fact tells us how important clean air is to us.



WHAT IS AIR POLLUTION?

Air pollution may be defined as any atmospheric condition in which certain substances are present in such concentrations that they can produce undesirable effects on man and his environment. These substances include gases, particulate matter (smoke, dust, fumes) radioactive materials and many others. Most of these substances are naturally present in the atmosphere in low concentrations and are usually considered to be harmless. The background concentrations of various components of dry air near sea level and their estimated residence times are given in Annex-1 Thus, a particular substance can be considered as an air pollutant only when its concentration is relatively high compared with the back ground value and causes adverse effects.

Air pollution is a problem of obvious importance in most of the world that affects human, plant and animal health. For example, there is good evidence that the health of 900 million urban people suffers daily because of high levels of ambient air sulfur dioxide concentrations. Air pollution is one of the most serious environmental problems in societies at all level of economic development. Air pollution can also affect the properties of materials (such as rubber), visibility, and the quality of life in general. Industrial development has been associated with emission to air of large quantities of gaseous and particulate emissions from both industrial production and from burning fossil fuels for energy and transportation.

When technology was introduced to control air pollution by reducing emissions of particles, it was found that the gaseous emissions continued and caused problems of their own. Currently efforts to control both particulate and gaseous emissions have been partially successful in much of the developed world, but there is recent evidence that air pollution is a health risk even under these relatively favorable conditions.

In societies that are rapidly developing sufficient resources may not be invested in air pollution control because of other economic and social priorities. The rapid expansion of the industry in these countries has occurred at the same time as increasing traffic from automobiles and trucks, increasing demands for power for the home, and concentration of the population in large urban areas called mega cities. The result has been some of the worst air pollution problem in the world.

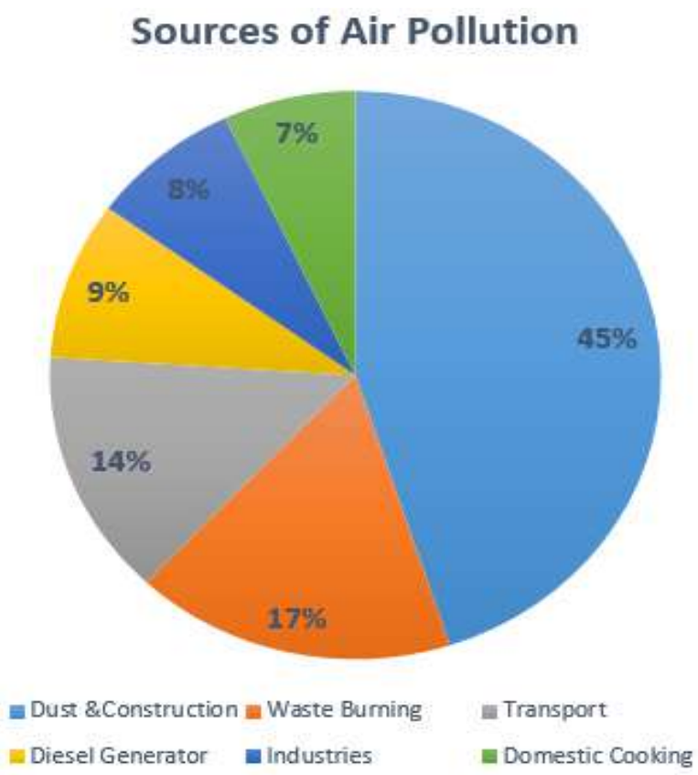
The quality of air indoors is a problem also in many developed countries because buildings were built to be airtight and energy efficient. Chemicals produced by heating and cooling systems, smoking and evaporation from buildings materials accumulate indoors and create a pollution problem. In Ethiopia, like many traditional societies, the problem of indoors air pollutions resulted from in efficient and smoky fuels used to heat buildings and cook. In the rural households of Ethiopia, most of the children and women are staying in overcrowded condition of a one roomed or thatched roof house that exposed them for the indoor air pollution. It is also known that mothers and children are spending more than 75% percent of their day time at home. Identification of the problems of both at outdoors and indoors air pollutions in the societies one has to make interventions to alleviate the health related problems and promote safe ventilation of air in the living and working areas. First, however, some basic science is needed to understand air pollution.

HOW DOES AIR GET POLLUTED?

The substances which contaminate the air are called air pollutants. Sometimes, such substances may come from natural sources like smoke and dust arising from forest fires or volcanic eruptions. Pollutants are also added to the atmosphere by certain human activities. The sources of air pollutants are factories, power plants, automobile exhausts and burning of firewood and dung cakes.

Many respiratory problems are caused by air pollution. Vehicles produce high levels of pollutants like carbon monoxide, carbon dioxide, nitrogen oxides and smoke. Carbon monoxide is produced from incomplete burning of fuels such as petrol and diesel. It is a poisonous gas. It reduces the oxygen-carrying capacity of the blood.

Smoke may contain oxides of nitrogen which combine with other air pollutants and fog to form smog. The smog causes breathing difficulties such as asthma, cough and wheezing in children. Many industries are also responsible for causing air pollution. Petroleum refineries are a major source of gaseous pollutants like sulphur-dioxide and nitrogen-dioxide. Sulphur-dioxide is produced by combustion of fuels like coal in power plants. Other kinds of pollutants are chlorofluorocarbons (CFCs) which are used in refrigerators, air conditioners and aerosol sprays. CFCs damage the ozone layer of the atmosphere. They reduce visibility. Such particles are also produced during industrial processes like steel making and mining. Power plants give out tiny ash particles which also pollute the atmosphere.



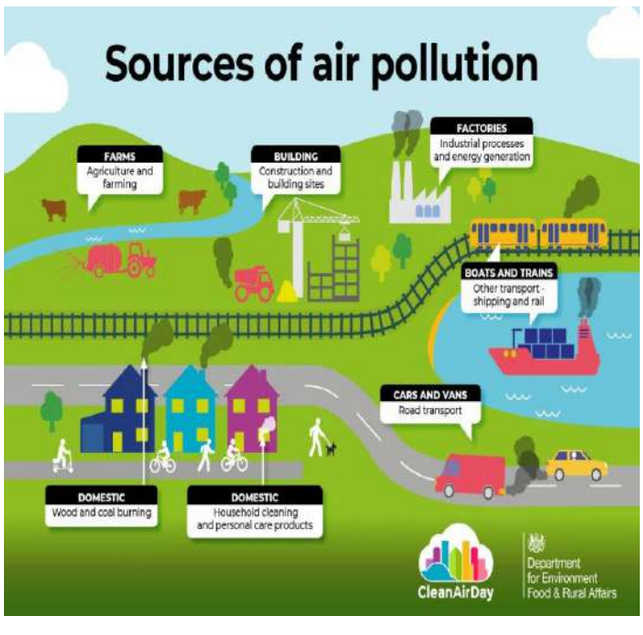
Particulate pollutants: Particulate matter suspended in air are dust and soot released from the industrial chimneys. Their size ranges from 0.001 to 500 µm in diameter. Particles less than 10µm float and move freely with the air current. Particles which are more than 10µm in diameter settle down. Particles less than 0.02 µm form persistent aerosols. Major source of SPM (suspended particulate matter) are vehicles, power plants, construction activities, oil refinery, railway yard, market place, industries, etc.

Fly ash: Fly ash is ejected mostly by thermal power plants as byproducts of coal burning operations. Fly ash pollutes air and water and may cause heavy metal pollution in water bodies. Fly ash affects vegetation as a result of its direct deposition on leaf surfaces or indirectly through its deposition on soil. Fly ash is now being used for making bricks and as a land fill material.

Lead and other metals particles: Tetraethyl lead (TEL) is used as an anti-knock agent in petrol for smooth and easy running of vehicles. The lead particles coming out from the exhaust pipes of vehicles is mixed with air. If inhaled it produces injurious effects on kidney and liver and interferes with development of red blood cells. Lead mixed with water and food can create cumulative poisoning. It has long term effects on children as it lowers intelligence.

Oxides of iron, aluminum, manganese, magnesium, zinc and other metals have adverse effect due to deposition of dust on plants during mining operations and metallurgical processes. They create physiological, biochemical and developmental disorders in plants and also contribute towards reproductive failure in plants.

Gaseous pollutants: Power plants, industries, different types of vehicles – both private and commercial use petrol, diesel as fuel and release gaseous pollutants such as carbon dioxide, oxides of nitrogen and sulphur dioxide along with particulate matter in the form of smoke. All of these have harmful effects on plants and humans.

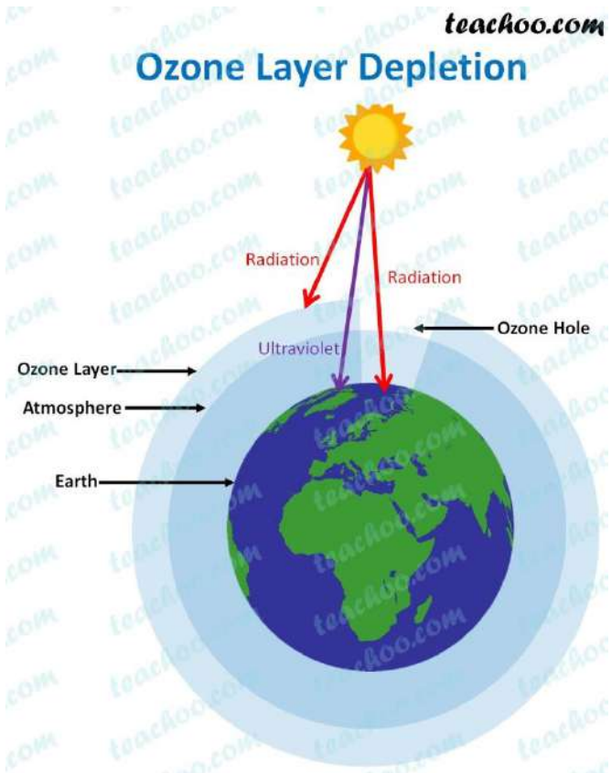


UNIT OF MEASUREMENT

Concentrations of air pollutants are commonly expressed as the mass of pollutant per Unit volume of air mixture, as mg/m3 , µg/m3 , ng /m3 Concentration of gaseous pollutants may also be expressed as volume of pollutant per million volumes of the air plus pollutant mixture (ppm) where 1ppm= 0.0001 % by volume. It is sometimes necessary to convert from volumetric units to mass per unit volume and vice versa. The relationship between ppm and mg/m3 depends on the gas density, which in turn depends on: □ Temperature □ Pressure □ Molecular weight of the pollutant The following expression can be uses to convert of between ppm and mg/m3 at any temperature or pressure. mg/m3 = 273 X PPM X molecular wt. X pressure 22.4 X temperature Simply multiply the calculated value of mg/m3 by 1000 to obtain µg/m3 The constant 22.4 is the volume in liter occupied by 1 mole of an ideal gas at standard concentration (0 0 c and 1 atm.). One mole of any substance is a quantity of that substance whose mass in grams numerically equals its molecular weight.

OZONE HOLE-CAUSES AND HARM DUE TO OZONE DEPLETION

The stratosphere has an ozone layer which protects the earth's surface from excessive ultraviolet (UV) radiation from the Sun. Chlorine from chemicals such as chlorofluorocarbons (CFCs) used for refrigeration, air conditioning, fire extinguishers, cleaning solvents, aerosols (spray cans of perfumes, medicine, insecticide) cause damage to ozone layer chlorine contained in the CFCs on reaching the ozone (O3) layer split the ozone molecules to form oxygen (O2). Amount of ozone, thus gets reduced and cannot prevent the entry of UV radiation. There has been a reduction of ozone umbrella or shield over the Arctic and Antarctic regions. This is known as ozone hole. This permits passage of UV radiation on earth's atmosphere which causes sunburn, cataract in eyes leading to blindness, skin cancer, reduced productivity of forests, etc. Under the "Montreal Protocol" amended in 1990 it was decided to completely phase out CFCs to prevent damage of ozone layer.



PUBLIC HEALTH IMPORTANCE OF AIR

Air pollution is a very complicated physical and chemical system. It can be thought of as a variety of constituents that are dissolved or suspended in air, many of which interact with one another and many of which acts together to produce their effects.

The constituents of air pollution change with the season, with industrial activity, with changes in traffic, and with the prevailing winds, to name just a few relevant factors. The composition of air pollution is, therefore, not constant from day to day or even week to week on an average, but trends to cycle. Average levels go up and down fairly consistently depending on the time of year but the actual levels are highly variable from one year to the next

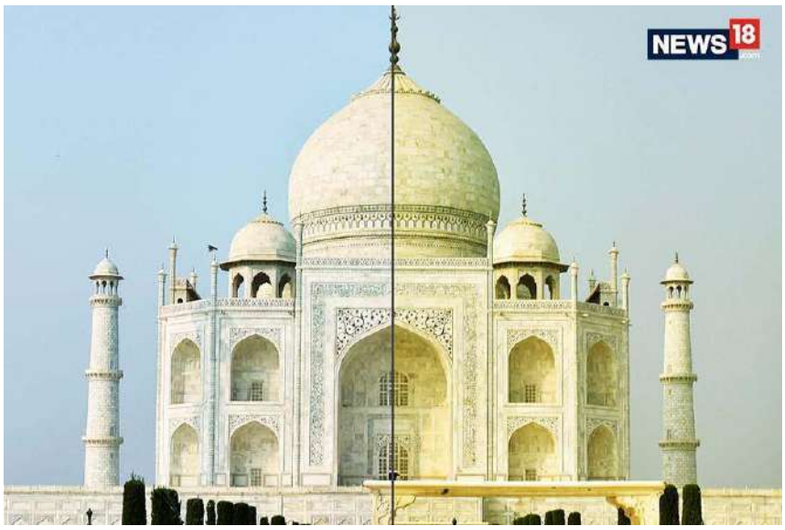
One of the most dangerous modes of transmission of health related problems is, air serves as a vehicle. Therefore poor ventilation of air and overcrowding conditions are creating more favorable situation to the transmission of pollutants.

In Ethiopia rural household conditions, where there are more family members, without having enough number of doors and windows and staying at home significant proportion of the day time are highly victims for indoor air pollutions.

Dust storm approaching Stratford, Texas.

CASE STUDY- THE TAJ MAHAL

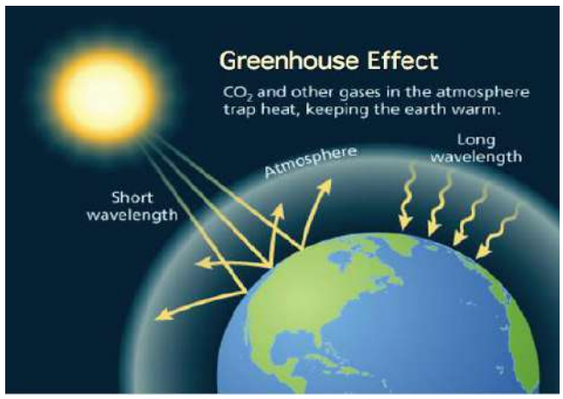
Over the past 2 decades, India's most famous tourist attraction, Taj Mahal located in Agra, has become a matter of concern. Experts have warned that pollutants in air are discoloring its white marble. So, it is not only living organisms that get affected by polluted air but non-living things like buildings, monuments and statues also get affected. The industries located in and around Agra like rubber processing, automobile, chemicals and especially the Mathura oil refinery, have been responsible for producing pollutants like sulphur dioxide and nitrogen dioxide. These gases react with the water vapor present in the atmosphere to form sulphuric acid and nitric acid. The acids drop down with rain, making the rain acidic. This is called acid rain. Acid rain corrodes the marble of the monument. The phenomenon is also called "Marble cancer". Suspended particulate matter, such as the soot particles emitted by Mathura oil refinery, has contributed towards the yellowing of the marble. The Supreme Court has taken several steps to save the Taj. It has ordered industries to switch to cleaner fuels like CNG (Compressed Natural Gas) and LPG (Liquefied Petroleum Gas). Moreover, the automobiles should switch over to unleaded petrol in the Taj zone.



EFFECT OF AIR POLLUTION ON THE TAJ MAHAL

GREENHOUSE EFFECT

A part of the radiation of the sun that falls on the earth is absorbed by the surface of the Earth, and a part is reflected back into space. A part of the reflected radiation is trapped by the atmosphere. The trapped radiations further warm the earth. We have seen a greenhouse in a nursery or elsewhere, we find that the sun's heat is allowed to get in but is not allowed to go out. The trapped heat warms the green house. The trapping of radiations by the earth's atmosphere is similar. That is why it is called the greenhouse effect. Without this process, life would not have been possible on the earth. But now it threatens life. Excess of CO2 in the air is one of the gases responsible for this effect. We know that CO2 is one of the components of air. We have also studied the role of carbon dioxide in plants. But if there is excess of CO2 in the air, it acts as a pollutant. On the one hand, CO2 is continuously being released because of human activities. On the other hand, area under forests is decreasing. Plants utilize CO2 from the atmosphere for photosynthesis, thereby decreasing the amount of CO2 in the air. Deforestation leads to an increase in the amount of CO2 in the air because the number of trees which consume CO2 is reduced. Human activities, thus, contribute to the accumulation of CO2 in the atmosphere. CO2 traps heat and does not allow it to escape into space. As a result, the average temperature of the earth's atmosphere is gradually increasing. This is called global warming. Other gases like methane, nitrous oxide and water vapor also contribute towards this effect. Like CO2 , they are also called greenhouse gases. Global warming has become a major concern for governments worldwide. Many countries have reached an agreement to reduce the emission of greenhouse gases. The Kyoto Protocol is one such agreement. The Gangotri glacier in the Himalayas has started melting because of global warming.



CONCLUSION

There are many success stories in our fight against air pollution. For example, a few years ago, Delhi was one of the most polluted cities in the world. It was being choked by fumes released from automobiles running on diesel and petrol. A decision was taken to switch to fuels like CNG and unleaded petrol. These measures have resulted in cleaner air for the city. The quality of air at various locations is monitored regularly by government and other agencies. We can use this data to generate awareness about air pollution among friends and neighbours. There is a need to switch over to alternative fuels instead of the fossil fuels for our energy requirements. These could be solar energy, hydropower and wind energy. Small contributions on our part can make a huge difference in the state of the environment. We can plant trees and nurture the ones already present in the neighbourhood.

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GREENHOUSE EFFECT

C.U. ROLL NO. – 202223-21-0015

C.U. REGISTRATION NO. – 223-1111-0055-20

SEMESTER II

E.N.V.S

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ORIGINS OF THE TERM

The origins of the term greenhouse effect are unclear. French mathematician Joseph Fourier is sometimes given credit as the first person to coin the term greenhouse effect based on his conclusion in 1824 that Earth's atmosphere functioned similarly to a "hotbox"—that is, a heliothermometer (an insulated wooden box whose lid was made of transparent glass) developed by Swiss physicist Horace Bénédict de Saussure, which prevented cool air from mixing with warm air. Fourier, however, neither used the term greenhouse effect nor credited atmospheric gases with keeping Earth warm. Swedish physicist and physical chemist Svante Arrhenius is credited with the origins of the term in 1896, with the publication of the first plausible climate model that explained how gases in Earth's atmosphere trap heat. Arrhenius first refers to this "hot-house theory" of the atmosphere—which would be known later as the greenhouse effect—in his work Worlds in the Making (1903).

What is the Greenhouse Effect?

The Sun powers Earth's climate, radiating energy at very short wavelengths, predominately in the visible or near-visible (e.g., ultraviolet) part of the spectrum. Roughly one-third of the solar energy that reaches the top of Earth's atmosphere is reflected directly back to space. The remaining two-thirds is absorbed by the surface and, to a lesser extent, by the atmosphere. To balance the absorbed incoming energy, the Earth must, on average, radiate the same amount of energy back to space. Because the Earth is much colder than the Sun, it radiates at much longer wavelengths, primarily in the infrared part of the spectrum (see Figure 1). Much of this thermal radiation emitted by the land and ocean is absorbed by the atmosphere, including clouds, and reradiated back to Earth. This is called the greenhouse effect. The glass walls in a greenhouse reduce airflow and increase the temperature of the air inside. Analogously, but through a different physical process, the Earth's greenhouse effect warms the surface of the planet. Without the natural greenhouse effect, the average temperature at Earth's surface would be below the

freezing point of water. Thus, Earth's natural greenhouse effect makes life as we know it possible. However, human activities, primarily the burning of fossil fuels and clearing of forests, have greatly intensified the natural greenhouse effect, causing global warming. The two most abundant gases in the atmosphere, nitrogen (comprising 78% of the dry atmosphere) and oxygen (comprising 21%), exert almost no greenhouse effect. Instead, the greenhouse effect comes from molecules that are more complex and much less common. Water vapour is the most important greenhouse gas, and carbon dioxide (CO2) is the second-most important one. Methane, nitrous oxide, ozone and several other gases present in the atmosphere in small amounts also contribute to the greenhouse effect. In the humid equatorial regions, where there is so much water vapour in the air that the greenhouse effect is very large, adding a small additional amount of CO2 or water vapour has only a small direct impact on downward infrared radiation. However, in the cold, dry polar regions, the effect of a small increase in CO2 or water vapour is much greater. The same is true for the cold, dry upper atmosphere where a small increase in water vapour has

a greater influence on the greenhouse effect than the same change in water vapour would have near the surface. Several components of the climate system, notably the oceans and living things, affect atmospheric concentrations of greenhouse gases. A prime example of this is plants taking CO2 out of the atmosphere and converting it (and water) into carbohydrates via photosynthesis. In the industrial era, human activities have added greenhouse gases to the atmosphere, primarily through the burning of fossil fuels and clearing of forests. Adding more of a greenhouse gas, such as CO2, to the atmosphere intensifies the greenhouse effect, thus warming Earth's climate. The amount of warming depends on various feedback mechanisms. For example, as the atmosphere warms due to rising levels of greenhouse gases, its concentration of water vapour increases, further intensifying the greenhouse effect. This in turn causes more warming, which causes an additional increase in water vapour, in a self-reinforcing cycle. This water vapour feedback may be strong enough to approximately double the increase in the greenhouse effect due to the added CO2 alone. Additional important feedback mechanisms involve clouds. Clouds are

effective at absorbing infrared radiation and therefore exert a large greenhouse effect, thus warming the Earth. Clouds are also effective at reflecting away incoming solar radiation, thus cooling the Earth. A change in almost any aspect of clouds, such as their type, location, water content, cloud altitude, particle size and shape, or lifetimes, affects the degree to which clouds warm or cool the Earth. Some changes amplify warming while others diminish it. Much research is in progress to better understand how clouds change in response to climate warming, and how these changes affect climate through various feedback mechanisms.

PHOTOGRAPH BY BJORN ANDERS NYMOEN, MYSHOT

ON THIN ICE

Polar bears have become a symbol of global warming, because the Arctic landscape is one of the first to absorb the impact of rising temperatures. Warming temperatures melt polar ice and force animals like the polar bear to move farther south in search of food and other resources.

How Does the Greenhouse Effect Work?

Solar energy absorbed at Earth's surface is radiated back into the atmosphere as heat. As the heat makes its way through the atmosphere and back out to space, greenhouse gases absorb much of it. Why do greenhouse gases absorb heat? Greenhouse gases are more complex than other gas molecules in the atmosphere, with a structure that can absorb heat. They radiate the heat back to the Earth's surface, to another greenhouse gas molecule, or out to space.

There are several different types of greenhouse gases. The major ones are carbon dioxide, water vapor, methane, and nitrous oxide. These gas molecules all are made of three or more atoms. The atoms are held together loosely enough that they vibrate when they absorb heat. Eventually, the vibrating molecules release the radiation, which will likely be absorbed by another greenhouse gas molecule. This process keeps heat near the Earth's surface. Most of the gas in the atmosphere is nitrogen and oxygen, which cannot absorb heat and contribute to the greenhouse effect.

What are Greenhouse Gases?

Earth's greenhouse gases trap heat in the atmosphere and warm the planet. The main gases responsible for the greenhouse effect include carbon dioxide, methane, nitrous oxide, and water vapor (which all occur naturally), and fluorinated gases (which are synthetic). Greenhouse gases have different chemical properties and are removed from the atmosphere, over time, by different processes. Carbon dioxide, for example, is absorbed by so-called carbon sinks such as plants, soil, and the ocean. Fluorinated gases are destroyed only by sunlight in the far upper atmosphere.

How much any one greenhouse gas influences global warming depends on three key factors. The first is how much of it exists in the atmosphere. Concentrations are measured in parts per million (ppm), parts per billion (ppb), or parts per trillion (ppt); 1 ppm for a given gas means, for example, that there is one molecule of that gas in every 1 million molecules of air. The second is its lifetime—how long it remains in the atmosphere. The third is how effective it is at trapping heat. This is referred to as its global warming potential, or GWP, and is a measure of the total energy that a gas absorbs over a

given period of time (usually 100 years) relative to the emissions of 1 ton of carbon dioxide.

Radiative forcing (RF) is another way to measure greenhouse gases (and other climate drivers, such as the sun's brightness and large volcanic eruptions). Also known as climate forcing, RF quantifies the difference between how much of the sun's energy gets absorbed by the earth and how much is released into space as a result of any one climate driver. A climate driver with a positive RF value indicates that it has a warming effect on the planet; a negative value represents cooling.

Five Major Greenhouse Gases

The most significant gases that cause global warming via the greenhouse effect are the following:

Carbon Dioxide

Accounting for about 76 percent of global human-caused emissions, carbon dioxide (CO_2) sticks around for quite a while. Once it's emitted into the atmosphere, 40 percent still remains after 100 years, 20 percent after 1,000 years, and 10 percent as long as 10,000 years later.

Methane

Although methane (CH_4) persists in the atmosphere for far less time than carbon dioxide (about a decade), it is much more potent in terms of the greenhouse effect. In fact, pound for pound, its global warming impact is 25 times greater than that of carbon dioxide over a 100-year period. Globally it accounts for approximately 16 percent of human-generated greenhouse gas emissions.

Nitrous Oxide

Nitrous oxide (N_2O) is a powerful greenhouse gas: It has a GWP 300 times that of carbon dioxide on a 100-year time scale, and it remains in the atmosphere, on average, a little more than a century. It accounts for about 6 percent of human-caused greenhouse gas emissions worldwide.

Fluorinated Gases

Emitted from a variety of manufacturing and industrial processes, fluorinated gases are man-made. Although fluorinated gases are emitted in smaller quantities than other greenhouse gases (they account for just 2 percent of man-made global greenhouse gas emissions), they trap substantially more heat. Indeed, the GWP for these gases can be in the thousands to tens of thousands, and they have long atmospheric lifetimes, in some cases lasting tens of thousands of years.

Water Vapour

The most abundant greenhouse gas overall, water vapor differs from other greenhouse gases in that changes in its

atmospheric concentrations are linked not to human activities directly, but rather to the warming that results from the other greenhouse gases we emit. Warmer air holds more water. And since water vapor is a greenhouse gas, more water absorbs more heat, inducing even greater warming and perpetuating a positive feedback loop. (It’s worth noting, however, that the net impact of this feedback loop is still uncertain, as increased water vapor also increases cloud cover that reflects the sun’s energy away from the earth.)

Mirror Landscapes

Haiti's brown landscape contrasts sharply with the rich forests of the Dominican Republic, right. Deforestation is a leading human contributor to global warming. Deforested areas increase the amount of carbon, a major greenhouse gas, in the atmosphere.

The Consequences of the Greenhouse Effect

Even though only a tiny amount of the gases in Earth's atmosphere are greenhouse gases, they have a huge effect on climate. Sometime during this century, the amount of the greenhouse gas carbon dioxide in the atmosphere is expected to double. Other greenhouse gases like methane and nitrous oxide are increasing as well. The quantity of greenhouse gases is increasing as fossil fuels are burned, releasing the gases and other air pollutants into the atmosphere. Greenhouse gases also make their way to the atmosphere from other sources. Farm animals, for example, release methane gas as they digest food. As cement is made from limestone, it releases carbon dioxide.

With more greenhouse gases in the air, heat passing through on its way out of the atmosphere is more likely to be stopped. The added greenhouse gases absorb the heat. They then radiate this heat. Some of the heat will head away from the Earth, some of it will be absorbed by another greenhouse gas molecule, and some of it will wind up back at the planet's surface again. With more greenhouse gases, heat will stick around, warming the planet.

Even slight rises in average global temperatures can have huge effects. Perhaps the biggest, most obvious effect is that glaciers and ice caps melt faster than usual.
The melted water drains into the oceans, causing sea levels to rise and oceans to become less salty.

Many scientists use the term “climate change” instead of “global warming.” This is because greenhouse gas emissions affect more than just temperature. Another effect involves changes in precipitation like rain and snow. Patterns in precipitation may change or become more extreme. Over the course of the 20th century, precipitation increased in eastern parts of North and South America, northern Europe, and northern and central Asia. However, it has decreased in parts of Africa, the Mediterranean, and parts of southern Asia.

The Greenhouse Effect Solution

The earth has always experienced warm and cool phases, with natural forces—from the sun's intensity, volcanic eruptions, and natural changes in greenhouse gas concentrations—affecting how much energy from the sun our planet absorbs. Scientists say that as recently as a couple of centuries ago, the planet underwent a "Little Ice Age," caused by a decrease in solar activity and an increase in volcanic activity. But today's climatic warming—particularly the increase in temperatures since the mid-20th century—is occurring at a pace that can't be explained by natural causes alone. According to NASA, "natural causes are still in play today, but their influence is too small or they occur too slowly to explain the rapid warming seen in recent decades."

Reducing our greenhouse gas emissions is a critical step in slowing the global warming trend. Many governments around the world are working toward this goal.

The biggest effort so far has been the Kyoto Protocol, which was adopted in 1997 and went into effect in 2005. By the end of 2009, 187 countries had signed and ratified

the agreement. Under the protocol, 37 industrialized countries and the European Union have committed to reducing their greenhouse gas emissions.

CONCLUSION

Greenhouse effect is very important for the survival of the life on earth. Without the greenhouse effect, the Earth would not be warm enough for humans to live. But if the greenhouse effect becomes stronger, it could make the Earth warmer than usual. Even a little extra warming can cause problems for humans, plants, and animals.

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TIGER

CONSERVATION

PROJECT

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INTRODUCTION

Tigers occupy an important place in the global culture. For ages, the tiger has been the symbol of magnificence, power, beauty and fierceness and has been associated with bravery and valour. They are the largest member of the cat family and are now disappearing. All subspecies have threatened conservation status, and some of them are on the verge of extinction. The urgent measures needed to conserve this iconic cat continues to grow as hazards do not diminish. Biologically, they are apex predators at the top of the food chain and consume ungulate herbivores that are at lower levels allowing the balance of the ecosystems and their health condition. A rather fascinating truth is that its clear superiority in size and strength notwithstanding avoids contact with people and will even hide away from even a single person if their paths cross. Hence their nickname of "The Gentleman of the Jungle." Henceforth, it's not just about saving a gorgeous animal. It is about making certain that we live a bit longer because the forests are known to produce ecological services like clean air, water, fertilisation, temperature regulation etc.

During British rule in India, the tiger was hunted in large numbers for several reasons. Hunting the tiger was a popular source of entertaining sport for the royal families and elites as they were killed for the beautiful skin which was used for making clothes, rugs as well as for its multitude of medicinal properties and other selfish interests. There was and there is a huge demand for tiger parts and products in the market outside India's border, which is proving an added threat to the tiger's very existence. It has been observed that large development projects like mining, thermal and hydroelectric dams are also affecting the tiger's habitat as many forests have been destroyed to facilitate such projects. Activists have rightly put the slogan: "Tigers are killed for greed and not out of need." To control all this, Project Tiger was initiated by the then Prime Minister Indira Gandhi in 1973 to create a safe and ideal environmental condition for the survival and growth of tigers and their prey. The tiger conservation project started with 9 Tiger Reserves and today stands with 28 Reserves across the country. Since its launch, the tiger population has shown a gradual increase. Other than conserving, the main aim of Project Tiger has been to aid and facilitate the breeding of tigers within a safe environment and then transport these tigers further afield so that their world population can be upped. Later in 2006, it was replaced by the National Tiger Conservation Authority. Along with governmental projects, some NGOs and individuals are implementing a variety of conservation activities to protect tiger habitats, mitigate tiger-human conflict, tackle wildlife crime, monitor tiger populations, raise awareness and improve the livelihoods of people living next to tigers. Efforts are also being done to save the rarely seen white tigers. Along with this, NDTV-Aircel Save Our Tigers, a social campaign was launched to create awareness about the alarming state of the tiger in the country. The campaign is supported by India's Superstar Amitabh Bachchan, Cricket Legend MS Dhoni, Sanctuary Asia (India's premier wildlife magazine) and the Wildlife Conservation Trust. WWF-India conducts regular environment education activities with local communities, stakeholders and the wider civil society to make them aware of the critical issues facing conservation, and the steps they can take to help. These awareness programs are targeted at school children and teachers in schools around tiger reserves as well as urban cities. Awareness programs are organised for numerous responsible stakeholders in touristy, encouraging them to follow and promote environment and wildlife-friendly practices around wildlife habitats.

Fig 1: Every tiger colour mutation in one photo

PRIMARY REASONS BEHIND THE DRIVE

Colonialism in India: Colonial period was an era of tiger killing with reckless abandon. The tiger has historically been a well-known big game animal and has been hunted for prestige as well as for taking trophies. It is true that Moguls and other royal families did indulge in "Shikar" on a limited basis and saw to it their population did not dwindle. With the advent of the use of gun powder for canons and the subsequent arrival of Europeans in particular British, there had been a gradual spurt in Shikar activities in many jungles of Bengal and adjacent states. A research-first ever undertaken published (15 May 2013) in the Proceedings of The Royal Society-B journal reported Indian tigers as subspecies suffered a massive loss during the British Raj, part of the reason was decline in the mating partners and lack of genetic diversity. Almost a total collapse of big cats was orchestrated by an organized "trophy hunting spree" by the British Bobs and India's ruling elite, the main impetus for this was mechanized trophy hunting that reduced their numbers from 40,000 to less than 1,800 in a mere 100 years. Valmik Thapar mentioned in his book 'Tiger – Portrait of A Predator', The highest known individual score is the 1,100 tigers shot by the Maharajah of Surguja." Being a princely class, the Indian Maharajahs had their grand ostentatious style, a unique combination of opulence and glamour, that was the cynosure of the eyes of British rulers. Their style of living was altogether different and had an aura about them. Umed Singh II, the Maharajah of Kotah, had a flair for expensive fancy automobiles and hunting expeditions in the woods. He took the affluent world by surprise by modifying a flaming red Rolls Royce Phantom 1925, the most expensive car, for tiger safaris in the Rajasthani jungles. As there were no restrictions on hunting, India's independence in 1947 ushered in an era of hunting for fun. Guaranteed trophies attracted people the world over to go hunting in the Indian jungles.

Fig 2: Tiger hunting, Colonial India. George V, Prince of Wales (front row, fifth from the left) in 1906. (Source:DailyMail UK)

Plunderers of Wildlife: Tiger poaching in India has seriously impacted the probability of survival of tigers in India. About 3,000 wild tigers now survive compared with 100,000 at the turn of the 20th century. This abrupt decimation in population count was largely due to the slaughter of tigers by colonial and Indian elite, during the British Raj period, and indeed following India's independence. Contemporary poachers used more lethal ways like poisoning, traps, firearms and electrocutions. Sansar Chand, the notorious Tiger poacher acknowledged selling 470 tiger skins and 2,130 leopard skins to just four clients from Nepal and Tibet. He hailed from the Thanagazi area of Alwar district, had been termed "the kingpin running the country's biggest wildlife trade syndicate". He stayed in the trade without getting arrested for forty years. He ran his business from Delhi's Sadar Bazar. He was called "Veerappan of the North". He is blamed for wiping out the entire tiger population of Sariska Tiger Reserve in 2005. Across their range, tigers are snared, poisoned and shot to fill a growing demand among China's elite. Today's market is not mired in traditional or cultural use of tiger products, nor are they used as ingredients in life-saving traditional medicines. These are incredibly expensive luxury items bought by or gifted to high-level government officials and wealthy businessmen. Serving tiger meat or tiger bone wine (made by steeping tiger bone in rice wine) often seals a business deal, and gifting this wine or displaying tiger skin is a preferred way to flaunt wealth and power. Every single part of the tiger is listed in the illegal markets. It is employed in ancient Asian medication that has no healthful worth in any respect, creating the deaths of those animals for this purpose needless.

PRIMARY REASONS BEHIND THE DRIVE

Destruction of Wildlife: With the advent of agriculture, the man began to grow large quantities of selected crops in his own chosen place, after clearing away the existing natural ecosystem. Out of thousands of edible plants on earth, we have come to depend on only a few. About 90% of the plant food that we eat comes from only twenty species and more than half comes from just three grains, viz., rice, wheat and corn. Selective cultivation has paved the way for the disappearance of wild and rare species. As a result, we have lost much of the faunal diversity that depended on those species. Large scale use of pesticides and fertilizers has polluted the land and river ecosystems. Habitat destruction is the main cause of wildlife extinction in India. The rapid deterioration of the environment due to human interference is aiding the disappearance of wildlife from the biosphere. According to IUCN, habitat loss and degradation have affected about 89 percent of all threatened birds, 83 percent of mammals and 91 percent of all threatened plants globally. Habitat loss is due to deforestation for extended cultivation, construction of dams, mining operations and road laying. When the natural habitat of animals is destroyed, it leads to a decline in their primary food supply and breeding and nesting grounds. Hence their numbers get drastically reduced. In the case of plants, if their natural habitat is destroyed and the species that control the pests that attack them are lost, then their survival is at risk. Pollution by heavy metals, persistent biocides, organic wastes, removal of sand from riverbeds and agricultural runoff have spoilt the river ecosystem. The marine ecosystem is affected by hot water from nuclear and thermal power plants, toxic effluents from coastal areas, oil spills, blasting and dredging, collection of undersized fishes and other organisms, exploitation of ornamental seashells and pearl oysters by domestic shell craft industry, export of sea fans and seaweeds, etc. The introduction of exotic species is a significant threat affecting 350 (30% of all threatened) bird and 361 (15% of all threatened) plant species. Sometimes cultivated for economic reasons, like the silver oak and eucalyptus, they tend to completely overrun the land, preventing the growth of natural species. The sholas, the natural vegetation of the Nilgiris, have thus dwindled. Since they play an important role in absorbing moisture and maintaining the water table, the Nilgiris are today facing acute water shortages. Contradictory laws and policies of the Government and ineffective implementation of laws have also affected the wildlife.

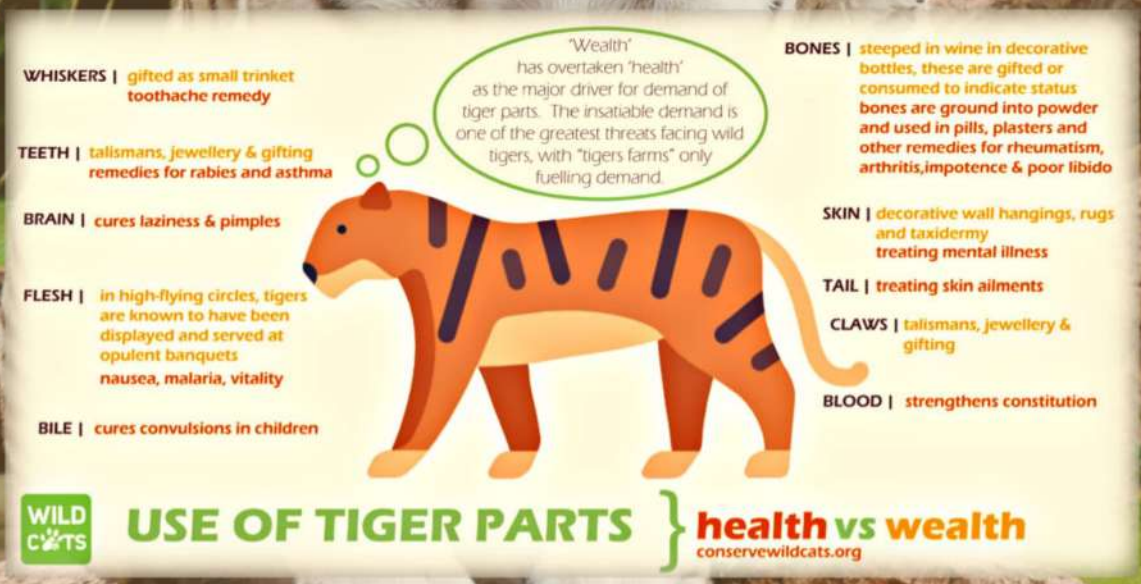

Fig 3: Anti-poaching is a conservation priority for our projects fighting the insatiable demand for wild tiger parts. Worrying trends highlight insidious "poach-to-order" operations, led by well-funded global criminal syndicates. Ironically the poacher tends to take the greatest risk for the lowest reward.

TIGER CONSERVATION IN INDIA

In July 2020, the Ministry of Environment released the Tiger Census Report on the eve of Global Tiger Day (29th July). India has 70 percent of the world's tiger population. It has been announced that Conservation Assured/Tiger Standards (CA/TS) framework will be extended to all 50 Tiger Reserves of India. As per the 4th All India Tiger Estimation (AITE), there are 2967 tigers in India. The Tigers are seen largely in the tropical forests of Asia. The recent reports generated by different international organizations show the tiger population is decreasing. According to the IUCN Red list, the tiger is listed as an endangered animal. The major threat faced by this species are Poaching, destruction of habitat, insufficient prey, etc. the tigers are killed for skins, bones, and meat. The Critical Tiger Habitats (CTHs) as per Wildlife Protection Act, 1972, are core areas of the tiger reserves meant to be "kept inviolate for tiger conservation." For recognition of critical tiger habitat, an expert committee is constituted and the final decision is notified by the state government. In Forest Rights Act, 2006, there is a mention of 'Critical Wildlife Habitats' which are part of reserves and sanctuaries meant to be kept inviolate for wildlife conservation (not just tigers). In the case of Critical Wildlife Habitats, Gram Sabhas and affected stakeholders have to give consent for the notification. Recently, there has seen a rise in the population of wild lions and tigers in India. The government has initiated many programs related to the conservation of the Tiger population in the country. According to the World Wildlife Fund and the Global Tiger Forum, the figure of wild tigers has gone up to 3,890 which earlier was 3200. The wildlife policy of India embraces conservation and protection through the provision of national parks and sanctuaries. This has assisted their sustainable growth and a drastic declining man-animal conflict. A proactive judiciary has shaped a well-built restriction against poachers. India is now home to 70% of the total Global Tiger Population. The various strategies that are planned for implementation include tiger reintroduction, landscape conservation and habitat management, scrutinizing protocols, strategies for anti-poaching, resource mobilization, and modern equipment and technology for monitoring. The anti-poaching strategies are also planned for implementation. The latest censuses show an augment in the number of tigers across the country in different National Parks which is evidence that preservation efforts do have an optimistic impact on the environment and wildlife.

Fig 4: Bandhavgarh National Park is one of the most popular tiger reserves in India. It has the highest density of Royal Bengal Tigers and it houses ancient Bandhavgarh Fort which has great historical importance. Located in the Umaria district of Madhya Pradesh, Bandhavgarh National Park covers a distance of 820 sq. km.

NATIONAL TIGER CONSERVATION AUTHORITY (NTCA)

The National Tiger Conservation Authority (NTCA) is a statutory body tasked with the management of Project Tiger and the many Tiger Reserves in India. It was established in December 2005 following the recommendation of the Tiger Task Force. National Tiger Conservation Authority (NTCA) is a statutory body under the Ministry of Environment, Forests and Climate Change. The Wildlife Protection Act of 1972 was amended in 2006 to provide for constituting the NTCA. The NTCA has eight experts or professionals having qualifications and experience in wildlife conservation, apart from three Members of Parliament of whom two are elected by the Lok Sabha and one by the Council of States. The Inspector-General of Forests, in charge of project Tiger, will be ex-officio Member Secretary.

Objectives:

- To nurture accountability in the management of Tiger Reserves either by the state or Central governments through providing a basis of operations within the federal structure.
- To address the livelihood interests of local people in areas surrounding Tiger Reserves.
- To provide the authority to Project Tiger so that its recommendations are implemented to their fullest extent.

Fig 5: The insignia of NTCA.

Fig 6: Kanha Tiger Reserve is situated in Madhya Pradesh and spreads across an area of 940 sq km. This wildlife reserve was established in 1955 with the sole purpose of preserving a few endangered species.

NATIONAL TIGER CONSERVATION AUTHORITY (NTCA)

Reasons behind initiation: The body parts of tigers fetch a huge price in the illegal market, this in itself is a huge threat to the tiger population in India. To ensure the survival of Indian tigers, a body like the National Tiger Conservation Authority is required. Keeping tiger protection as a topmost priority, the NTCA cooperates with other bodies such as the Central Bureau of Investigation, Wildlife Crime Control Bureau and the Police departments by issuing alerts for any illegal poaching activities of project Tiger, will be ex-officio Member Secretary.

To prevent such activities, it carries out the following tasks:

- To launch tiger reserve level monitoring using a camera trap to keep a photo ID database of individual tigers.
- To assist states with anti-poaching operations
- To advise the states for combing forest floor to check for snares/traps
- To utilize information technology for improved surveillance using thermal cameras set up in Jim Corbett National Park.
- To alert the states as and when required by transmitting information related to poachers.

Shivalik-Gangetic Plain Landscape Complex	2006	2010	2014
Uttarakhand	178	227	340
Uttar Pradesh	109	118	117
Bihar	10	8	28
Shivalik-Gangetic	297	353	485
Central Indian Landscape Complex and Eastern Ghats Landscape Complex			
Andhra Pradesh (Including Telangana)	95	72	68
Chhattisgarh	26	26	46
Madhya Pradesh	300	257	308
Maharashtra	103	169	190
Odisha	45	32	28
Rajasthan	32	36	45
Jharkhand	-	10	3+
Central India	601	601	688
Western Ghats Landscape Complex			
Karnataka	290	300	406
Kerala	46	71	136
Tamil Nadu	76	163	229
Goa	-	-	5
Western Ghats	402	534	776
North Eastern Hills and Brahmaputra Flood Plains			
Assam	70	143	167
Arunachal Pradesh	14	-	28
Mizoram	6	5	3+
Northern West Bengal	10	-	3
North East Hills, and Brahmaputra	100	148	201
Sunderbans	-	70	76
TOTAL	1,411	1,706	2,226

Fig 7: The numbers mark a significant improvement from 2006 when the number of tigers in India was estimated at 1,411 because of the investments.

NATIONAL TIGER CONSERVATION AUTHORITY (NTCA)

Some of the Powers and Functions under the amended Wildlife Protection Act, 1972 is as follows:

- Ensure critical support including scientific, information technology and legal support for better implementation of the tiger conservation plan.
- Facilitate and support the tiger reserve management in the State for biodiversity conservation initiatives through people's participation by supporting similar initiatives in adjoining areas consistent with the Central and State laws.
- Provide information on protection measures including future conservation plans, estimation of the population of tiger and their natural prey species report on untoward happenings such as poaching and any other illegal activities.
- Facilitate ongoing capacity building programme for skill development of officers and staff of tiger reserves.
- Evaluate and assess aspects of sustainable ecology while ensuring that no environmentally destructive activities such as mining, the industry is carried out within the proximity of Tiger Reserves.

Fig 8: The Safari Park recently experienced a big cat baby boom.

PROJECT TIGER

A vigorous tiger population shows the strength of the ecosystem and self-sustenance which are the key objectives of Project Tiger under the National Tiger Conservation Authority. It is a statutory body of the Ministry with an overall supervisory and coordination part, performing capacities as gave in the Wildlife (Protection) Act, 1972. By launching the Project Tiger in 1973 by then PM Indira Gandhi, the Government of India has taken a revolutionary initiative for conserving its national animal. It gives fund help to the 'tiger range states', for in-situ conservation of tigers in the chosen tiger reserves. It has put the endangered tiger on a guaranteed path of revival by protecting it from extinction. The Project Tiger aims to promote an exclusive tiger agenda in the core areas of tiger reserves, with inclusive people participation. The project aims at ensuring a viable population of Bengal tigers in their natural habitats, protecting them from extinction, and preserving areas of biological importance as a natural heritage forever represented as close as possible the diversity of ecosystems across the distribution of tigers in the country. Its task force visualized these tiger reserves as breeding nuclei, from which surplus animals would migrate to adjacent forests. Funds and commitment were mustered to support the intensive program of habitat protection and rehabilitation under the project. The government has set up a Tiger Protection Force to combat poachers and funded relocation of villagers to minimize human-tiger conflicts. During the period 1973-74, nine tiger reserves were established in different states of the country, by pooling the resources available with the Central and State Governments. These nine reserves covering an area of almost 13,017 sq km. These reserves were namely Manas Tiger Reserve (Assam), Palamau Tiger Reserve (Bihar), Similipal Tiger Reserve (Odisha), Corbett Tiger Reserve (Uttar Pradesh), Kanha Tiger Reserve (Madhya Pradesh), Melghat Tiger Reserve (Maharashtra), Bandipur Tiger Reserve (Karnataka), Ranthambore Tiger Reserve (Rajasthan) and Sunderbans Tiger Reserve (West Bengal). Project Tiger in India was launched as a 'Central Sector Scheme' with the full assistance of the Central Government till 1979-80. However, later on, it became a 'Centrally Sponsored Scheme' since 1980-81. The WWF has also assisted in the form of equipment, expertise and literature.

Fig 9: Project Tiger initiative, spearheaded by former PM Indira Gandhi was a pioneering effort towards tiger conservation in India.

Fig 10: Project Tiger initiative's posters for social awareness.

ACHIEVEMENTS OF THE DRIVE

The Project Tiger has put the tiger on a certain course of revival from the edge of destruction. The population of tigers in the country has been augmented considerably after the establishment of the project. It has contributed to numerous indescribable environmental profits to society. The project has opened a wide door of tourism and thereby employment opportunities. This initiative has brought the participation of local people and their participation has made the habitat revive. The main achievements of Project Tiger in India include excellent recovery of the habitat and consequent increase in the tiger population in the reserve areas, from 268 in nine reserves in the year 1972 to 1976 in 27 reserves in the year 2003. Thus, Project Tiger is considered as the conservation of the entire ecosystem and apart from tigers, all other wild animals also have increased in number in the project areas. Further, the damages done to the habitat were to be rectified, to facilitate the recovery of the ecosystem to the maximum possible extent. The overall administration of the project is monitored by a 'Steering Committee'. The implementation of the project is carried out by the respective State Government. A Field Director is appointed for each reserve. He is aided by field and technical personnel. Chief Wildlife wardens are responsible for field execution. In recent times, within the tiger reserves, wireless communication systems and outstation patrol camps have been developed, as a result of which poaching has declined considerably.

Fig 11: Terming the feat achieved by the Wildlife authorities in the country a shining example of Aatmanirbhar Bharat, the MoEFCC said that the country hosted around 70 percent of the animal population in the world.

CONTROVERSIES & COMPLICATIONS

Fig 12: In India, these huge cats are being killed and slaughtered for their pelts and bones. And then, the bones are smuggled to China to be mixed with wine and traditional Chinese medicine. Majority of the skins end up in the country as well, where it is used in creating luxurious home decors and ornaments.

TThe Forest Rights Act passed by the Indian government in 2006 recognizes the rights of some forest-dwelling communities in forest areas. This has led to controversy over the implications of such recognition for tiger conservation. Some have argued that this is problematic as it will increase conflict and opportunities for poaching; some also assert that "tigers and humans cannot co-exist". Others argue that this is a limited perspective that overlooks the reality of human-tiger coexistence and the abuse of power by authorities, evicting local people and making them pariahs in their traditional lands rather than allowing them a proper role in decision-making, in the tiger crisis. The latter position was supported by the Government of India's Tiger Task Force and is also taken by some forest dwellers' organizations.

CONCLUSION

The Tiger conservation project in India has been an absolute triumph despite all these difficulties, India still holds the best chance for saving the tiger in the wild. Tigers are found in 17 states within India, with 7 states reportedly having a population in excess of hundred tigers. Adequate funding and international pressure will help. But probably the most effective way to conserve the tiger in India is to enhance NGO participation to keep the issue energised on a national level and to increase general awareness. The Indian conservation and scientific community is now a proven force; it needs to be strengthened. With deliberate social awareness and campaigning the humans have stopped interfering and exploiting the tigers. However, poaching and illegal hunting are obvious. Highways and railways are cutting across the forest landscape, dams are being planned in fragile ecosystems, tiger poaching is being reported even during coronavirus pandemic. Project Tiger has been undertaken by more than fifty national parks, and every park is putting an equal effort to save the endangered species. Increasing four thousand tigers in the past few years is one of the landmark achievements of the project. The national parks are taking initiatives to save and conserve every animal. The National Tiger Census of 2018 estimates that India has 2,967 wild tigers, out of which 2,461 individual tigers (83% of the total) have been photographed by the camera traps. The survey was carried out in an effective area of 121,337 square kilometres (46,848 square miles) of the country's landscape. The tiger population has shown an approximate growth by one-third from the last census in 2014 (from 2,226 in 2014 to 2,927 in 2018 tigers in the wild). Moreover, Project Tiger also generated jobs for many individuals. The wildlife has been facing little fewer problems since the project started. Project Tiger has saved not only tigers but also saved other aspects of wildlife!

Fig 13: Dodo, the 2-year-old chimpanzee feeds milk to Aorn, a 2-month-old tiger cub, at the Samut Prakan Crocodile Farm and Zoo on the outskirts of Bangkok, Thailand. (Source: Tumblr)

EXOTICS

Why are Tigers in Crisis?

Only around **3,890** tigers remain in the wild, down from **100,000** in the 1900s.

Tigers have lost **97%** of their home range.

There are more tigers in captivity than there are in the wild.

Of the nine modern tiger subspecies, three became extinct in the 20th century. All six remaining subspecies are listed as endangered or critically endangered.

Reasons for population decline are habitat destruction, habitat fragmentation, and poaching.

What are Some Unique Tiger Characteristics?

Tigers are the biggest cats in the world.

No two tigers have the same stripe pattern.

Tigers sometimes lure their prey by mimicking their prey's call.

Tigers roar in "infrasound," which means parts of the tiger's roar are below frequencies humans can hear. The lower the frequency, the farther a sound can travel.

Tigers can't taste anything sweet.

Did You Know?

A group of tigers is called a streak or an ambush.

The tiger is the national animal of Bangladesh, India, Malaysia,

If you shaved a tiger and lion, you wouldn't be able to tell them apart just by looking at them.

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Semester – II

CBCS Curriculum

ENVS Assignment – Pollution of the Ganges

Scottish Church College

College Roll no. – HISA20M399

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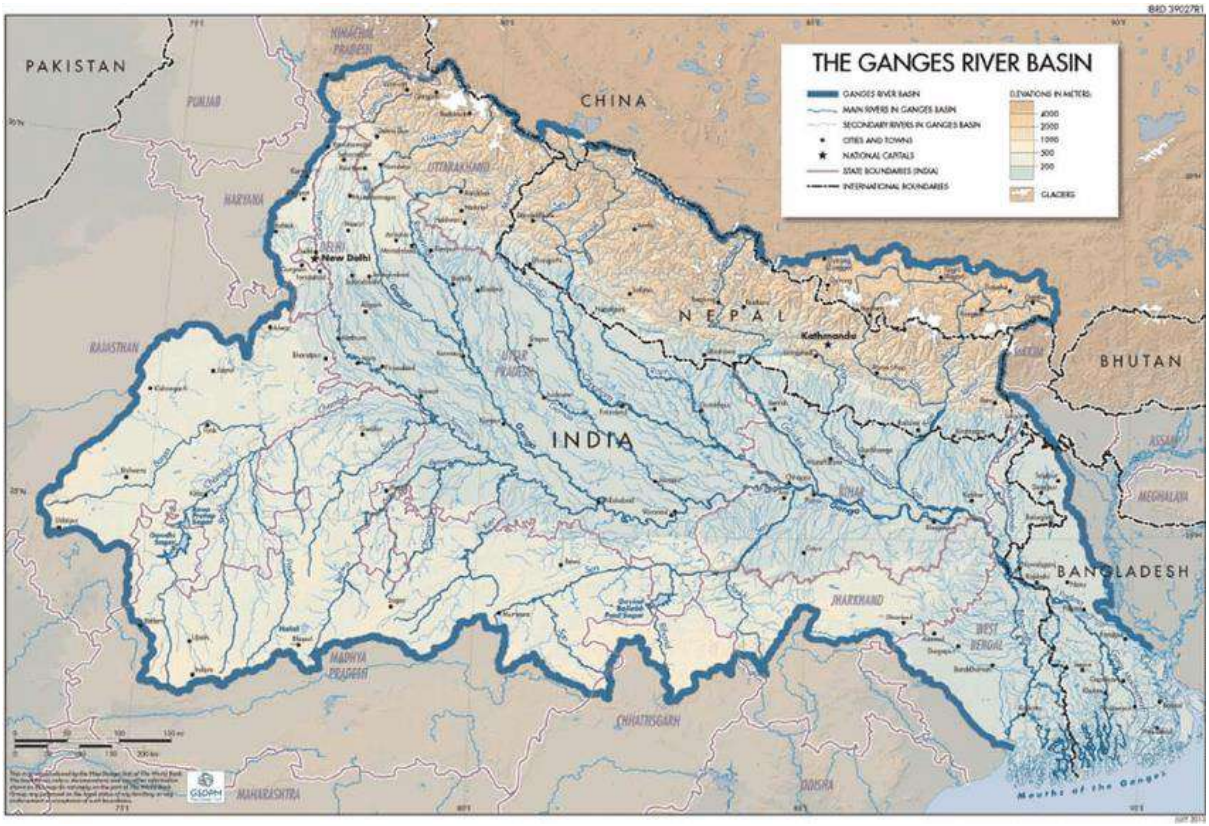
Unit -1

Introduction

Ganges, vernacularly referred to as the Ganga, forms a very important part in the overall Hindu pantheon. Revered by the common people and equated with a divine motherly force. *Ganga Maiya*, as the river is often referred to as, emerges from the Gangotri Glacier at Gomukh in Uttarakhand as a small river by the name of Bhagirathi. The Bhagirathi is joined by another river by the name of Alaknanda. At Devprayag in the lower Himalayas, the Alaknanda and Bhagirathi rivers merge to give birth to the Ganga. The Ganga goes on to travel from the Lower Himalayas to the Lower Indo Gangetic Plains before finally draining into Bay of Bengal, birthing to the largest Delta in the World. The Ganges traverses through the states of Uttarakhand, Uttar Pradesh, Bihar and finally West Bengal. The Ganga splits into two at Farakka to join the Brahmaputra in Bangladesh, giving birth to a larger river by the name of Padma.



1. The Ganges River Basin

It is, thus quite baffling to comprehend the sorry state the river is often found in. Supporting over 450 million people who depend on its water for their basic

sustenance. Ganga has become a bedlam of pollution and degeneracy. Reaching an almost frightening juncture, where the river is doing more harm than any actual good. The religious notion of the river, drives home the belief that the Ganga is a holy deity who cannot be tainted. No human activity can pollute its holy water. But the reality is far more complicated and quite the opposite. Human activities of industrialization, agriculture, waste disposal etc. has all lead to the poisoning of the Ganga, and has in turn stained the holy waters of it. Posing a major threat to human, animal and aquatic lives.

Today, a river as glorious as the Ganga finds itself inhospitable. In this tutorial, we'll be discussing the causes of such pollution and its long term effects on our environment and the society. We'll further try to furnish the possible getaways, and focus on the several efforts by the Government to clean up its waters. In turn, through this work we're looking to create a greater awareness about the Gangetic degeneracy.

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Unit -2

River Ganga and the Causes of its Pollution

Human Waste and Sewage Disposal

Several human factors on the backdrop of rapid urbanisation has induced severe water pollution to River Ganga and its tributaries. In many regions, degradation of the river is visible due to encroachment of river bed, illegal sand mining, active netting for fishes, public bathing, washing clothes and animals, as well as something as vile as open defecation. At several places water from the Ganga is even pumped out on a large scale for irrigation, and is in turn infused with toxic fertilisers. The demography of North India has been actively pressurising the river until its breaking point.

Furthermore, the River flows through over hundred cities with populations of 1 Lakh or more. Followed by approximately 97 cities with population between 50 thousand to 1 Lakh. Add into the numerous towns and settlements it touches by during its 2,525 km journey from its source to the ocean, and we find clear evidence that a large proportion of the sewage water with higher organic load in the Ganga, is from this very population, through domestic water usage. Steps taken by the government aimed towards building sewage treatment plants haven't been greatly successful either, with just a few sewage treatment plants propping up compared to the hundreds that were supposed to be introduced in accordance to the Ganga Action Plan (GAP). Thus in a worrying state of affairs,

the vast population of the country has been acting as a primary and an alarming source of the Ganga water degradation.

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Industrial and Chemical Waste

A major source of the Ganga river pollution goes back to the industries of our country. The most important industrial pollution source is from Uttar Pradesh, which accounts for almost 55% of it, followed by Haryana, Rajasthan, Madhya Pradesh, West Bengal and others. Flowing through these states, the Ganga carries several prominent industrial cities on its banks. Including, Varanasi, Kanpur, Prayagraj etc. Through countless industries such as distilleries, paper/pulp, tanneries, sugar and slaughter houses, tons of chemical wastes are dumped into the streams of the river on a daily basis.

2. Untreated effluents being discharged into the Ganga

Toxicity of the water is enhanced through dumping of chemicals such as arsenic, sulphur, mercury and chromium. Posing hazardous threats to the purity of the water, its useful properties as well as the vast array of aquatic life, the Industries have been gradually poisoning the Ganga beyond repair. This intense discharge

of sewage into the Ganga is responsible for 75% of its pollution with approximately 3000 million litres per day of sewage generated in towns along the Ganga. This volume is way too large to be tackled by the self-rehabilitation capacity of the river.

For instance, the leather industry that integrates vast amount of chromium and similar toxins in its functioning. The majority of which ends up getting discharged in the waters of the Ganges during the peak dry season, a period when the river trickles at its slowest, and is in turn bogged down by untreated wastes. Furthermore, a big number of small to average-scaled industries are located in the residential areas of almost all the cities, towns and villages, which directly discharges their effluents into the river. The presence of arsenic in and around groundwater sources has also been detected in all the states the Ganga flows through.

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Religious Traditions and Adverse Effects

Ganga's presence in the popular Hindu imagination dictates that, it is revered as this mystical entity with waters so hallowed it purifies a common soul. Thus it's of no surprise that the river often finds itself the backdrop of elaborate rituals and religious practices. Yearly Hindu traditions, such as the Kumbh Mela gatherings, sees hundreds and thousands of Hindu pilgrims take a dip in the holy waters of the Ganges in Prayagraj, Haridwar, Nashik and Ujjain. Approximately seven lakh individuals are said to take bath in the Ganga during these events, and as a result unwillingly contribute to the pollution of the river. A steep price paid for devotion.

The holiness of the river also means that, for millennia the ashes of the dead are ritually dumped into the Ganges. Varanasi or Benaras in particular is considered a "holy city" where dying opens up the gates of achieving instant *moksha*, where the deceased is delivered from the cycle of life and death. Before the COVID-19 pandemic, almost up to 80 corpses were cremated on the Ghats. Now, the number is in the hundreds. The ones who ritually cremate the bodies, ask the family of the dead to fetch flowers, fabric and firewood to commence the final ceremony. After the corpse is cremated, all of the ashes are plunged into the river, along with any other remains. The ashes, while strictly posing no threat to the purity of the river, when combined with the dumping of the "other remains" such as fabrics intensifies the toxicity.

3. Mass cremation of bodies in a ghat in Varanasi

Furthermore, there lies the problem of discharging corpses. These dead bodies usually killed by diseases such as leprosy and tuberculosis are usually not completely cremated. They are often half burnt, sometimes not cremated at all, crudely thrown into the river wrapped in simple cloth. These corpses end up spreading disease and contaminate the river further. They float around ironically almost completely unnoticed, perhaps consciously ignored by bathers hoping to purify their souls. At one point, the problem of corpse dumping got so worse that the authorities began to train thousands of flesh-eating turtles to clear the river of decomposing dead bodies. A curious initiative that ultimately bore no benefits due to the rapid mismanagement and corruption, as well as illegal turtle poaching.

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Further Miscellaneous Causes

Other than the more glaring cases, there also happens to be several smaller but equally effective causes of the Ganga water pollution. The many tributaries of the river often bring in toxic pollutants. Reports say, out of all the tributaries joining the Ganges, Ramganga (carrying the Kashipur and Moradabad discharges) and Kali (with the Meerut and Modinagar wastes) both severely contribute to the overall pollution. Further biological monitoring of the Ganga has shown that two major tributaries, Pandu and Varuna, are also increasing the

pollution load of the river, being “severely polluted” on their way to the confluence point.

In recent decades, human activities have quadrupled on the basis of increasing of India’s tourism boom. The gigantic population of India and their reverence to the river aside, Ganga and the major religious centers based on it have been attracting takers from all over the globe. Cities such as Uttarakhand, Haridwar and Rishikesh has been playing a critical role in contributing to the tourism based pollution. These cities usually see hotels propping up like Mushroom groves, with minimum proper sewage disposal facilities. Couple this, with the vacationing people and their general disdain towards maintaining cleanliness in face of having a good time. The tourists usually opt for the former, leaving the Ganga River to pay the price for their apathy.

Another factor that has indirectly influenced the Ganga water pollution are the construction of Dams and Multipurpose projects. Case in point, the Haridwar Dam, which has led to the decay of the river by greatly hampering the flow of the river. Likewise, the very famous Farakka Barrage has caused an upward flow of salinity in the downstream of the Ganges, exerting damage on the groundwater, soil and the river itself. The Ganga, already dependent on monsoon for its water, gets further drained due to these dams, which in turns hampers its self-purifying techniques. The oxygen retention capacity takes a hit, and the pollutants continue running havoc.

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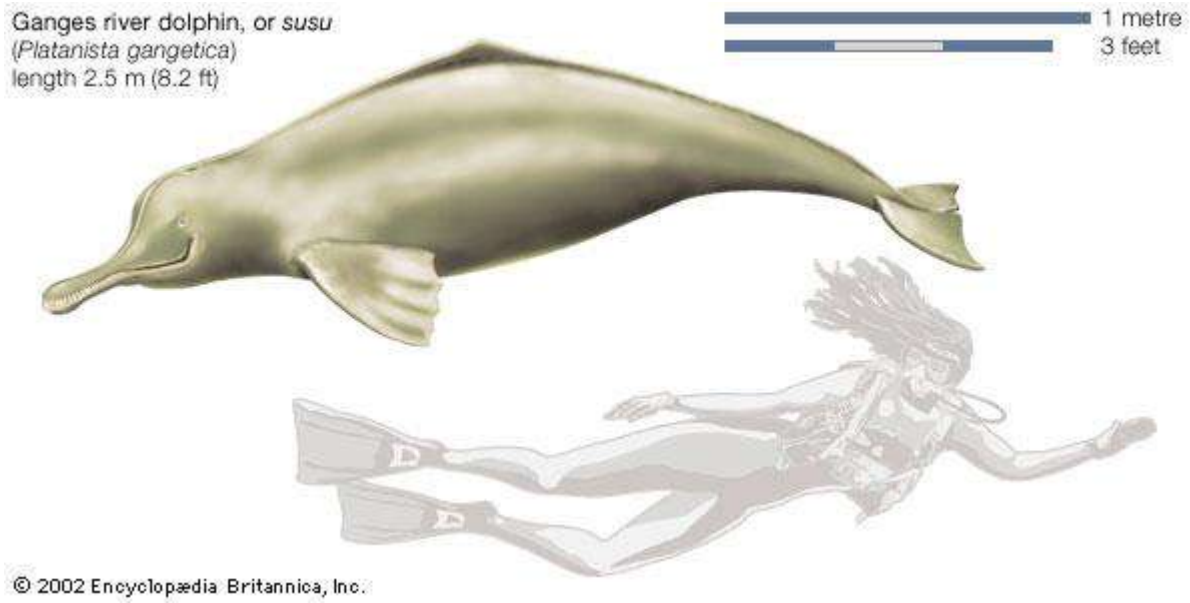
Unit -3

Gangetic Pollution: The Far Reaching Impact

The pollution of the Ganges is not only a point of worry in terms of the river bodies and their purity. But also the far reaching impact it has on the flora, fauna and the ecology, both aquatic and land based. We have already spoken about Ganga’s high self-purification methods. This cleansing process is usually aided by aquatic microorganisms that break down accumulated waste materials requiring dissolved oxygen (DO) in the water to do their job. A high level of DO is usually a sign of a healthy river. It was this high DO capacity of the Ganga which facilitated in it having a sprawling eco system. Something that has taken a major hit over the years due to the constant polluting. Flowing over 2500 km, the Ganga and its tributaries are home to over 140 fish species, 90 sort of amphibians and many birds, apart from its famous reptiles and mammals. And this does not even include the biodiversity-rich delta, the Sundarbans.

Thus, it's quite baffling to note, how the very same Ganga, now boasts trillions of disease-inducing bacterium, parasite and microbes. The aquatic life of the river has taken a deep toll on the wake of the pollution, with species like the Gangetic River Dolphins (P. g. gangetica) and the Ganges Soft-shell Turtle (Nilssonia gangetica) all running on life support, hitting the endangered mark a long time back.



4. The Gangetic river dolphin, or susu

Things take a worrisome turn when we notice, that a large amount of our common population battles the fear of water-borne diseases on a daily basis, as they depend on the river for bathing, laundry, drinking, cleaning utensils and washing. The River and its toxic water induce various diseases such as Cholera, Dysentery, Hepatitis, and Diarrhoea. It also reportedly plays host to the Coliform Bacteria, providing a testament to the massive amount of human and animal excreta present in the water. Furthermore, reports suggest a dangerous development in the water of the Ganges, due the amount of untreated wastes and sewages being dumped into the streams. The presence of Chromium, Mercury, Lead and several other chemical/metallic compounds in the water, has gradually turned it neurotoxic. The consumption of which can instigate neurological ailments such as seizures in a person, and can even end up killing them. It is quite worrying how the concentration of such toxic metals have increased rapidly over the past few decades.

Consequently, the Ganga and its poisonous waters have seeped onto the soil content, contaminating the groundwater as well as hampering fertility. A rise in concentrations of toxic metals in vegetables and grains grown in contaminated soils can be noticed at an alarming rate. Furthermore, the toxicity ends up eating

the nitrogen content of the fertile soil. This poses a serious threat to humans and the environment because of its apparent bioaccumulation and non-biodegradability.

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Unit -4

River Ganga and the efforts to clean it up

The Ganga Action Plan (GAP)

The Ganges Action Plan was launched by, then Prime Minister of India, Rajiv Gandhi, on June 1986. Its primary objective was to improve the water quality of the Ganges through the interception, diversion, and treatment of domestic sewage and to prevent toxic and industrial chemical wastes from identified polluting units from entering the river.

Initially launched in Varanasi and some other cities. It was aimed at stoppage of sewage disposal in to the river by renovation of sewage pumping and treatment plants, and existing sewerage system, installation of new sewage treatment plants (STP), prevention of throwing dead bodies into the river, and regulated use of pesticides and insecticides for agriculture. The effluents from the sewage treatment plants could be treated as rich source of energy (say biogas) and manorial matter. But sadly, Ganga Action Plan Phases I and II met with only partial success due to various factors, the failure on part of the government to involve more people being cited as a major one. The sewage pumps did not work in the flood season and during power failures, often for prolonged periods, resulting in total sewage of the city draining into the river. The treated effluents from STP caused health hazards, ruined crops and polluted groundwater.

It was a completely technocratic and bureaucratic exercise. Lack of tangible data on the water use and wastewater generation ensured that the plans bore no real benefits. Today we find that sewers laid are not connected to STPs and STPs installed have no sewage to treat and even if they have sewage for once, there is no electricity to run. More importantly in many settlements we also find that the treated effluent is actually untreated, negating the effort wasting precious human and financial resources.

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Namami Ganga

5. Discarded wastes flooding the banks of Ganga

Emotions were high, and hope was in the air when the National Democratic Alliance government decided to launch the Namami Ganga in mid-May 2015. Over Rs. 20,000 crore was allotted to the project, and there was strong public belief that the project will yield better results than the GAP of old. It was supposed to be implemented by the National Mission for Clean Ganga (NMCG), and its state counterparts—State Programme Management Groups. NMCG would establish field offices wherever necessary, with the National Ganga Council (NGC) being set up on the wake of the decision. And to give more importance to the matter at hand, the Prime Minister was made the head of it. The NGC were to have on board the chief ministers of five Ganga basin states – Uttarakhand, Bihar, Uttar Pradesh, Jharkhand and West Bengal, along with several Union ministers and it was supposed to meet once every year. Things were on a serious track with 48 Industrial units around the Ganga also being shut down.

But after over 5 years, has the Namami Ganga been able to deliver the promises it once boldly made? The answer is unsatisfactory to say the least. Like the Ganga Action Plan, it has been riddled with mismanagement, delays, corruption and escalating costs. Sewage Treatment Plants are mostly unable to keep up with the volume of daily sewage discharged by the cities. Most of the sewage network of the major cities are not even properly built. This leads to the raw untreated sewage from the domestic and industrial units, flowing directly into

the streams of the Ganga like usual. The project has also further lagged behind in clearing plastic congestion in the streams, promoting a nuisance which mingles with similar intoxicants and gives rise to toxic sludge. This sludge takes a worse form, when it mixes with human faecal matter. Another sector, the government has failed to catch up to. The government mandated toilets are usually easily overflowed, accompanied by septic tanks with minimum treatment capacity. Such lack of management, prompts the inhabitants staying near the Rivers, to turn towards the water bodies as their usual dumping grounds.

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Other than these, several other projects and conferences had been working for the Ganga water clean-up cause over several points in time. Including the Ganga Manthan, the Clean Ganga Fund, and the NCMG etc. all with minimum long term success.

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Unit -5

Conclusion

The Ganges has been bestowed the status of National River in the year 2008. It has held a special place in the sacred landscape of India, and it will continue to do so long into the future. One of the very few rivers in this world so systematically revered, put on a pedestal and transformed into a myth of its own. The sheer amount of legends throughout the *Hindu Shastras*, attached to its origin, bears testament to the fact. She is a goddess, a mother, a healer who washes away the mortal sins and grants boons. She is amrita or nectar, a pure, life-giving substance. Even *Charak samhita*, the ancient medical treatise characterizes the river water as pure and sacred, carrying immense medicinal value.

It is quite heart-breaking to notice over the years, pressures of urbanization, accompanied by the growing threat of pollution, calling for serious attention to the Ganga. Pollution control programs—GAP I in 1985 and GAP II in 1991, as well as the Namami Ganga of recent years—have attempted to clean the Ganges but have had little success. These projects were woefully behind schedule and incurred major corruption and cost overruns. They might have been clear in terms of its goals, but suffered from a top-down, technocratic approach to problem solving, lacked resources and institutional capacity as well as public participation. Despite a plethora of studies regarding the Gangetic pollution, there needs to be an effort to imbibe the issue into a broader public

consciousness. Something, which will further solve the aforementioned problem of a lack of local public participation, at a grass root level.

6. Cremation of ashes in Varanasi. A predominant visual.

There also needs to be a conscious effort to overcome the religious prejudices laden with Ganga. The elaborate rituals, *ghat* regulations and cremation procedures should be curbed to an extent, taking in account, both the purity of the river and the riverine life it supports. Holding onto the age old belief of Ganga's perceived eternal purity, will only do more harm than good. And steps should be taken to induce flexibility in public perception, in order to make a way for science.

Thus, it's understandable the Ganges, not only needs the government to be more assertive in their efforts, but also us, the common people. It is high time we need to step up and adopt sustainable methods of conserving the Ganga, a river no less than a national treasure.

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INTRODUCTION

Rivers are the most important surface fresh water resource in the world. The total volume in world‟s rivers is about 2,115 km . Rivers are easily accessible, and useful in multiple facets. Most perennial rivers are primary renewable water resource for agriculture, domestic and industrial use. Additionally, they are vital for navigation, aquatic life, and generation of hydroelectricity. In short, rivers are indispensable in maintaining environmental equilibrium and for human development. Accordingly, it is clearly evident that all the civilizations, since ancient times till date, have thrived along major rivers of the world. Consequently, the rivers held the positio prima in all parts of the ancient world. As the world entered the modern era, on the advent of technology and industrialization, the essentiality of rivers and our dependence on them has increased.

The Ganga is not just a River; the mythological importance associated with the River is deep-rooted in the Indian culture and is considered a “ Holy River”. The status and recognition which River Ganga has attained, in India and worldwide, is a wondrous one. If a person deliberately makes up his mind to clear all his conceptions about the reverence towards River Ganga, its glory and its mystic characteristics; and decides to ponder about what really makes the River outstanding, there is a logical path on which his thoughts can tread on.

The Ganga-Brahmaputra-Meghna composite river system, which drains a massive 1.7 million km, is one of the largest river systems in the world by drainage area. The trans-boundary river has a basin spread over four countries – India, Nepal, China and Bangladesh. River Ganga is fed by snow-melt water from Himalayan glaciers and also by sub-surface flows and Plateau Rivers; and flows perennially. The River flows for 2,525 kms making it the 39th longest in the world and second in terms of the total suspended load which is 524 Mega tonnes/year. This perennially flowing River has spurred development in the entire basin. Dams and barrages have been built with an intention of providing energy and massive increases in food production. Some parts of the River are used for navigation. The River carries fertile alluvial sediment from the Himalayas and deposits in the plains of Uttar Pradesh, turning the latter into one of the most fertile alluvium plains in the world. Most importantly, the Ganga basin supports a population of about 600 million and generating over 40% of India‟s GDP in this region. All these physical and natural attributes of the River Ganga already make it an important and special river system of the world.

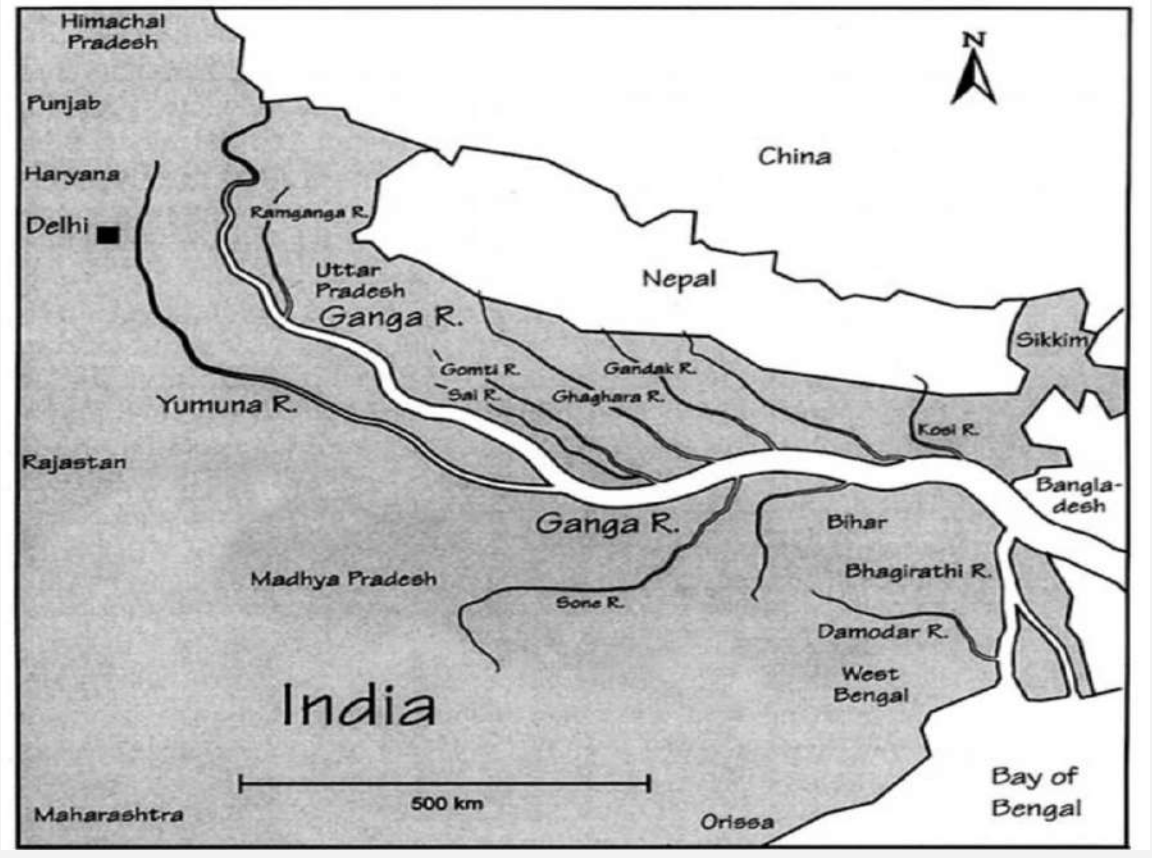
The Course of the River Ganga

River Ganga is the longest river of India and its basin area covers almost 26 percent of the country. Out of 2,510 km total length, the river flows for a length of 2,071 km in India. The river has three district courses. The river has its source in the `Gomukh' cave of the Gangotri glacier in the Kumaon Himalayas, where it is known as the river `Bhagirathi. From the confluence of river Bhagirathi and river Alaknanda at Devprayag, the river is known as Ganges.

The upper course stretches from the source till Hardwar. The middle course stretches from Hardwar to Rajmahal Hills in Bihar. The river in this course passes through Uttar Pradesh and Bihar and is joined by numerous tributaries, such as Ram Ganga, Gomti, Ghaghara, Gandak, Kosi from the left hand side and Jamuna, Chambal etc from the right hand side. Jamuna is the most important tributary of the river Ganga.

The lower course is in West Bengal. From the Rajmahal hills, the river flows towards south. Near Dhulian in Murshidabad, it is divided into two branches, such as

1. Bhagirathi-Hooghly which passes through West Bengal and the other
2. Padma (main branch) which passes through Bangladesh and both drains to the Bay of Bengal. The important tributaries in the lower course and Damador, Ajay, Mayurakshi etc. The river creates as extensive delta at its mouth.



Map of India showing the route of the Ganga river.

POLLUTION

Pollution of the Ganges (or Ganga), the largest river in India, poses significant threats to human health and the larger environment. Severely polluted with human waste and industrial contaminants, the river provides water to about 40% of India's population across 11 states,serving an estimated population of 500 million people, which is more than any other river in the world. Today, the Ganges is considered to be the fifth-most polluted river in the world.Raghubir Singh, an Indian photographer, has noted that no one in India spoke of the Ganges as being polluted until the late 1970s.However, pollution has been an old and continuous process in the river by the time people were finally acknowledging its pollution.

CAUSES

The main causes of water pollution in the Ganga river are the disposal of human sewage and animal waste, increasing population density, and disposal of industrial waste into the river.

HUMAN WASTE

The river flows through 100 cities with populations over 100,000; 97 cities with population between 50,000 to 100,000, and about 48 towns. A large proportion of the sewage water with higher organic load in the Ganga is from this population through domestic water usage.

INDUSTRIAL WASTE

Because of the establishment of a large number of industrial cities on the bank of the Ganga like Kanpur, Prayagraj, Varanasi and Patna, countless tanneries, chemical plants, textile mills, distilleries, slaughterhouses, and hospitals prosper and grow along this and contribute to the pollution of the Ganges by dumping untreated waste into it. One coal-based power plant on the banks of the Pandu River, a Ganges tributary near the city of Kanpur, burns 600,000 tons of coal each year and produces 210,000 tons of fly ash. The ash is dumped into ponds from which a slurry is filtered, mixed with domestic wastewater, and then released into the Pandu River. Fly ash contains toxic heavy metals such as lead and copper. The amount of parts per

million of copper released in the Pandu before it even reaches the Ganga is a thousand times higher than in uncontaminated water. Industrial effluents are about 12% of the total volume of effluent reaching the Ganges. Although a relatively low proportion, they are a cause for major concern because they are often toxic and non-biodegradable.[2] Plastic and industrial waste, such as waste water from the Factories that sit on the banks of the Ganga, are another cause of pollution. The most worrying problem facing the river is its increasing lack of water. Water for irrigation is being removed faster than the rainy season can replenish it.

DAMS AND PUMPING STATIONS

Built in 1854 during the British colonisation of India, the Haridwar dam has led to decay of the Ganges by greatly diminishing the flow of the river. The Farakka Barrage was built originally to divert fresh water into the Hooghly River but has since caused an increase of salinity in the downstream of the Ganges, having a damaging effect on the ground water and soil along the river. The barrage has caused major tension between Bangladesh and India. Bangladesh is actively considering to construct Ganges Barrage Project for mitigating the salinity problem.The government of India has planned about 300 dams on the Ganges and its tributaries in the near future despite a government-commissioned green panel report that has recommended scrapping 34 of the dams citing environmental concerns.

Three more barrages across the Ganges main river are existing at Bijnor, Narora and Kanpur. The barrages at Bijnor and Narora divert all the water including base flows during dry season to the canals for irrigating vast area up to Allahabad city. Most of the water available at the upstream of the Kanpur barrage is used during dry season for the drinking water needs of cities. Downstream of Kanpur barrage, adequate water is not available from the barrage to dilute the polluted water reaching the main river during the dry seasons of year.

RELIGIOUS TRADITIONS

During festival seasons, over 70 million people bathe in the Ganga to cleanse themselves of their past sins. Some materials like food, waste or leaves are left in the Ganga which are also responsible for its pollution. Traditional beliefs hold that being cremated on its banks and floating down the Ganga will cleanse the sins of those who die and carry them directly to salvation. In Varanasi alone, an estimated forty thousand bodies are cremated every year and are deposited into the Ganga. Because many families cannot afford the high cost of sufficient quantities of cremation wood, many of the bodies deposited into the Ganges are only half-burnt.

EFFECTS

Marine life

The results of mercury analysis in various specimens collected along the basin indicated that some fish muscles tended to accumulate high levels of mercury. Of it, approximately 50–84% was organic mercury. A strong positive correlation between mercury levels in muscle with food habit and fish length was found.

The Ganges river dolphin is one of few species of fresh water dolphins in the world. Listed as an endangered species, their population is believed to be less than 2000. Hydroelectric and irrigation dams along the Ganges that prevents the dolphins from travelling up and down river is the main reason for their reducing population. The Ganges softshell turtle (Nilssonia gangetica) is found in the Ganges, Indus, and Mahanadi river systems of Pakistan, northern India, Bangladesh, and southern Nepal. This turtle inhabits deep rivers, streams, large canals, lakes and ponds, with a bed of mud or sand. According to the International Union for Conservation of Nature, freshwater turtle species are vulnerable. Due to their long lifespan and high trophic level in the aquatic food web, turtles are vulnerable to heavy metals pollution, a major kind of pollution in the Ganges.

Wildlife

Some of the dams being constructed along the Ganges basin will submerge substantial areas of nearby forest. For example, the Kotli-Bhel dam at Devprayag will submerge 1200 hectares of forest, wiping out the forest area.

Human beings

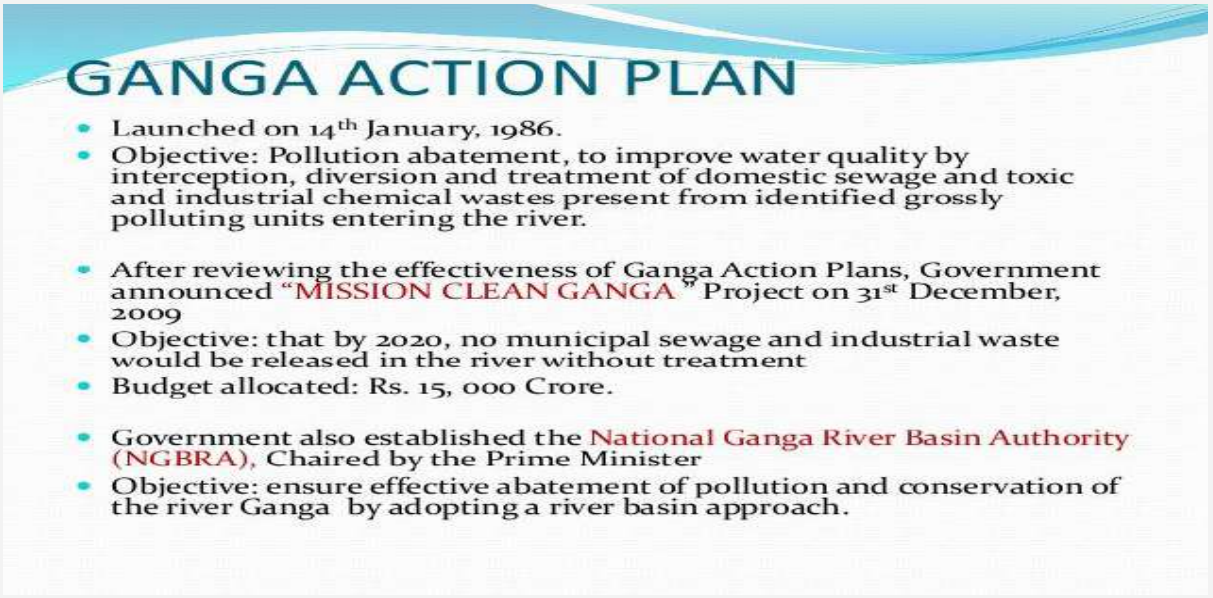
An analysis of the Ganges water in 2006 and 2007 showed significant associations between water-borne/enteric disease and the use of the river for bathing, laundry, washing, eating, cleaning utensils, and brushing teeth.Water in the Ganges has been correlated to contracting dysentery, cholera, hepatitis, as well as severe diarrhoea which continues to be one of the leading causes of death of children in India.

THE GANGA CLEAN UP EFFORTS

GANGA ACTION PLAN

The Ganga Action Plan was launched on 14th January 1986 with the main objective of pollution abatement, to improve water quality by interception, diversion and treatment of domestic sewage and toxic and industrial chemical wastes present,from identified grossly polluting units entering into the river.

After reviewing the effectiveness of the "Ganga Action Plan" , the Government announced the " Mission Clean Ganga" project on 31st December,2009 with the objective that by 2020, no municipal sewage and industrial waste would be released in the river without treatment,with the total budget around Rs.15,000 crore.



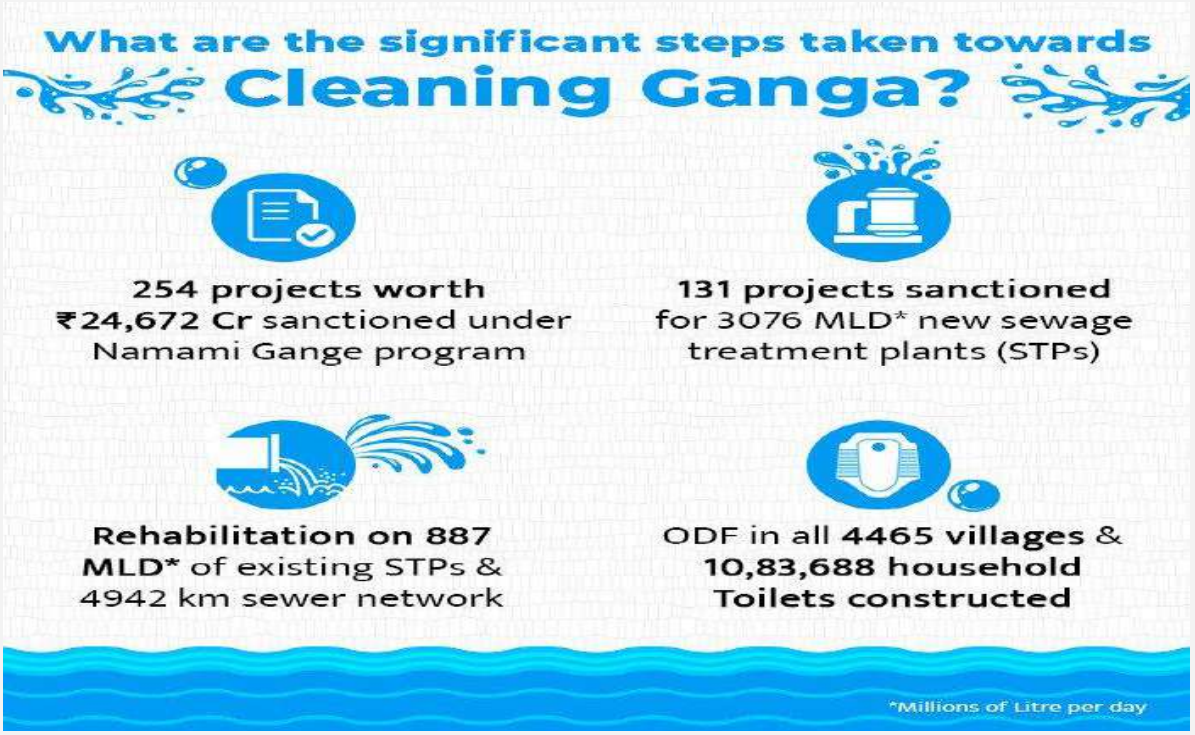
NAMAMI GANGA PROGRAM

In the budget tabled in Parliament on 10 July 2014, the Union Finance Minister Arun Jaitley announced an integrated Ganges development project titled 'Namami Gange' (meaning 'Obeisance to the Ganges river') and allocated ₹2,037 crore for this purpose. The objectives were effective abatement of pollution, conservation, and rejuvenation of the Ganges. Under the project, 8 states are covered. Ministry of Drinking Water Supply and Sanitation proposes to make 1,674 gram panchayats by the Ganges open defecation-free by 2022, at a cost of Rs 1,700 cr (central share). An estimated Rs 2,958 Crores (US$460 million) have been spent till July 2016 in various efforts in cleaning up of the river.

As a part of the program, government of India ordered the shut down of 48 industrial units around the Ganges.

The program has a budget outlay of Rs. 20,000 crore for the next five years. This is a significant five-fold increase over the expenditure in the past 30 years (Government of India incurred an overall expenditure of approximately Rs. 4000 crore on this task since 1985). The centre will now take over 100% funding of various activities/ projects under this program. Taking a leaf from the unsatisfactory results of the earlier Ganges Action Plans, the centre now plans to provide for operation and maintenance of the assets for a minimum 10-year period, and adopt a PPP/SPV approach for pollution hotspots. In an attempt to bolster enforcement the centre also plans to establish a four-battalion Ganga Eco-Task Force. The program emphasises on improved co-ordination mechanisms between various ministries/agencies of central and state governments. Major infrastructure investments which fall under the original mandate of other ministries viz. Urban Development (UD), Drinking Water & Sanitation (DWS), Environment Forests & Climate Change (EF&CC) etc., will be undertaken in addition.

'Namami Gange' will focus on pollution abatement interventions namely interception, diversion and treatment of waste water flowing through the open drains through bio-remediation / appropriate in-situ treatment / use of innovative technologies / sewage treatment plants (STPs) / effluent treatment plant (ETPs); rehabilitation and augmentation of existing STPs and immediate short term measures for arresting pollution at exit points on river front to prevent inflow of sewage etc.



Significantly the approach is underpinned by socio-economic benefits that the program is expected to deliver in terms of job creation, improved livelihoods and health benefits to the vast population that is dependent on the river.

The main pillars of Namami Gange Programme are:

1. Sewerage Treatment Infrastructure
2. River-Front Development
3. River-Surface Cleaning
4. Bio-Diversity
5. Afforestation
6. Public Awareness
7. Industrial Effluent Monitoring
8. Ganga Gram

Its implementation has been divided into entry-level activities (for immediate visible impact), medium-term activities (to be implemented within five years of time frame) and long-term activities (to be implemented within ten years).

Clean Ganga Fund

The Union Cabinet gave its approval for setting up of Clean Ganga Fund in September 2014 with the aim of using the collection for various activities under the Namami Gange programme for cleaning the Ganges.

Utilisation of funds

- Cleaning up of the Ganges
- Setting up of waste treatment plants
- Conservation of biotic diversity of the river
- Development of public amenities
- Activities such as Ghat redevelopment and Research and Development and innovative projects.

National Mission for clean Ganga

The National Mission for Clean Ganga (NMCG) is the implementation wing of National Ganga Council which was set up in October 2016 under the River Ganga (Rejuvenation, Protection and Management) Authorities order 2016. The order dissolved National Ganga River Basin Authority. The aim is to clean the Ganges and its tributaries in a comprehensive manner. Gajendra Singh Shekhawat is the present Union Cabinet Minister in Ministry of Jal Shakti.

Namami Gange Programme

Under National Mission for Clean Ganga, Namami Gange Programme was launched in 2014. This is a Flagship program under Union Government. A budget of 20,000 crore was given with the twin objective of effective abatement of pollution, conservation and rejuvenation of National River Ganga. Unlike previous projects for cleaning Ganga, Namami Gange is most comprehensive river conservation program.

CONCLUSION

The Constitution of India mandates the central and state governments to provide both a clean and decent environment and clean drinking water for the people (Article 48A, Art. 51 (A) (g), Article 21). Also, the Supreme Court has declared that the right to a decent and clean environment is a fundamental right.

Namami Gange has a well-balanced spread of 221 projects, which include STP, ghat development, surface cleaning afforestation, sanitation, and public awareness, out of which 58 have been completed. There is a concerted focus on 10 towns that contribute to 64% of the total sewage discharged in Ganga. To address the cross-functional challenge faced by GAP, Namami Gange has synergized itself with government schemes by signing MoUs with 10 central ministries. Levels of both dissolved oxygen (DO) and biological oxygen demand (BOD) have significantly improved, as shown in the below figures:

- BOD was 1.7 in Rishikesh in 1986; it improved to 1 in 2017
- DO was 8.1 in Rishikesh in 1986; it increased to 10 in 2017

To manage levels of industrial pollutants, a survey of all the 1,109 grossly polluting industries (GPIs) has been conducted, of which 333 were closed down and closure notices were sent to non-complying GPIs. 4,464 villages situated on the bank of Ganga have been declared as open defecation free (ODF). Moreover, Namami Gange was instrumental in constructing more than 12.7 lakhs household toilets. Trash skimmers have been deployed in 11 cities to collect any surface waste.
Six public outreach programmes were organised in areas around Ganga basin:

- Swachhta Pakhwada
- Ganga Sankalp Divas
- Ganga Nirikshan Yatra
- Ganga Dusshera
- Ganga Vriksharopan Saptah
- Swachhta Hi Seva Pakhwada

Ganga is an integral part of the socio-eco-cultural-political fabric of India. However, the longest river has faced the brunt of increasing industrialization, which has not only affected the flow but also the quality of its water. Namami Gange Programme aims to restore the purity and flow of water in the Ganga River through abatement of pollutants and treatment of discharged water. Namami Gange has not only taken lessons from the failure of GAP, butit has also ensured cross-state cooperation as well as public support to expedite the processes.

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Environmental pollution:-

INTRODUCTION-

The environment is the surrounding of an organism . The environment in which an organism lives is made up of various components like air, water

, land , etc . These components are found in fixed proportions to create aharmonious balance in the environment for the organism to live in . any kind of undesirable and unwanted change in the proportions of these component can be termed as pollution . This issue is increasing with every passing year . It is an issue that creates economic ,physical , and social troubles . the environmental problem that is worsening with each day

needs to be addressed so that its harmful effects on humans as well as the planet can be discarded .

WHAT IS ENVIRONMENTAL POLLUTION?

Environmental pollution has existed for centuries but only started to be significant following the industrial revolution in the 19th century. Pollutionoccurs when the natural environment cannot destroy an element withoutcreating harm or damage to itself.

The elements involved are not produced by nature, and the destroying process can vary from a few days to thousands of years (that is, for instance, the case for radioactive pollutants).

Pollution takes place when nature does not know how to decompose anelement that has been brought to it in an unnatural way.

Environmental pollutants have various adverse health effects from early life some of the most important harmful effects are perinatal disorders, infant mortality, respiratory disorders, allergy, malignancies, cardiovasculardisorders, increase in stress oxidative, endothelial dysfunction, mental disorders, and various other harmful effects

Pollution must be taken seriously, as it has a negative effect on natural elements that are an absolute need for life to exist on earth, such as waterand air. Indeed, without it, or if they were present in different quantities, animals – including humans – and plants could not survive. We can identify several types of pollution on Earth: air pollution, water pollution and soil pollution.

- *Environment Pollution is the addition of contaminants into the natural environment that causes detrimental effects to nature, natural resources and mankind.*

- *Any unnatural and negative changes in all the dimensions like chemical, physical and Biological characteristics of any componentof the ecosystem*
  i.e. air, water or soil Which can cause harmful effects on variousforms of life and property is called Environmental pollution.

What is a Pollutant?

• Any substance which causes harmful effects or uneasiness in the organisms, then that particular substance may be called as the pollutant.

The materials that cause pollution are of two types:

1. *Persistent pollutants: Those pollutants which remain consistent in the environment for a long period of time without any change in its original form are called persistent pollutants. For example pesticides, nuclear wastes, and plastics etc.*
2. *Non-persistent pollutants: These pollutants are the opposite of persistent pollutant and break down in the simple form. If this process of breaking down is done by living Organisms, then such pollutants are referred to as biodegradable pollutants.*

From another perspective, pollutants can be classified as follows:

1. *Primary Pollutants: Primary pollutants are those which remain in the form in which they were added to the environment for ex. DDT, Plastic*
2. *Secondary Pollutants: Secondary pollutants are formed due to interaction of primary pollutants amongst themselves viz. PAN by the interaction of NOx & Hydrocarbons.*

According to their existence in nature:

1. *Quantitative Pollutants: These substances are already present in the atmosphere but they become pollutant when their concentration level reaches to a particular level which is above a threshold limit.*
2. *Qualitative Pollutants: These are man-made pollutants eg. Fungicides, herbicides*

Causes of Environmental Pollution:-

1. *INDUSRIES:-*

Industries have been polluting our environment, especially since the beginning of the industrial revolution, as mentioned above, notably due tothe increasing use of fossil fuels. In the 19th century and for a significant part of the 20th century, coal has been used to make machines work faster,replacing human force.

Though pollution by industries mainly causes air pollution, soil and water contamination can also occur. This is particularly the case for power-generating industries, such as plants producing electricity (May they be adam, a nuclear reactor or some other type of plant).

Also, the transportation of this energy can be harmful to the environment.We can take as an example of the transportation of petrol through pipelines; if there is a leak in the pipeline, the soil will automatically be polluted.

At the same time, if the tanker transporting petrol from its production plant to the place where it will be consumed leaks or sinks, the water willget contaminated.

2. *TRANSPORTATION:-*

Ever since men abandoned animal power to travel, pollution of the environment has become higher and higher. Its levels have only beenincreasing until now. Similarly to industries, pollution caused by transport can mainly beattributed to fossil fuels.

The environmental impact of transport is significant because transport is a major user of energy, and burns most of the world's petroleum. This creates air pollution, including nitrous oxides and particulates, and is a significant contributor to global warming through emission of carbon dioxide. Within the transport sector, road transport is the largest contributor to global warming.

Environmental regulations in developed countries have reduced the individual vehicle's emission. However, this has been offset by an increasein the number of vehicles, and increased use of each vehicle (an effect known as the Jevons paradox). Some pathways to reduce the carbon emissions of road vehicles have been considerably studied. Energy use and emissions vary largely between modes, causing environmentalists tocall for a transition from air and road to rail and human-powered transport,and increase transport electrification and energy efficiency.

3. AGRICULTURE ACTIVITIES:-

Agriculture is mainly responsible for the contamination of water and soil. This is caused by the increased use of pesticides, as well as by the intensive character of its production. Almost all pesticides are made from chemical substances and are meant to keep diseases and threatening animals away from the crops.

The pollution may come from a variety of sources, ranging from point source water pollution (from a single discharge point) to more diffuse, landscape-level causes, also known as non-point source pollution and air pollution. Once in the environment these pollutants can have bothdirect effects in surrounding ecosystems, i.e. killing local wildlife or contaminating drinking water, and downstream effects such as dead zones caused by agricultural runoff is concentrated in large water bodies.

Animal agriculture has an outsized impact on pollutants that enter the environment. Bacteria and pathogens in manure can make their way into streams and groundwater if grazing, storing manure in lagoons and applying manure to fields is not properly managed.

Agricultural pollution refers to biotic and abiotic byproducts of farmingpractices. About biotic and abiotic :-

- *ABIOTIC:-Pesticides and herbicides are mainly used in agriculture for crop production. Pesticides persist and accumulate in soils, which can alter microbial processes, increase plant uptake of the chemical, and are toxic to soil organisms. Pesticides also accumulate in animals that eat contaminated pests and soil organisms. Inaddition, pesticides can be more harmful to beneficial insects, such as pollinators, andto natural enemies of pests.*
- *BIOTIC:-The biotic factors refer to all the living beings present in an ecosystem, and the abiotic factors refer to all the non- living components like physical conditions (temperature, pH, humidity, salinity, sunlight, etc.) and chemical agents (different gases and mineral nutrients present in the air, water,soil, etc.)*

4. *SOIL EROSION:-*

   Intensive farming operations greatly contribute to soil erosion and sedimentation as millions of fertile soils are broken down, degraded, and eroded via storm water runoffs,which end up accumulating as sediments in rivers, streams, lakes, oceans or other land regions. Thus, it affects water quality by making it dirty or contaminating it with the agrochemical residues present in the soils.

   Sedimentation also contributes to the build-up of the agricultural pollutants in waterways and other land areas. Sedimentation may also restrict light penetration in water, thereby affecting aquatic life forms, and the consequential turbidity can hamper the feeding habits of the aquatic fish.

SOME DIFFERENT TYPES OF ENVIRONMENT POLLUTION:-

1. AIR POLLUTION:-

Air pollution refers to the release of pollutants into the air—pollutants which are detrimental to human health and the planetas a whole.

According to the World Health Organization (WHO), each year air pollution is responsible for nearly seven million deaths around the globe.

Vehicle emissions, fuel oils and natural gas to heat homes, by-products of manufacturing and power generation, particularly coal - fueled power plants, and fumes from chemical production arethe primary sources of human-made air pollution.

Nature releases hazardous substances into the air, such as smoke from wildfires, which are often caused by people; ash and gases fromvolcanic eruptions; and gases, like methane, which are emitted from decomposing organic matter in soils.

Ozone, an atmospheric gas, is often called smog when at ground level. It is created when pollutants emitted by cars, power plants, industrial boilers, refineries, and other sources chemically react in thepresence of sunlight.
Nine out of ten human beings currently breathe air that exceeds the WHO's guideline limits for pollutants, with those living in low- and middle-income countries suffering the most. In the United States, the Clean Air Act, established in 1970, authorizes the U.S. Environmental Protection Agency (EPA) to safeguard public health by regulating the emissions of these harmful air pollutants.

WHAT CAUSES AIR POLPOLLUTION

Most air pollution comes from vehicles , factory coal burning andetc. Burning fossil fuels releases gases and chemicals into the air." And in an especially destructive feedback loop, air pollution not only contributes to climate change but is also exacerbated byit.

Certain gases in the atmosphere can cause air pollution. For example, in cities, a gas called ozone is a major cause of air pollution. Ozone is also a greenhouse gas that can be both goodand bad for our environment. It all depends where it is in Earth's atmosphere.

Climate change also increases the production of allergenic air pollutants, including mold (thanks to damp conditions caused by extreme weather and increased flooding) and pollen (due toa longer pollen season).

SMOG AND SOOT:-

Smog (sometimes referred to as ground-level ozone) occurs when emissions from combusting fossil fuels react with sunlight. Soot (also known as particulate matter) is made up of tiny particles of chemicals, soil, smoke, dust, or allergens—in the form of either gasor solids—that are carried in the air. The sources of smog and sootare similar.

Smog can irritate the eyes and throat and also damage the lungs, especially those of children, senior citizens, and peoplewho work or exercise outdoors.

GREEN HOUSE GASES:-

Greenhouse gases are gases in Earth's atmosphere that trap heat. They let sunlight pass through the atmosphere, but they prevent the heat that the sunlight brings from leaving the atmosphere. The main greenhouse gases are:

Water vapor

Carbon dioxide

Methane

Ozone

Nitrous oxide Chlorofluorocarbons

Greenhouse gases lead to warmer temperatures, which in turn lead to the hallmarks of climate change: rising sea levels, more extreme weather, heat-related deaths, and the increased transmission of infectious diseases.

1. OCEAN POLLUTION : CAUSES EFFECTS ANDPREVENTION

Oceans, which account for 70 percent of the surface of our plante , play a pivotal role in the health of our planet and those who inhabit it. Unfortunately, our oceans are polluted . According to the national oceanic and atmospheric administration, billions of pounds of trash and other pollutants enter our oceans every year
.the monumental impacts of this are far reaching in this post , we're talking a closer look at the various causes of ocean pollution, its effects and the steps we can take to combat it .

Dumping of sewage:-

The dumping of sewage in the ocean is often regarded as the cheapest and easiest method of sewage disposal . Most of the untreated sewage containing lethal substances find their way into the ocean waters through the sewer systems and has detrimental effects on the health of marine flora and fauna .

Land runoff:-

Referred to as non – point pollution, runoff is caused when to soilis infiltrurated with water to its maximum exteet and the excess water then flower from the land into the flower from the land in to the ocean via the drainage systems like rivers and streams . This runoff water carries with it the harmful toxins : the little dumped in towns and cities , pesticides, and other soil contaminants . all these toxins are then dumped into the ocean along with the runoff.

Industrial chemicals :-

The untreated effluents and garbage along with harmful chemicals are also released into water bodies from several industries . the waste from industries like fossil fuel ,plastic manufacturing, agrochemical sand pharmaceuticals contains harmful toxins like mercury , DDT ,phthalates ,bisphenol -A, and other chemical substances. These pollute the oceans by altering the pH level of the water which contributes to the death of most aquatic flora and fauna . Such toxins also enter the bodies of marine animals and accumulated up the. Food chain from one level to another , resulting in bio magnification when contrition of toxins increases as it ascends the food chain. .

Plastic:-

A large quantity of single – use plastics have been mercilessly dumped as litter into the marine environment and have found on beaches , in polar ice seas, and even on the shorelines of the world's most remote uninhabited island . Plastic debris has been transforming some marine areas into a plastic soup , leading to the choking of marine life and causing a potential large – scale impact on the marine environment .

Oil spills:-

Oil destroys the insulating ability of fur – bearing mammals , such as sea otters , and the water repellency of a bird's feathers,thus exposing these creatures to the harsh elements .without theability to repel water , birds and mammals will die from hypothermia .

3. NOISEPOLLUTION

Most of us are accustomed to the sound we hear every day whether it's loud music , the television , people talking on their phone, the traffic , and even pets braking in the middle of the night : These have all but become a part of urban culture , and they rarely disturb us. However , when the sound of the televisionkeeps you from sleeping all night or the traffic starts giving you aheadache , it transcends the boundaries of mere noise and qualifies and noise pollution.

Increased risk of cardiovascular diseases Being exposedto noise pollution for ten consecutive years or more raises your chances of suffering from at least one cardiovascular diseases later in life by 300% . about a decade back , scientists from the university of Gothenburg found out that high noise levels increases an individual 's pulse rates and cause constriction of blood vessels , thus making him/her vulnerable to heart attacks or high blood pressure. Being exposed touch noisesfor more than 8 hours a day could even be worse .

> *POOR SLEEP:-*

If you have even lived in a noisy neighborhood , you know now irregular sleep can get on a noisy night .the danger of not sleeping well at night is that your day gets boring , you get tired early , and you are forced to forego most energy draining activities . You connot, for example , be effective at the gym which increases cholesterol levels in your body . Poor sleepingpatterns can also cause serious cardiovascular problems, in thelong run .

> *Damaged brain and hearing power:-*

High – intensity sound waves cause unnecessary ripples in the ear canal, disturbing the fluid that aid communications between the ear and the brain .the disturbance destroys the tiny , very delicate, hair fallacies that send signals to the brain whenever sounds enter the ear. Hearing loss is very probable after 50% of these hairs are gone , necessitating hearing devices , particularly for children. Research has also shown that uncontrolled exposure to high – intensity noises can seriously jeopardies a kid's memory and reading power.

CONCLUSION

- *Environment is gift of god given to us so we should protect it from ourselves as we are the destroyer of our own environment so it our duty and we should it nether we have to suffer from the harsh conditions.*
- *So we whole as one unit have to protect our environment from getting polluted in order to save ourselves.*

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TOPIC OF TUTORIAL : WATER POLLUTION

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TOPIC

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9. WATER POLLUTION CONTROL AND MANAGEMENT
10. LEGISLATIVE MEASURES FOR PREVENTING WATER POLLUTION

INTRODUCTION TO WATER POLLUTION

Hydrosphere covers more than 75% of the earth surface either as oceans [salt water] or as fresh water. Hydrosphere includes sea rivers , oceans , lakes , ponds , streams etc.

Most of the earth's surface water is in the oceans , which contains about 35 parts per thousand of dissolved salt of hemoindin, most of fresh water is salt content of 0.2% of found either in lakes and ponds [still water] or rivers and [streams] [running water] .

Fresh water is also available in the form of rains , snow ,dew etc.

MEANING OF WATER POLLUTION

In nature , water is in its pure from . Impurities get added to it as it percolates beneath the surface of the earth and also when it is used for human activities . Water pollution can be defined as the presence in water of some foreign substances or impurities [organic , inorganic , radiological or biological in such quantity . So as to constitute a health hazard by lowering the water quantity and marking it unfit for use.

Water pollution is a state of deviation from the pure condition where by its normal function and properties are affected .It has been mentioned before that a knowledge of aquatic environmental . Chemistry is the key to the understanding of water pollution and its control.

Water pollution can be best considered in the perspective of possible pollutant cycles throughout the environment. Any shift in the naturally dynamic equilibrium existing among the environmental segments.

SIGNS OF WATER POLLUTION

1. Bad taste of drinking water.
2. Offensive odours from lakes , rivers and ocean beaches.
3. Unchecked growth of acquatic weeds in water, sea water.
4. Decrease in number of fish in fresh water, sea water.
5. Oil and grease floating on water surfaces.
6. These disturb the normal uses of water for public water supply.

Recreation and Aesthetics

Fish, other aquatic life and wildlife

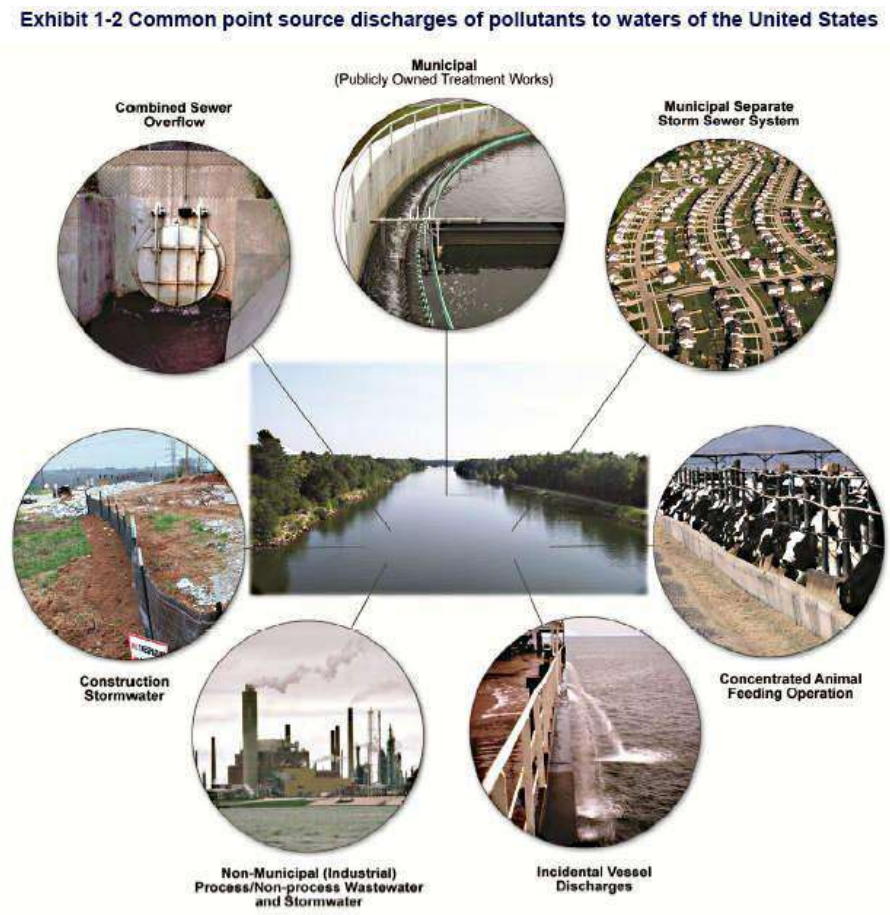
MAJOR SOURCES OF WATER POLLUTION

There are two major sources of water pollution namely

1. Point sources
2. Diffused sources

1. Point sources : Those sources which can be identified at a single location are known point sources , for instance the flow of water pollutants through regular channels like sewage system , industrial effluents etc .Contaminate the ground water and cause water pollution.

   The water pollution caused by point sources can be minimized if all the domestic sewage , industrial ,effluents cattle field and livestock waste water are all centrally collected treated up to reused for different beneficial purpose.



2.Diffused sources :Those sources whose location cannot be easily identified are called diffused sources . In this case the pollutants scattered on this ground ultimately reach the water pollution . for instance , agriculture [pesticides, fertilizers], mining construction etc.

The water pollution caused by diffused sources like agriculture can be controlled by changing the cropping patterns tillage particles and advanced farm management practices which do not contaminate the water bodies.

COMMON SOURCES OF WATER POLLUTION

This section gives information about the significant sources of water pollution.

1. Sewage [waste water]:sewage is another names of waste water from domestic and industrial processes . Despite strict regulatory control , the environment agency data shows that the water and sewage industry accounted for almost quarter of the serious water incidents in England and wales in 2006.

2. Agricultural pollution: The agriculture industry covers 76% of the land area of England Wales. Agricultural processes such as uncontrolled spreading of slurries and manure , disposal of sheep dig ,tillage , ploughing of the land use of pesticides and fertilizers can cause water pollution . Accidental spills from milk dairies can also affect the quality of water.

3. 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 .Oil spills also reduce oxygen supplies within the water environment .The main cause of the related water pollution are:-
    a. Loss from storage facilities
    b. Spillage during delivery
    c. Deliberate disposal of waste oil drainage system.

4. River dumping : lots of people dump super market trolleys, bicycles ,electronic waste into rivers .This is illegial and offenders may be charged for fly – tipping if caught . River dumping not only causes water pollution : it also harms wildlife and increases the risk of flooding .

5. Marine dumping: The worldwide fund for nature estimates that staggering amount of waste enters into the sea every year part of this is due to deliberate dumping of waste into coastal waters .others sources of waste at sea includes plastics and other materials blown or washed from lands . Marine dumping is illegal under national and international legislation.

CLASSIFICATION OF WATER POLLUTANTS

Water is used for various purposes like bathing , execration ,laundary,cooking and cleaning etc.After using the water , manufacturing plants, industries , residential and commercial waste water which is contaminated by many pollutants.

Water pollutants can be classified into the following categories :-

a. Suspended matter [solids] comprises of silt ,sand , mineral codes.
b. Thermal discharge waste hot water returned to the original water returned to the original water bodies .
c. Pathogens [bacteria viruses protozoa, helminthes].
d. Natural organic pollutants .
e. Synthetic organic compounds [detergents , pesticides , fertilizers].
f. Inorganic chemicals [acids ,alkalies ,metals]
g. Radioactive substances
h. Sediments

PROBLEMS CAUSED BY WATER POLLUTION

This severe water pollution problem caused in the following ways
1.Bacterial and viral contamination: Sewage waters may contain a number of pathogenic bacteria and viruses .This is a threat to human health as they cause a number of water borne diseases such as typhoid ,dysentery ,hepatitis etc.

Biological oxygen demand [BOD]:Biological oxygen demand is the amount of oxygen required for biological oxidation by microbes in any unit volume of water .The release of raw sewage into lakes etc creates BOD due to oxidative breakdown of the detritus by microorganism chemical oxygen [COD].

2.Eutrophication : Sewage consists of nitrates phosphate sodium ,potassium ,calcium etc. and their addition into water bobies makes it rich in nutrients , especially phosphate and nitrate ions .These nutrients make the water bodies highly productive or eutrophic and the phenomena is called eutrophication.

Ecological dis-disbalance may occur .

Water- borne diseases may occur and it may assume epidemic state.

Affects recreation and tourism due to excessive growth of algae and other aquatic plants , making the water and beaches unfit for recreation purposes control of water pollution.

The following measures can be taken to control water pollution :

a. Thermal pollution : for minimising thermal pollution hot water should be cooled before realse from factories and removal of forests canopies and irrigation returns flows should be prohibited.
b. Prohibition :Besides reserving seprate water supplies for livestock , the following prohibition should be enforced to avoid contamination of the main sources of drinking water.

WATER POLLUTION CONTROL AND MANAGEMENT

Clean water is essential for healthy environment to support life available and exploitable water resources and sustaining their quality is most relevant in India where rainfall distribution is uneven and confined to 3-4months in a year .

Moreover ,anthropogenic global and local climatic distorations resulting from global warming due greenhouse , denudation of forest canopy loss of top soil and severe environmental degradation have adverse impact on the monsoons pattern in India .

Hence in spite of vast water resources in lakes and rivers and good monsoon, India faces perennial problems of floods and drought sand highly polluted water resources.

The key challenges to better management of the water quality in India comprise of temporal and spatial variation of rainfall, uneven geographic distribution of surface water resources, persistent droughts , overuse of ground water and contamination , drainage and salinisation and water quality problems due to treated , partially treated and untreated wastewater from urban settlements ,industrial establishments and run off from irrigation sector besides poor management of municipal solid waste and animal dung in rural areas (CPCB Report , 2013), some of the control measures are given below:

1. The Ganga Action Plan and the National River Action Plan are being implemented for addressing the task of trapping ,diversion and treatment of municipal wastewater.
2. In most of the country, waste water from domestic sources us hardly treated, due to inadequate sanitation facilities. This waste water, containing highly organic pollutant load, finds its way into surface and groundwater courses near the vicinity of human habitation from where further water is drawn for use .Considerable investments should be done to install the treatment systems.
3. With rapid industrialization and urbanization, the water requirement for energy and industrial use is estimated to rise to about 18%(191bcm)of the total requirement 2025(CPCB Report, 2013). Poor environment management systems, especially in industries such as thermal power stations , chemicals , metals and minerals , leather processing and sugar

mills, have led to discharge of highly toxic and organic wastewater. This has resulted in pollution of the surface and groundwater sources from which water is also drawn for irrigation and domestic purpose.

4. For the agricultural sector , water and electricity for irrigation are subsidized for political reasons .This leads to wasteful flood irrigation rather than adoption of more optimal practices such as sprinkler and drip irrigation .Optimized irrigation , cropping patterns and farming practices should be encourage for judicious use of water.
5.

LEGISLATIVE MEASURES FOR PREVENTING WATER POLLUTION

It is important to utilize a good quality and unpolluted water. The quality and unpolluted water . The quality criteria may vary depending on the use .Individual efforts do pay in this regard , however, a common policy in the form of legislation is always more effective . The enactment of 'prevention and control of water pollution act' in 1974 has helped in the prevention of water pollution . The standards have been prescribed for water pollution under Environment (protection) Act 1986.

- General standards for water pollutants for discharge of effluents in water bodies on land (inland surface water, public sewers, irrigated land and coastal areas)
- Standards specific for each type of industry
- Standards defined for the amount of waste water to be discharged for different industries.
- Standards limiting the amount of a particular pollutant on the basis of production capacity of an industrial unit.

The state pollution control boards have been empowered to grant consent to new / existing water polluting industries under water 'Prevention and Control of Pollution Act -1974.' They have been empowered to shut down any industrial unit which fails to meet the prescribed standards under this Act. The state governments have also been authorized to take punitive measures against defaulting industries .

CONCLUSION

- Water is the most important component that we need in our daily life so, by decreasing the water pollution is the same as saving our own lives.

- I think that we should change our habits because the water is a natural resource very important and if we follow the same way till now one day maybe our children wake up and they won't have water to drink.

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Department of History

Scottish Church College

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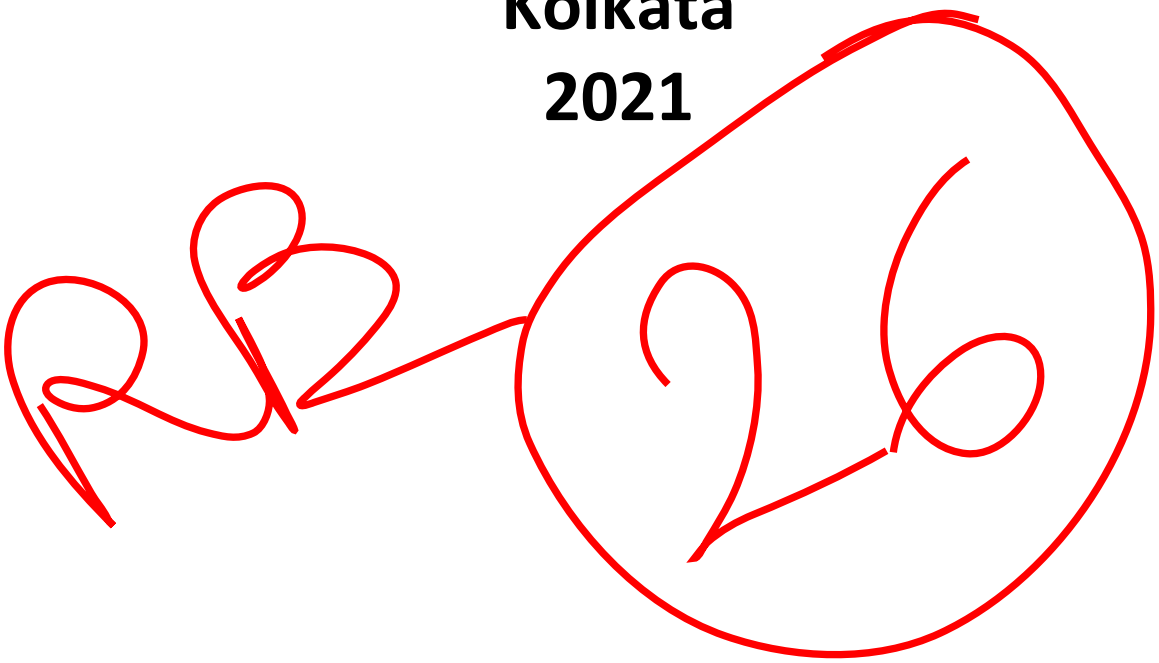

INTRODUCTION

Climate change includes both global warming driven by human-induced emissions of greenhouse gases and the resulting large-scale shifts in weather patterns. Though there have been previous periods of climatic change, since the mid-20th century humans have had an unprecedented impact on Earth's climate system and caused change on a global scale. The largest driver of warming is the emission of greenhouse gases, of which more than 90% are carbon dioxide (CO_2) and methane. Fossil fuel burning (coal, oil, and natural gas) for energy consumption is the main source of these emissions, with additional contributions from agriculture, deforestation, and manufacturing. The human cause of climate change is not disputed by any scientific body of national or international standing. Temperature rise is accelerated or tempered by climate feedbacks, such as loss of sunlight- reflecting snow and ice cover, increased water vapor (a greenhouse gas itself), and changesto land and ocean carbon sinks.

Temperature rise on land is about twice the global average increase, leading to desert expansion and more common heat waves and wildfires. Temperature rise is also amplified in the Arctic, where it has contributed to melting permafrost, glacial retreat and sea ice loss.Warmer temperatures are increasing rates of evaporation, causing more intense storms andweather extremes. Impacts on ecosystems include the relocation or extinction of many species as their environment changes, most immediately in coral reefs, mountains, and the Arctic. Climate change threatens people with food insecurity, water scarcity, flooding, infectious diseases, extreme heat, economic losses, and displacement. These impacts have led the World Health Organization to call climate change the greatest threat to global healthin the 21st century. Even if efforts to minimize future warming are successful, some effects will continue for centuries, including rising sea levels, rising ocean temperatures, and ocean acidification.

GLOBAL WARMING

Global warming is a phenomenon of climate change characterized by a general increase in average temperatures of the Earth, which modifies the weather balances and ecosystems fora long time. It is directly linked to the increase of greenhouse gases in our atmosphere, worsening the greenhouse effect.

The average temperature of the planet has increased by 0.8º Celsius (33.4° Fahrenheit) compared to the end of the 19th century. Each of the last three decades has been warmerthan all previous decades since the beginning of the statistical surveys in 1850.

At the pace of current CO2 emissions, scientists expect an increase of between 1.5° and 5.3°C (34.7° to 41.5°F) in average temperature by 2100. If no action is taken, it would have harmfulconsequences to humanity and the biosphere.

CAUSES

The greenhouse effect is a natural phenomenon. However, the increase in greenhouse gasesis linked to human activities. It is thus no surprise that the world's leading climate scientists believe that human activities are very likely the main cause of global warming since the mid-twentieth century, mostly because of:

FOSSIL FUELS

The massive use of fossil fuels is obviously the first source of global warming, as burning coal, oil and gas produces carbon dioxide - the most important greenhouse gas in the atmosphere -as well as nitrous oxide.

DEFORESTATION

The exploitation of forests has a major role in climate change. Trees help regulate the climateby absorbing CO2 from the atmosphere. When they are cut down, this positive effect is lost and the carbon stored in the trees is released into the atmosphere.

INTENSIVE FARMING

Another cause of global warming is intensive farming, not only with the ever-increasing livestock, but also with plant protection products and fertilizers. In fact, cattle and sheepproduce large amounts of methane when digesting their food, while fertilizers produce nitrous oxide emission

WASTE DISPOSAL

Waste management methods like landfills and incineration emit greenhouse and toxic gases -including methane - that are released into the atmosphere, soil and

waterways, contributing to the increase of the greenhouse effect.

MINING

Modern life is highly dependent on the mining and metallurgical industry. Metals and minerals are the raw materials used in the construction, transportation and manufacturing of goods. From extraction to delivery, this market accounts for 5% of all greenhouse gas emissions.

OVERCONSUMPTION

Finally, overconsumption also plays a major role in climate change. In fact, it is responsible for the overexploitation of natural resources and emissions from international freight transport, which both contribute to global warming.

EFFECTS

- *On biodiversity*

  The increase of temperatures and the climate upheavals disturb the ecosystems, modifythe conditions and cycles of plant reproduction. The scarcity of resources and climate change are changing life habits and migratory cycles of animals. We are already witnessing the disappearance of many species - including endemic species - or, conversely, the intrusion of invasive species that threaten crops and other animals.

  Global warming therefore impacts biodiversity. It is the balance of biodiversity that is modified and threatened. According to the IPCC, a 1.5°C (34.7°F) average rise might put20-30% of species at risk of extinction. If the planet warms by more than 2°C, most ecosystems will struggle.

- *On oceans*

  Because of global warming, permafrost and ice are melting massively at the poles, increasing the sea level at a rate never known before. In a century, the increase reached 18 cm (including 6 cm in the last 20 years). The worst-case scenario is a rise of up to 1mby 2100.

The acidification of the oceans is also of great concern. In fact, the large amount of CO_2 captured by the oceans makes them more acidic, arousing serious questions aboutthe adaptability of seashells or coral reefs.

- *On humans*

  Human beings are not spared by these upheavals. Climate change is affecting the global economy. It is already shaking up social, health and geopolitical balances in many parts ofthe world. The scarcity of resources like food and energy gives rise to new conflicts.

  Rising sea levels and floods are causing population migration. Small island states are in the front line. The estimated number of climate refugees by 2050 is 250 million people.

- *On the weather*

  For decades now, meteorologists and climatologists around the world have been watching the effects of global warming on the weather phenomena. And the impact ishuge: more droughts and heatwaves, more precipitations, more natural disasters likefloods, hurricanes, storms and wildfires, frost-free season, etc.

GREEN HOUSE EFFECT

The greenhouse effect is the process by which radiation from a planet's atmospherewarms the planet's surface to a temperature above what it would be without this atmosphere.

Radiatively active gases (i.e., greenhouse gases) in a planet's atmosphere radiateenergy in all directions. Part of this radiation is directed towards the surface, thus warming it. The intensity of downward radiation – that is, the strength of the greenhouse effect – depends on the amount of greenhouse gases that the atmosphere contains. The temperature rises until the intensity of upward radiationfrom the surface, thus cooling it, balances the downward flow of energy.

Earth's natural greenhouse effect is critical to supporting life and initially was a precursor to life moving out of the ocean onto land. Human activities, mainly the burning of fossil fuels and clearcutting of forests, have increased the greenhouseeffect and caused global warming.

The planet Venus experienced a runaway greenhouse effect, resulting in anatmosphere which is 96% carbon dioxide, and a surface atmospheric
pressure roughly the same as found 900 m (3,000 ft) underwater on Earth.

Venusmay have had water oceans, but they would have boiled off as the mean surface temperature rose to the current 735 K (462 °C; 863 °F).

The term greenhouse effect is a slight misnomer, in the sense that physical greenhouses warm via a different mechanism. The greenhouse effect as anatmospheric mechanism functions through radiative heat loss while a
traditional greenhouse as a built structure blocks convective heat loss. The result,however, is an increase in temperature in both cases.

GREEN HOUSE GASES

The greenhouse gases responsible for the greenhouse effect are:

- Water Vapor
- Carbon Dioxide
- Methane
- Ozone

CAUSES

The following are the factors that are responsible for the cause of greenhouse effect:

- Deforestation: This is considered to be one of the most responsible factors for the cause of greenhouse effect. This is due to the reduction in the releasein the oxygen and absorption of carbon dioxide by the plants.
- Fossil fuel burning: Fossil fuels such as coal, oil, and natural gases are usedas a means of energy which releases a huge number of harmful gases into the environment.
- Population: As the population increases, the need for space increases whichagain results in deforestation.

EFFECTS

Greenhouse gases have far-ranging environmental and health effects. They cause climate change by trapping heat, and they also contribute to

respiratory disease from smog and air pollution. Extreme weather, food supply disruptions, and increased wildfires are other effects of climate change caused by greenhouse gases.The typical weather patterns we've grown to expect will change; some species will disappear; others will migrate or grow.

PREVENTION

- Afforestation: Afforestation on a large-scale area helps in decreasing therelease of carbon dioxide in the atmosphere.
- Conservation of energy: Switching to renewable sources of energy such assolar energy, wind energy, etc. will reduce the use of fossil fuels. This eventually reduces the release of carbon dioxide into the atmosphere.
- Policy intervention: When the government comes up with strict policies tomaintain the overall air quality of the city.

URBAN IMPACT

The climate in urban areas differs from that in neighboring rural areas, as a result of urban development. Urbanization greatly changes the form of the landscape, andalso produces changes in an area's air.

TEMPERATURE

Increased urban land use and occupation alters the local thermal field resulting in thedevelopment of urban heat islands. An urban heat island is a phenomenon where the surface temperature and air are concentrated in urban areas rather than surrounding suburban/ rural areas. The solar energy absorbed and produced from solar radiation and anthropogenic activity is partitioned accordingly: warming the air above the surface via convection, evaporating moisture from the urban surface system, and storing heat in surface materials, such as buildings and roads. The solarenergy is stored during the day and typically released during the night. Dark materials making up the buildings, impermeable soil and paved surfaces retain a majority of the solar energy. This allows for larger heat islands and increased thermal discomfort.

Surface reflectivity in urban areas can impact ambient temperature. When the vegetative surface is dark and dry it can reach 52 °C, whereas when the land is light and moist it reaches 18 °C. Water evaporation usuallyhelps to release energy from vegetative surfaces to cool the surface above. But mosthotspot locations have little greenery which influences the formation of urban heat islands. Darker man-made surfaces have a lower albedo and heat capacity than natural surfaces allowing for increased photochemical reaction rates and absorption of visible radiation. This phenomenon can also be exacerbated when people release waste heat via heating and ventilating systems (e.g., air conditioners) and vehicular emissions. Expansion of these urban areas can lead to higher surface and air temperatures contributing to urban climate.

PRECIPITATION

Because cities are warmer, the hot air is more likely to rise, and if the humidity ishigh, it will cause convectional rainfall – short intense bursts of rain
and thunderstorms. Urban areas produce particles of dust (notably soot) and these act as hygroscopic nuclei which encourages rain production. Because of the warmer temperature there is less snow in the city than surrounding areas.

WINDS

Wind speeds are often lower in cities than the countryside because the buildings actas barriers (wind breaks). On the other hand, long streets with tall buildings can act as wind tunnels – winds funneled down the street – and can be gusty as winds are channeled round buildings (eddying).

HUMIDITY

Cities usually have a lower relative humidity than the surrounding air because cities are hotter, and rainwater in cities is unable to be absorbed into the ground to be released into the air by evaporation, and transpiration does not occur because cities have little vegetation. Surface runoff is usually taken up directly into the subterranean sewage water system and thus vanishes from the surface immediately.Better understanding of urban temperature and water vapor contributions and/ or loss will reveal the reasons for lower relative humidity within cities, especially since relative humidity is dependent on temperature changes.

CONCLUSION

Climate change is the greatest threat to global health in the 21st century. Health professionals have a duty of care to current and future generations. You are on the front line in protecting people from climate impacts - from more heat-waves and other extreme weather events; from outbreaks of infectious diseases such as malaria, dengue and cholera;from the effects of malnutrition; as well as treating people that are affected by cancer, respiratory, cardiovascular and other non-communicable diseases caused by environmentalpollution

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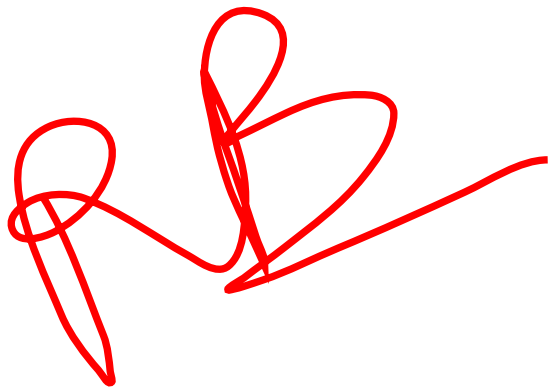

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Introduction

Environmental pollution is one of the main threats for our planet. Environmental Pollution is any discharge of material or energy into water, land, or air that causes or may cause acute or chronic detriment to the earth's ecological balance or that lower the quality of life. In simple words, Environmental Pollution is a process of contaminating the environment in a way that it becomes unsafe to use. A substance, which causes pollution, is known as pollutant. Pollutants can be solid, liquid or gaseous substances present in greater concentration than in natural abundance and are produced due to human activities or due to natural happenings. The industrialization of our society, the introduction of motorized vehicles, rapid urbanization and explosion of the human population, harnessing of the natural resources as well as unplanned sewage and waste disposal from industries and cities has been causing a tremendous increase in waste byproducts. Thus, environmental pollution usually occurs as a result of energy conversions and the use of resources which leaves their by-products behind in water, soil or air.

> U.S. President's Science Advisory Committee,1966 has defined environmental pollution as , "*the unfavourable alterations of our surroundings wholly or largely as a byproduct of man's action through direct or indirect effects of change in energy pattern, radiation levels, chemical and physical constitution and abundance of the organisms"*

Pollution is thus, direct or indirect change in any component of the environment which is harmful to the living organisms and in particular undesirable for man.

Pollutants

Any substance present in the environment in such concentration which adversely effects the environment by damaging the growth rate of a species and by interfering with the food chains, and affects the health, comfort and property etc. is considered as a pollutant**.** According to the Indian Environment (Protection) Act, 1986, "A pollutant has been defined as any solid, liquid or gaseous substance present in such concentration as may be or tend to be injurious to the environment". Smoke from industries and automobiles, domestic and commercial sewage, radioactive substances from nuclear plants and discarded household articles come under the category of pollutants.

Classification of Pollutants

1) Depending upon their existence in nature pollutants are of two types, namely:

    a) **Quantitative pollutants** – These are those substances normally occurring in the environment, who acquire the status of a pollutant when their concentration gets increased due to the unmindful activities of man.

    b) **Qualitative pollutants** – These are those substances which do not normally occur in nature but are added by man like insecticides. Depending upon the form in which they persist after being released into the environment, the pollutants are categorized into two types, namely :
        i) *Primary Pollutants* – These are those which are emitted directly from the source and persist in the form in which they were added to the environment. Like ash, smoke, fumes, nitric oxide, sulphur dioxide, hydrocarbons etc.
        ii) *Secondary Pollutants* – These are those which are formed from the primary pollutants by chemical interaction with some constituent present in the atmosphere. Examples are: sulphur trioxide, nitrogen dioxide, aldehydes, ketones, ozone etc. Primary pollutants like nitrogen oxides and hydrocarbons react in the presence of sunlight to form peroxyacyl nitrate and ozone, two secondary pollutants.

2) In terms of ecosystem i.e. according to their natural disposal, the pollutants can be classified into two basic groups:

    a) **Bio-degradable Pollutants:** These are the pollutants that are quickly degraded either by natural means like biological/microbial action or by some engineered systems. The degradable pollutants can be further sub-divided into two categories:

        i) *Rapidly degradable or non-persistent pollutant:* The degradation of these pollutants is very fast process. For example, the decomposition of sewage and wastes of animals and plants is a faster process.
        ii) *Slowly degradable or persistent pollutant:* The degradation of these pollutants is a very slower process. It seems as if the amount of pollutant remains unchanged with time. For example, degradation of synthetic compounds and radio-active elements like Iodine 137, Plutonium 239 takes a longer period of time.

    b) **Non-degradable Pollutants:** These are the substances that either do not degrade or degrade very slowly in the natural environment. These include mercury salts, long chain phenolic chemicals, DDT and Aluminium cans etc. Most of these mutants get accumulated in the environment and also get biologically magnified as these move along

the food chains in an under composed state. These may also react with other compounds in the environment to produce toxins. These can be further subdivided into two more classes:

i) *Waste*: e.g. glass, plastic, phenolic, aluminum cans etc.
ii) *Poisons*: e.g. radio-active substances, pesticides, smog gases, heavy metals.

Types of Pollutions

Depending upon the area or the part of environment affected, pollution may be broadly divided into following types:

- Air pollution
- Water pollution
- Land pollution
- Noise pollution
- Radiation Pollution
- Thermal pollution

Air Pollution

Air pollution is one of the biggest challenges of present humanity. Air pollution means the presence of any abnormal material or property in the air that reduce the usefulness of the air resources. The term pollution may be referred in context with outdoor open atmospheric conditions, localized air condition, and enclosed space conditions. Air pollution occurs due to the presence of undesirable solid, liquid 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 human activities. 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.

Figure 1 Industrial Smoke polluting the air

Sources of Air Pollution

Among the major sources of pollution are power and heat generation, the burning of solid wastes, industrial processes, and, especially, transportation. The common pollutant gases emitted during the domestic burning of coal, kerosene oil, firewood, cow dung cakes, smoke from cigarettes etc. are carbon monoxide (CO), carbon dioxide (CO2), sulphur dioxide (SO2), etc. About 90% of global air pollution is constituted by the following pollutants.

- Carbon Dioxide (CO2)
- Carbon Monoxide (CO)
- Sulphur Dioxide (SO2)
- Oxides of Nitrogen (NO2)
- Hydrocarbons
- Particulate Matter

Effects of Air Pollution

- **Effects on Human Health:** Exposure to air pollution is associated with numerous effects on human health, including pulmonary, cardiac, vascular, and neurological impairments. The health effects vary greatly from person to person. High-risk groups such as the elderly, infants, pregnant women, and sufferers from chronic heart and lung diseases are more susceptible to air pollution. Children are at greater risk because they are generally more active outdoors and their lungs are still developing. Exposure to air pollution can cause both acute and chronic health effects.
- **Effects on plants:** When some gaseous pollutants enter leaf pores they damage the leaves of crop plants. Chronic exposure of the leaves to air pollutants can break down the waxy coating that helps prevent excessive water loss and leads to

damage from diseases, pests, 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.

- **Effects of air pollution on materials:** Every year air pollutants damage materials 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.
- **Effect on climate:** Atmospheric changes induced by pollution contribute to global warming, a phenomenon which is caused due to the increase in concentration of certain gases like carbon dioxide, nitrogen oxides, methane and CFCs. There could be several adverse effects of global warming. With a warmer earth the polar ice caps will melt causing a rise in ocean levels and flooding of coastal areas. In countries like Bangladesh or the Maldives this would be catastrophic. If the sea level rises by 3m., Maldives will disappear completely beneath the waves.

Control measures for air pollution

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 though 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. Providing a greater height to the stacks can help in facilitating the discharge of pollutants as far away from the ground as possible. 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.

Water Pollutions

Water is one of the most important biological components that sustain life. However, nowadays water is highly polluted and is one of the pivotal issues in the world. Water quality refers to the physical, chemical and biological characteristics of water. Thus, in simple words, we can that polluted water is that water which has been abused, defiled in some way, so that it is no longer fit for use. Water pollution can be defined as “the presence of too much of undesirable substances in water which tend to degrade the quality of water’s physical, chemical and biological characteristics, making it unsuitable for beneficial use”.

Figure 2 Water polluted by human waste

Sources of Water Pollution

Water pollution is one of the most serious environmental problems. Water pollution is caused by a variety of human activities such as,

- Domestic sewage discharged into rivers from areas located on its banks.
- Excretory wastes of humans and animals in water bodies.
- Disposal of urban and industrial waste matter into water bodies.
- Industrial wastes effluents from urban areas containing high concentration of oil, heavy metals and detergents.
- Minerals, organic wastes and crop dusting from agricultural fields with phosphate and nitrogen fertilizers that reach lakes, rivers
- Chemical fertilizers, pesticides, insecticides, herbicides and plant remains.
- Industrial waste water containing several chemical pollutants, such as calcium, magnesium, chlorides, supplied, carbonates, nitrates, nitrites, heavy metals and radioactive waste from nuclear reactor.
- Natural sources of pollution of water are soil erosion, leaching of minerals from rocks and decaying of organic matter.

Water pollutants are categorized as point source pollution and non-point source pollution.

1. Point source pollution: When pollutants are discharged from a specific location such as a drain pipe carrying industrial effluents discharged directly into water body it represents point source pollution. In other words, point source pollution is defined as any single identifiable source of pollution from which pollutants are discharged.

2. Non Point source pollution: Those sources which do not have any specific location for discharging pollutants, in the water body are known as non-point sources of water pollution. For example, run off from agricultural fields, grazing lands, construction sites, abandoned mines and pits etc.

Effects of Water Pollution

Water pollution is the second major source of waterborne diseases and health problems after air pollution.

- **Effects on humans**: On consuming polluted water, humans can suffer from diseases like amoebic dysentery, skin cancers, cholera, typhoid fever, damage of nervous system, genetic mutations/ birth defects, hepatitis, malaria. Metals like lead, zinc, arsenic, copper, mercury and cadmium in industrial waste waters adversely affect humans and other animals. Consumption of arsenic polluted water leads to skin lesions, rough skin, dry and thickening of skin and ultimately skin cancer. Pollution of water bodies by mercury causes Minamata disease in humans and dropsy in fishes. Lead causes dyslexia; cadmium poisoning causes Itai – Itai disease etc.

- **Effects on plants and animals:** Water pollution results in lower crop yields, excess growth of algae can kill aquatic life, reduce photosynthesis, disrupts food chain and food web. Oil spills are a major problem in near-coastal waters and can kill or adversely affect fish, other aquatic organisms and birds and mammals. Spills can kill or reduce populations of organisms living in coastal sands and rocks, and may kill the worms and insects that serve as food to birds and other animals.

Control measures for preventing water pollution

- Setting up effluent treatment plans to treat waste.
- Industrial wastes must be treated before discharge.
- Educate Public for preventing water pollution and the consequences of water pollution
- Strict enforcement of Water Pollution Control Act.
- Continuous monitoring of water pollution at different places.
- Developing economical method of water treatment.
- Regular cleaning drives

Figure 3 Cleaning Drive in beaches

Land Pollution

Land pollution is the degradation of the earth's land surface through misuse of the soil by poor agricultural practices, mineral exploitation, industrial waste dumping, and indiscriminate disposal of urban and toxic wastes.

Land pollution is responsible for damage done to natural habitat of animals, deforestation and damage done to natural resources, and the general decaying up of our communities. Polluting the land by harmful chemicals can lead to entry of pollutants into food chain. This is commonly caused by excess use of fertilizers in agriculture, irresponsible disposable of industrial wastes etc.

Sources and Effects of Land Pollution

The major sources of land pollution are highlighted below:

Soil erosion: Soil erosion can be defined as the movement of topsoil from one place to another. Soil erosion removes rich humus topsoil developed over many years through vegetative decay and microbial degradation and thus strips the land of valuable nutrients for crop growth. Strip mining for minerals and coal lays waste thousands of acres of land each year, denuding the earth and subjecting the mined area to widespread erosion problems. The increase in urbanization due to population pressure presents additional soil-erosion problems; sediment loads in nearby streams may increase as much as 500 to 1,000 times. Water logging and salinity makes soil infertile.

Industrial Waste: Large numbers of industrial chemicals, dyes, acids, fertilizer companies, pharmaceutical companies etc. find their way into the soil and are known to create many health hazards including cancer. Toxic compounds affect plant growth and human life also.

Urban Wastes: Because of modem life style and eating habits the urban wastes are becoming very dangerous to the human beings. Urban wastes include both which is a non-degradable material and harmful to the society in long run.

Figure 4 Lack of waste management causing land pollution

Agricultural sources: Agricultural chemicals especially fertilizers and pesticides pollute the soil. Fertilizers in the runoff water from these fields can cause eutrophication in water bodies. Pesticides are highly toxic chemicals which affect humans and other animals adversely causing respiratory problems, cancer and death. Hazardous chemicals enter into food chain from soil disturbing the biochemical process.

Plastic bags: Plastic bags made from low density polyethylene, is virtually indestructible, create colossal environmental hazard like land pollution. The discarded bags block drains and sewage systems.

Control measures for preventing soil pollution

- Soil erosion must be prevented or controlled by proper tree plantation.
- All the wastes from industry, domestic, must be dumped with proper treatment.
- Use of synthetic fertilizers must be avoided instead natural fertilizers must be preferred.
- Educate people regarding consequences of soil pollution and to prevent soil pollution.
- Toxic and non-degradable materials must be totally banned.
- Recycling and reuse of industrial and domestic wastes can minimize soil pollution considerably.

Noise Pollution

Noise pollution has a relatively recent origin and is one of the least discussed problems. Noise is one of the most pervasive pollutants. To be more precise, noise by definition is “sound without value” or “any noise that is unwanted by the recipient”. Noise like other pollutants is a byproduct of industrialization, urbanization and modern civilization. Noise level is measured in terms of decibels (dB). WHO has prescribed optimum noise level as 45 dB by day and 35 dB by night. Anything above 80 dB is hazardous.

Sources of Noise Pollution

All human activities contribute to noise pollution to varying extent. Noise pollution is more intense in the work environment than in the general environment. Sources of noise pollution are many and may be located indoors or outdoors.

Indoor sources include noise produced by household gadgets like radio, television, generators, electric fans, washing machine, vacuum cleaners, air coolers, air conditioners and family conflict. The average background noise in a typical home today is between 40 and 50 decibels. Noise pollution is more in cities due to a higher concentration of population and industries and activities such as transportation.

Outdoor sources of noise pollution include indiscriminate use of loudspeakers, industrial activities, automobiles, rail traffic, aeroplanes and activities such as those at market place, religious, social, and cultural functions, sports and political rallies. During festivals, marriage and many other occasions, use of fire crackers contribute to noise pollution.

Effects of Noise Pollution

The research shows that many illnesses are connected to noise pollution, such as hearing loss, high blood pressure, coronary heart diseases, loss of temper, decrease in work efficiency, sleeplessness, anxiety and speech interference. The effect is variable, depending upon individual susceptibility, duration of exposure, nature of noise, and time distribution of exposure. On the average an individual will experience a threshold shift when exposed to noise levels of 75 to 80 dB for several hours. This shift will last only several hours once the source of noise pollution is removed. A second physiologically important level is the threshold of pain, at which even short-term exposure will cause physical pain (130 to 140 dB). Any noise sustained at this level will cause a permanent threshold shift or permanent partial hearing loss. At the uppermost level of noise (greater than 150 dB), even a single short-term blast may cause traumatic hearing loss and physical damage inside the ear.

Control measures for preventing noise pollution

- Noise is everywhere, it is not as easy to control as other pollutions. Reducing noise pollution by muffling the sounds at the source is one of the best methods in industry and for urban living. Using earplugs where abnormal noise is produce.

- Banning noise polluting vehicles, controlling vibration of machines by proper lubricating machine, plantation of trees on road sides and near building can absorb noise, constructing sound proof rooms, enforcing noise pollution control act and educating people about noise pollution and its consequences.

- Creation of green cover adjacent to municipal roads and in mines is the way to mitigate noise pollution. It has been observed that noise level reduces by 10 decibels per every 10m wide green belt development.

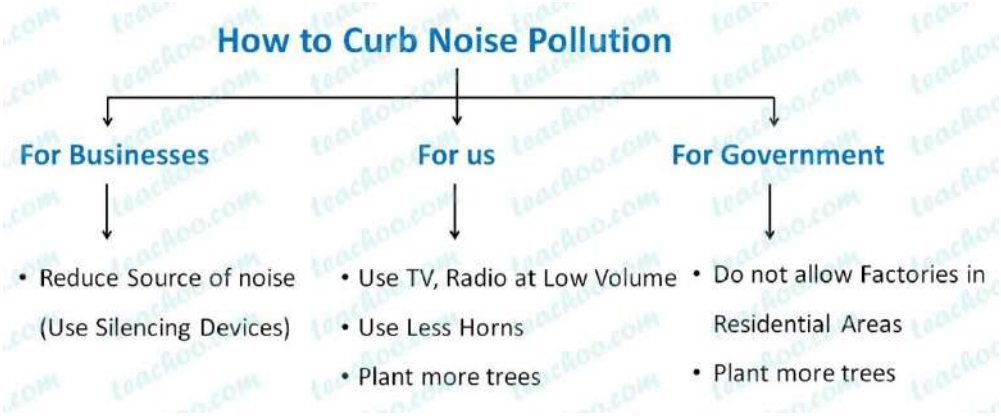

Table 1 Measures to check Noise Pollution

Radiation Pollution

Radiation pollution is one of the serious types of pollution and also neglected one. This is the pollution due to abnormal radiation in the environment. Radiation pollution is any form of ionizing or non-ionizing radiation that results from human activities. The radiations emanating from the decay of radioactive nuclides are major sources of radiation pollution.

Figure 5 Radioactive Nuclear plant emitting gases

Sources of Radiation Pollution

- The most well known radiation results from the detonation of nuclear devices and the controlled release of energy by nuclear-power generating plants, from cell and mobile towers, by use of wireless Internet access modems etc.
- Other sources of radiation include spent-fuel reprocessing plants, byproducts of mining operations, and experimental research laboratories. Increased exposure to medical X-rays and to radiation emissions from microwave ovens and other household appliances, although of considerably less magnitude, all constitute sources of environmental radiation.

Effects of Radiation Pollution

Public concern over the release of radiation into the environment greatly increased following the disclosure of possible harmful effects to the public from nuclear weapons testing, the accident (1979) at the Three Mile Island nuclear-power generating plant near Harrisburg, and the catastrophic 1986 explosion at Chernobyl, A Soviet nuclear power plant. In the late 1980s, revelations of major pollution problems at U.S. nuclear weapons reactors raised apprehensions even higher. The environmental effects of exposure to high-level ionizing radiation have been extensively documented through post-war studies on individuals who were exposed to nuclear radiation in Japan. Some forms of cancer show up immediately.

Control measures for preventing radiation pollution

- Radioactive nuclear wastes cannot be treated by conventional chemical methods and must be stored in heavily shielded containers in areas remote from biological habitats.
- The safest of storage sites currently used are impervious deep caves or abandoned salt mines.
- Most radioactive wastes, however, have half-lives of hundreds to thousands of years, and to date no storage method has been found that is absolutely infallible.

Thermal Pollution

Thermal pollution is the discharge of waste heat via energy dissipation into cooling water and subsequently into nearby waterways. In simple words, this pollution arises due to release of excess heat from thermal power plants, industries involved in metals molding etc. The heat is released into the surrounding air rising the temperature of the locality drastically.

Sources of Thermal Pollution

- The major sources of thermal pollution are fossil-fuel and nuclear electric-power generating facilities and, to a lesser degree, cooling operations associated with industrial manufacturing, such as steel foundries, other primary metal manufacturers, and chemical and petrochemical producers.
- Power plants- thermal and nuclear, chemical and other industries use lot of water for cooling purposes and the used hot water is discharged into rivers, streams or oceans. Discharge of hot water may increase the temperature of the receiving water by 5 to 11 °C above the ambient water temperature.

Effects of Thermal Pollution

The discharge of heated water into a waterway often causes ecological imbalance, sometimes resulting in major fish kills near the discharge source. The increased temperature accelerates chemical-biological processes and decreases the ability of the water to hold dissolved oxygen. Unlike terrestrial ecosystems, the temperature of water bodies remain steady and does not change very much. Accordingly, aquatic organisms are adapted to a uniform steady temperature of environment and any fluctuation in water temperature severely affects aquatic plants and animals. Hence discharge of hot water from power plants adversely affects aquatic organisms. Aquatic plants and animals in the warm tropical water live dangerously close to their upper limit of temperature, particularly during the warm summer months. It requires only a slight deviation from this limit to cause a thermal stress to these organisms. Discharge of hot water in water body affects feeding in fishes, increases their metabolism and affects their growth. Their swimming efficiency declines. Running away from predators or chasing prey becomes difficult. Their resistance to diseases and parasites decreases. Due to thermal pollution biological diversity is reduced. Thus rapid and dramatic changes in biologic communities often occur in the vicinity of heated discharges.

Control measures for preventing thermal pollution

One of the best methods of reducing thermal pollution is to store the hot water in cooling ponds, allow the water to cool before releasing into any receiving water body.

Conclusion

Environmental pollution is a challenge in most developed societies of the world; contemporary societies of developing countries in particular also grapple with the problems of environmental pollution and are seeking ways to tackle it. This contemporary issue has a negative ripple effect on the health and socio-economic well-being. The environmental pollution calls for radical actions for environment protection and rehabilitation. More than that, the problem should be resolved on a global level by the united efforts of the global community. We are biologically predisposed to provide for our offspring and may try to ensure that this provision continues after our death. However, our interactions with other members of society are wide-ranging and many people leave legacies to benefit the wider community. In the last decades substantial improvements have been achieved in the general knowledge of environment-economy interactions from both the scientific/technical and economic viewpoint, including how future generations can be accounted for in decision-making. Considerable work has also been undertaken to analyse the interactions between some social aspects and natural resources depletion, though more investigation is still required in this area. Further investigation is also needed to understand and measure the interactions occurring simultaneously between the three dimensions.

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Tiger Conservation Project in India

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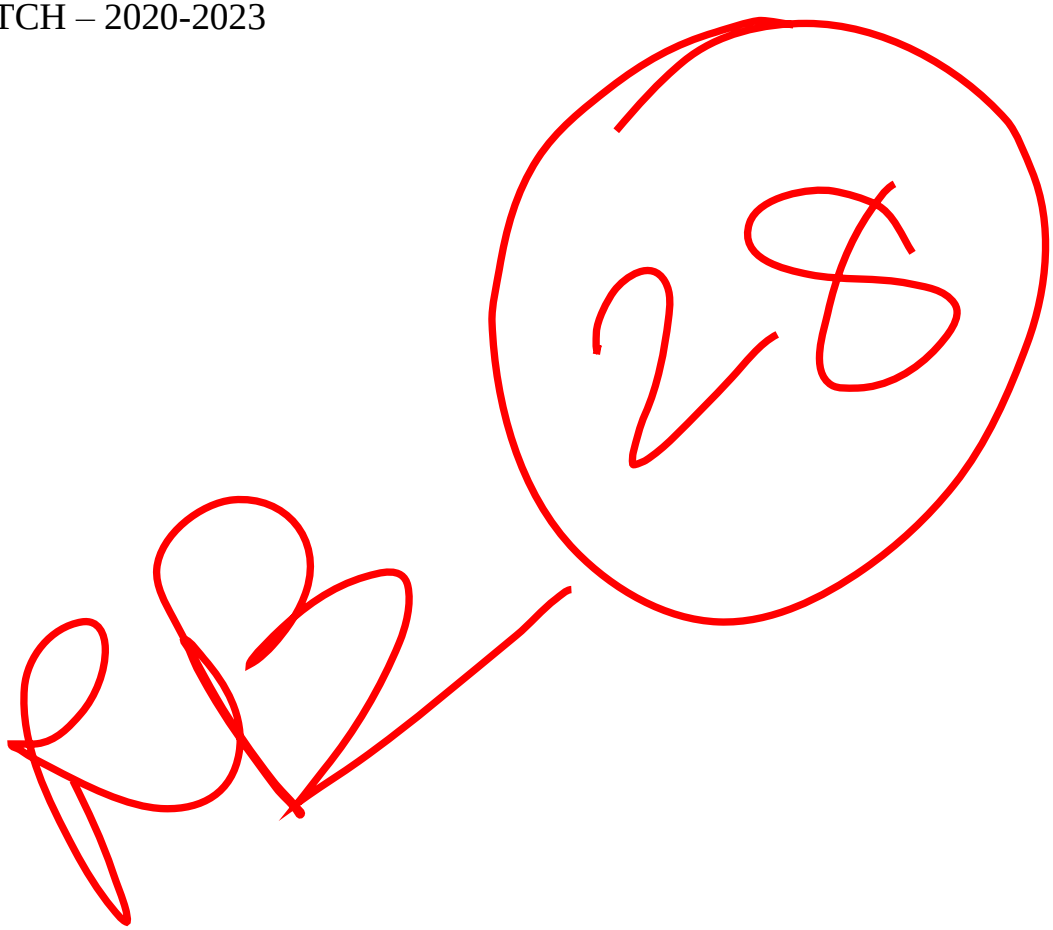

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INTRODUCTION

100 years ago, it was easy to see the tiger in its natural habitat - around 100,000 of them roamed across Asia, including several sub-species that are now extinct. Today the number of tigers in the wild is about 3,000 and if this trend continues, tigers may cease to exist.

A Report on Tiger census ahead of International Tiger Day on July 29 was released by the Environment Minister, Prakash Javadekar and as per the report the country "has 70 percent of world's tiger population". Since the beginning of the 20th century, the tiger population across the world dropped sharply and it is for the first time in conservation history, their numbers are on the rise. The increased number of big cats in India reflects equilibrium in nature as Tiger is an incredible part of it. The awe-inspiring tiger can be seen as one of the most iconic animals on Earth. Let's look at a detailed analysis of Tiger conservation efforts of the world in general and India in particular in this context.

TIGER CONSERVATION PROJECT IN INDIA

What is the necessity to conserve Tiger as a species?

Tigers are listed as "Endangered" on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species globally and the Malayan and Sumatran sub-species are listed as "Critically endangered."

The major reasons for the decline of tigers are poaching, Loss of natural habitat and prey depletion, Man-animal conflict, Diseases, Tourist Interference, Pollution and Climate Change.

Tiger plays a pivotal role in the health and diversity of an ecosystem, a unique animal, and a top predator at the apex of the food chain and keeps the population of wild ungulates in check, thereby helping to keep a balance between prey herbivores and the vegetation upon which they feed. Therefore, the presence of tigers in the forest can be treated as an indicator of the well-being of the ecosystem. The extinction of the tiger is an indication that its ecosystem is not sufficiently protected.

Although Tigers had been hunted for at least a thousand years, it was estimated that 100,000 of them living in the wild. As the 20th century drew to a close there was a common fear that only 5,000-7,500 lefts in the world.

Tigers had been given as a prize; their skins as a source of expensive coat till recently and were killed stating that they posed a threat to the human population.

By the early 1970s tiger hunting was banned by most of the countries and trade in tiger skins was also barred.

These efforts were properly awarded as Censuses of tigers in the 1980s showed their numbers to be increasing.

These conservation efforts had been appeared successful and believed that there no longer was a threat of extinction.

But things were not as they expected. Tiger parts like skulls, bones, whiskers, sinews, and blood had long been used by Asian peoples, especially the Chinese, in medicines and potions used to treat rheumatism, rat bites, and various diseases and for various uses like in the restoration of energy and as aphrodisiacs. These body parts were never in short supply until tiger hunting was banned.

In the late 1980s, however, there was serious evidence that tigers were still being killed began to accumulate. New tiger counts revealed that previous counts were having serious flaws and the previous censuses had been inflated by officials who either were in collusion with poachers or were merely eager to impress their superiors.

At the same time, reports of poaching were multiplying, and as the dwindling supplies pushed prices ever higher, the underground trade in tiger parts

Though there were a high number of seizures and destruction of such parts, but little effort was being put forth to stop the smugglers and the potions remained available in Chinese apothecaries in several nations.

Severe pressure was put on governments to impose sanctions on countries that failed to take adequate measures to eliminate the trade in tiger parts.

Conservationists urged Pres. Bill Clinton's administration to take action believing that only the threat of punitive measures by the U.S. would force any real change and in April 1994 USA barred the importation of wildlife products from Taiwan, valued at about $25 million annually. Some governments were attempting to cooperate.

In March India convened the first meeting of the 10-nation Global Tiger Forum in an organized attempt to save the species. In India, where the largest number of tigers lived, as a need of the rapidly growing human population for more territory, both the habitat and food supply of tiger was robbing.

Tiger estimation surveys have been conducting by the Wildlife Institute of India (WII) and the National Tiger Conservation Authority (NTCA), Government of India, in partnership with NGOs like WWF-India.

The number of tigers in 2002 stood at 3,642 based on a census using the pug mark technique.

The comprehensive country-wide tiger estimation exercise in 2010-11 conducted by WII, NTCA in partnership with WWF-India revealed a mean tiger population estimate of 1,706 which revealed the pathetic condition of tiger conservation in India.

There were only 2,226 tigers left in the wild in India as per the 2014 tiger estimation exercise conducted by WII in association with the NTCA using camera traps.

What are the global initiatives for Tiger conservation?

Tiger conservation tries to check the animal from becoming extinct and protecting and preserving its natural habitat.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES has played an important role in improving international efforts for tiger conservation.

CITES (also known as the Washington Convention) is a multilateral treaty to protect endangered plants and animals.

CITES aims to ensure the international trade in specimens of wild animals and plants does not threaten the survival of the species in the wild, and it offers protection in varying degrees to more than 35,000 species of animals and plants.

Tiger has been protected under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1975 which means commercial international trade in tiger is prohibited.

Global Tiger Recovery Program

13 tiger range countries adopted a Global Tiger Recovery Program at the Tiger Summit held in St Petersburg, Russia in November 2010.

The aim is to double the number of wild Tigers by 2022 effectively through actions;

Preserve, manage, enhance and protect habitats of tiger effectively;

Eradicate poaching, smuggling and illegal trade of tigers, their parts and derivatives;

Cooperate in Transboundary landscape management and in combating illegal trade;

Engage with local and indigenous communities;

Increase the effectiveness of Tiger habitat management;

Restore tigers to their former range.

Global Tiger Recovery Plan outlines how each country can contribute to the ambitious goal, called as TX2

Tiger Population in India

Major threats responsible for the declining of Tiger population

The Tigers are seen largely in the tropical forests of Asia. The recent reports generated by different international organizations show the tiger population is decreasing. According to the IUCN Red list, the tiger is listed as an endangered animal. The major threat faced by this species are Poaching, destruction of habitat, insufficient prey, etc. the tigers are killed for skins, bones, and meat.

- The list of major threats to the Tiger Population are.
- Man- animal conflict.
- Hunting, poaching and illegal trade.
- Habitat and loss of prey species.

Due to anthropogenic activities, the tiger population has lost its habitat. The loss of habitat resulted in the reduction of their prey species. They started coming out of the forest and come to the village in search of prey.

Tiger those who came in search of its prey they attacked domestic animals, and human beings. In vengeance, tigers are often killed by angry human beings.

Hunting, illegal trade and poaching.

Hunting of tigers is a huge issue faced by the tiger population from ancient times. Hunting stands as a symbol of status. The people used the bones, teeth of the tiger for commercial purposes which can also be named as illegal trade.

The body parts are used for medicinal purposes also. This has caused the utmost decline in tiger populations since 1930. Poaching is the next threat to the leftover tiger population.

Anthropogenic Activities.

The anthropogenic destructive activities that have caused the devastation of habitat and prey species are the main long-term threats to the continuation of the declining tiger population in the country.

Man, and animals compete for finding their habitat. Tigers need large territories. Along with the habitat, tigers have also experienced a severe loss of prey species populations such as antelopes and deer.

The man has acquired the forest land for human settlements and industrial activities. This has ultimately resulted in complete destruction of animal habitats.

The same affected the climatic condition, harmony, and poses a threat to the existence of human beings. The Ken-Betwa River interlinking project which intends to irrigate the drought-hit Bundelkhand region is also a reason for the declining Tiger population in India. According to the wildlife experts, the Panna Tiger Reserve which is located near this place will have a greater impact due to the project.

Tiger reintroduction.

Landscape conservation, and habitat management

Scrutinizing protocols, strategies for anti-poaching

Resource Mobilization, and

Modern equipment and technology for monitoring.

The anti-poaching strategies are also planned for implementation. The latest censuses show an augment in the number of tigers across the country in different National Parks which is evidence that preservation efforts do have an optimistic impact on the environment and wildlife.

Why a project mode?

The three key imperatives in tiger conservation which necessitate a 'project mode' are: a focused approach to prioritize actions, in the interest of tiger conservation within and outside the tiger reserves, eliciting the support of local stakeholder communities and ensuring the necessary infrastructure for protection and management. Considering the fact that conservation of tiger has ecological national significance transcending State boundaries, the Government of India provides funding support and technical guidance to States through the ongoing Centrally Sponsored Scheme of Project Tiger and other schemes for wildlife conservation. Tigers are present in the forests of seventeen states in our country at present, which also include their protected areas / tiger reserves. The distribution of tigers/density vary in these states due to several ecological and human reasons, viz. the forest cover, terrain, natural prey availability, presence of undisturbed habitat and the quality of managerial efforts taken towards protection. Despite three decades of project tiger and the efforts of the Centre and the States, tiger continues to remain one of the most endangered large predators in the world. The causative factors are many including loss of habitat due to agriculture expansion and development, revenge killings by people due to man animal conflicts and above all, the demand for the body parts and derivatives of tiger in the illegal international market among others. These factors contribute to the decimation of tiger population in the wild. Therefore, continuance of a focused, species specific, multifaceted, ecosystem project like the Project Tiger becomes important and crucial at this juncture to address the threats faced by the tiger and its habitat. Since tigers are at the top of the ecological food-chain, they are also indicators of the well-being of the habitat, and their conservation results in the overall conservation of all other species of plants and animals sharing the ecosystem. A healthy tiger population indicates that other ecological components in its habitat are equally robust, since tigers need large amount of prey and good habitat. The investments made in a project of this kind are more than justified. Tiger conservation results in several intangible yet life–supporting benefits. Some such environmental externalities are highlighted here.

The Intangible gains.

Carbon dioxide absorption (carbon sequestration):

Tons and tons of fuel wood are used by us which release the carbon dioxide back into the atmosphere. Presence of a large quantum of carbon in the atmosphere due to several such emissions at a large scale increases the green-house effect, and hence the absorption of carbon by forest vegetation (facilitated to a large extent by the forest cover conserved in tiger reserves and other protected areas) becomes crucial. Meso climate Presence of continuous forest cover

to a depth of about ten km impacts the climate of the nearby area (almost up to hundred km). This phenomenon is beneficial to both human beings as well as agriculture crops, since they are protected from climatic extremes. Rainfall The evapo-transpiration from trees contribute to marginal increase in rainfall in the area, and becomes an additional advantage wherever the ground water is also sufficient. Water harvesting the forest growth reduces the surface run-off and facilitates water storage as well as loss of top soil due to erosion, which may otherwise lead to reduction of impoundment in storage devices. The layer of decaying organic matter on a forest floor and the root system of the vegetation growing on it facilitate infiltration of water. River flow the forest trees conserved in a tiger reserve and other protected areas regulate the water flow. The presence of trees in a catchment area, absorb the water and release the same gradually. This is beneficial, since on one hand the risk of extreme flooding is reduced, and on the other the flow season is also extended. Thus, a project with such benefits become important both for our life support as well as food security. No singular sustainable livelihood project can deliver such benefits in a "stand alone" manner, since the levels of sustainability are difficult to define, and such levels even when defined always entail compromises, and the net outcome of such trade–offs may not be tiger conservation! The fringe dwellers living around tiger reserves are dependent on forests for their livelihood. Though many of them are not in the food gathering stage, the resource dependency of such people needs to be reckoned for safeguarding the ecological viability of the habitats. The project tiger strategy of "core-buffer" provides scope for eco-development inputs in the impact/buffer zones of tiger reserves. A small investment, based on site specific participatory planning in consultation with the people, complemented by sectoral integration of inputs in the larger surrounding landscape, is important to reduce the resource dependency through livelihood opportunities to such people**.**

Present status of tigers.

As per the findings of All India Tiger Estimation in 2008, using the refined methodology, the total country level population of tiger is 1411 (mid-value), the lower and the upper limits being 1165 and 1657 respectively. The new findings are based on determining spatial occupancy of tigers and sampling such forests using camera traps in a statistical framework. This assessment is not comparable to the earlier total count using pug marks. The new findings indicate a poor status of tiger population in areas outside tiger reserves and some protected areas. The tiger population, by and large, in tiger reserves and in some protected areas of the 17 tiger states are viable, while requiring ongoing conservation efforts. In the recent past, tigers went locally extinct in Sariska and Panna tiger reserves mainly due to poaching.

Reasons for tiger decline

The reasons for tiger decline in areas outside tiger reserves / protected areas are as below:

(i) Degradation of forest status outside Protected Areas / Tiger Reserves owing to:

(a) human pressure. (b) livestock pressure. (c) ecologically unsustainable land uses.

(ii) Fragmentation leading to loss of gene flow from source populations.

(iii) Loss of forest quality in terms of prey biomass.

(iv) Tiger deaths due to man-animal conflict.

(vi) Tiger deaths due to poaching.

(vi) Loss of reproduction owing to disturbance on account of heavily used infrastructure like highways, etc

(vii)Lack of adequate protection outside protected area

(viii)Insurgency / law and order problems

Present approach to tiger conservation.

Owing to habitat fragmentation on account of ecologically unsustainable land uses, biotic pressure and poaching, the following approach is imperative: 9.1 Consolidating / strengthening the source population of tiger and its prey in tiger reserves, protected areas and tiger bearing forests This involves the following active managerial interventions: (i) Protection / anti-poaching operations / intelligence networking (ii) Strengthening of infrastructure within tiger reserves (iii) Creation of inviolate space through relocation (iv) Capacity building of frontline staff / local people and officers (including strengthening of training centres and training in related fields, viz. enforcement, intelligence networking, tourism activities, etc.) 9.2 Managing the "source-sink dynamics" by restoring habitat connectivity This involves the following managerial interventions: (I) Actively providing incentives to local people for the eco-system services / corridor values provided by them by not degrading the forest (payment for eco-system services) (ii) Incentives to local people for taking up plantations and protecting natural root stocks besides preventing free grazing (iii) Encouraging stall feeding of cattle and fostering marketing of dairy products (iv) Providing subsidized gas connection to local people for reducing their dependency on forest towards fuel wood collection 9.3 Mainstreaming tiger / wildlife concerns in the landscape through smart practices with other

Core and Buffer Area

Core Area: The core area has the legal status of a Wildlife Sanctuary or National Park. These areas are free of all forestry operations and human activities.

Buffer Area: These multi-purpose areas consist of forest and non-land and subjected to conservation-oriented land use. Initially the nine tiger reserves under the early days of Project Tiger were:

Bandipur National Park (1973-74) – Karnataka

Jim Corbett National Park (1973-74) – Uttar Pradesh

Kanha National Park (1973-74) – Madhya Pradesh

Manas National Park (1973-74) – Assam

Melghat Wildlife Sanctuary (1973-74) – Maharashtra

Palamau National Park (1973-74) – Bihar

Ranthambore National Park (1973-74) – Rajasthan

Simlipal National Park (1973-74) – West Bengal

Sunderbans National Park (1973-74) – Orissa

Today the number of tiger reserves, which come under the 'Project tiger' of India, has increased to 27. For example:

Periyar National Park (1978-79) – Kerala

Sariska National Park (1978-79) – Rajasthan

Buxa National Park (1982-83) – West Bengal

Indravati National Park (1982-83) – Chattisgarh

Rise In Population of Tiger

Recent years have seen a rise in the population of wild lions and tigers in India. The government has initiated many programs related to the conservation of the Tiger population in the country.

According to the World Wildlife Fund and the Global Tiger Forum, the figure of wild tigers has gone up to 3,890 which earlier was 3200.

The wildlife policy of India embraces conservation and protection through the provision of national parks and sanctuaries. This has assisted their sustainable growth and a drastic declining man-animal conflict. A proactive judiciary has shaped a well-built restriction against poachers.

India is now home to 70% of the total Global Tiger Population. The various strategies that are planned for implementation include:

Reasons for the rise in the population of Tiger

Establishment of various programs and institutions like TraMCA, Project tiger, Project snow leopards, NGT, aiming at the protection of the tiger and its habitat.

TraMCA is a joint initiative of India and Bhutan for transboundary biodiversity preservation established in 2008.

Providing suitable habitat with the availability of prey, water bodies, etc. So that Tiger doesn't come out which results in man-animal conflict.

Limiting the tourists to peripheral areas and not core areas where Tiger mate and small cubs generally are taken care of.

Better trained and efficient Forest administrators and rangers to deal with the issue of hunting and poaching.

People participate in the conservation of tiger and establishments of Vanya Prani Saathi for the same.

Tiger conservation initiatives in India

A vigorous Tiger population shows the strength of the ecosystem and self-sustenance which are the key objectives of Project Tiger under the National Tiger Conservation Authority.

By launching the Project Tiger, the Government of India has taken a revolutionary initiative for conserving its national animal. It was launched in 1973. It is a 100% Centrally Sponsored Scheme of the Ministry of Environment, Forests and Climate Change.

The Project Tiger is administered by The National Tiger Conservation Authority (NTCA). It is a statutory body of the Ministry with an overall supervisory and coordination part, performing capacities as gave in the Wildlife (Protection) Act, 1972.

Benefits of Project Tiger

The Project Tiger has put the tiger on a certain course of revival from the edge of destruction. The population of tigers in the country has been augmented considerably after the establishment of the project. It has contributed to numerous indescribable environmental profits to society. The project has opened a wide door of tourism and thereby employment opportunities. This initiative has brought the participation of local people and their participation has made the habitat to revive.

International Cooperation for Tiger conservation

To control the Transboundary illegal trade in wildlife and conservation, India signed a bilateral understanding with Nepal.

A tiger conservation protocol was signed by India with China

For the conservation of tigers in the Sunderban region, India has signed a protocol with Bangladesh.
With Russia, India has constituted a group on tiger and leopard conservation.

CONCLUSION

"Project tiger"- is one of the most ambitious conservation projects in the world, hardly having any parallel in terms of its scale, magnitude and diversity of field operations and challenges. With a view to ensure protection of tiger and its habitats, many initiatives have been undertaken by the Government since 1960. In 1972, for the first time, the then Prime Minister Smt. Indira Gandhi set up a Task Force under the Chairmanship of Dr. Karan Singh which made various recommendations on the subject. Based on the recommendations of the Task Force, nine tiger reserves were identified to be covered under the Project Tiger, which have now increased to 39 tiger reserves falling in 17 States in the length and breadth of the country. This encompasses almost 32,219.691 sq km of core / critical tiger habitat in the form of forests, meadows, mountains and scrub land. The Project has helped in protection of endangered species. It has a holistic, ecosystem approach. Its core–buffer strategy, protection and development initiatives gave a new perspective to the concept of wildlife management in our country and has been a "role model" for conservation. However, Project Tiger, over the vicissitude of time, is now facing several constraints towards achieving its objective. The 'in-situ' conservation strategy of Project Tiger "Project Tiger" is a focused, in-situ conservation initiative to save the flagship species - the tiger. The core-buffer strategy of Project Tiger has successfully fostered source populations of tiger in designated tiger reserves. The core areas of tiger reserves are important source sites for tiger and the buffers provide scope for the sink populations while addressing the man-tiger interface. The National Legislation [The Wildlife (Protection) Act, 1972] has been amended in 2006 to provide a separate chapter on tiger conservation with enabling provisions for constituting the National Tiger Conservation Authority, the core-buffer areas, preparation of reserve-specific Tiger Conservation Plan and corridors. The recent finding of the all-India tiger estimation, using the refined methodology, has identified the following six tiger occupied landscapes in India:

1. Shivaliks and the Gangetic Plain
2. Central Indian Landscape
3. Eastern Ghats
4. Western Ghats
5. North-East Hills and Brahamputra Plains and
6. Sunderbans

The status of tiger source populations, in the above landscapes, are viable and satisfactory, while requiring ongoing managerial inputs. However, the situation in the context of tiger is poor in other forest areas owing to loss of quality for sustaining a viable natural prey base for tigers.

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TOPIC FOR TUTORIAL: GANGES POLLUTION

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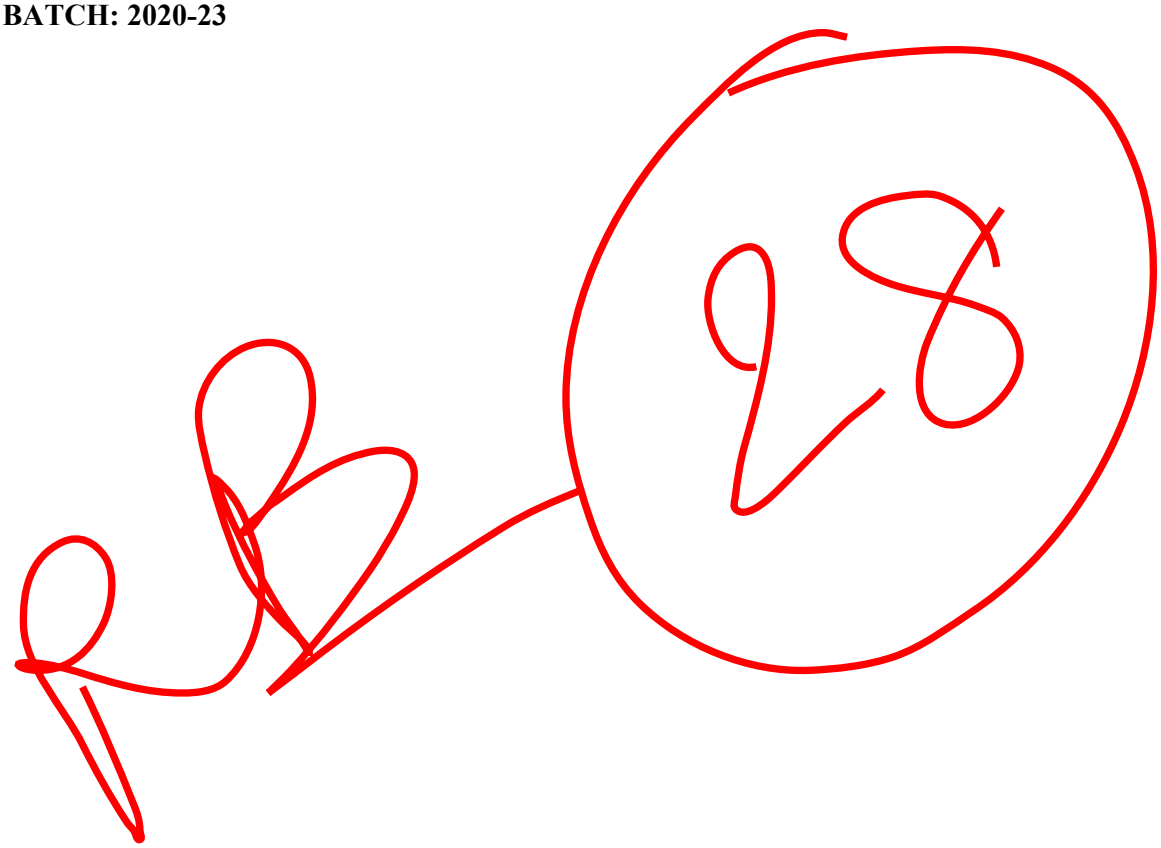

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1. INTRODUCTION

Water pollution has now become a crisis internationally. According to the recent reports of NITI Aayog, most of the major Indian cities, including Delhi will completely run out of groundwater by 2025. The water crisis which is annually faced by the different sectors such as industry, agriculture causes a lot of problems. Pollution **of the Ganges** (or Ganga), the longest and the largest river in India, creates significant threats to human health, the environment, animals and even plants. The river provides water to about 40% of India's population across 11 states, serving an estimated population of 500 million people, which is more than any other river in the world. However, the water is severely polluted with human wastes and industrial contaminants, which also causes many water-diseases.

Today, the Ganges is considered to **be the fifth-most polluted river** in the world but the contamination of the very river is creating many problems. This project deals with reasons behind the pollution of the river Ganga and it examines the effective measures taken by the government. It also suggests changes to expedite the cleaning process of the river.

Untreated water can cause water pollution (nrdc.org).

2. CAUSES BEHIND THE POLLUTION IN IN GANGES

The main causes of water pollution in the Ganga River are the disposal of human sewage and animal waste, increasing population density, and disposal of industrial waste into the river.

- **HUMAN WASTE**

  The Ganga flows through almost 100 cities (such as Kolkata, Kanpur, and Allahabad). Out of the 100, 97 cities have a population between 50,000 and 100,000. There are also 48 towns. Large amount of domestic sewage with higher organic load is released into the water without it being properly treated. The bacteria from the sewage hence keeps multiplying, giving rise to water-based diseases.

.

- **INDUSTRIAL WASTE**

Industrial wastes gets dumped into the Ganges in various cities(thequint.com).

The establishment of a large number of industrial cities on the bank of the Ganga like Kanpur, Prayagraj, Varanasi and Patna, led to the creation of countless tanneries, chemical plants, textile mills etc. the hospitals also prosper and grow along this and contribute to the pollution of the Ganges by dumping untreated waste into it. One coal-based power plant on the banks of the Pandu River, a Ganges tributary near the city of Kanpur, burns 600,000 tons of coal each year and produces 210,000 tons of fly ash. The ash is dumped into ponds from which a slurry is filtered, mixed with domestic wastewater, and then released into the Pandu River. Fly ash contains toxic heavy metals such as lead and copper. The amount of parts per million of copper released in the Pandu before it even reaches the Ganga is a thousand times higher than in uncontaminated water. Industrial effluents are about 12% of the total volume of effluent reaching the Ganges. Although a relatively low proportion, they are a cause for major concern because they are often toxic and non-biodegradable. Plastic and industrial waste, such as waste water from the Factories that sit on the banks of the Ganga, are another cause of pollution. The most worrying problem facing the river is its increasing lack of water. Water for irrigation is being removed faster than the rainy season can replenish it

- **RELIGIOUS TRADITION**

Almost 60 million people bathe in Ganga during the festival season as it is traditionally believed that it would cleanse them of past sins. Materials like food, waste or leaves are left in the Ganga which are also responsible for its pollution. Traditionally, it is believed that being cremated on its banks and floating down the Ganga will cleanse the sins of those who die and carry them directly to salvation. In Varanasi alone, an estimated forty thousand bodies are cremated every year and are deposited into the Ganges

Every year, lakhs of people perform religious festivals in the Ganges River. (medicalxpress.com)

3. EFFECTS OF THE GANGES POLLUTION

- **MARINE LIFE**

The majority of the Ganga pollution is organic waste, sewage trash, food and human and animal remains. Over the past century, city populations along the Ganga have grown at a tremendous rate, however the waste control infrastructure has remained the same**. Recent water samples collected in Varanasi reveals that faecal coli form counts of about 50,000 bacteria per 100 millilitres of water,10,000% higher than the government standard** for safe river. Bathing contamination of groundwater and fish-kill episodes are the major effects of toxic discharges from the industries. Farraka Barrage creation has led to the occupational displacement of people both upstream and downstream. For a long time the fisher people in Bihar have been protesting against the barrage as this has hindered the natural migration of the valuable fishes from the sea especially *Hilsa*, a delicacy.

The results of mercury analysis in various specimens collected along the basin indicated that some fish muscles tended to accumulate high levels of mercury. Of it, approximately 50–84% was organic mercury. A strong positive correlation between mercury levels in muscle with food habit and fish length was found.

The Ganges river dolphin is one of few species of fresh water dolphins in the world. Listed as an endangered species, their population is believed to be less than 2000. Hydroelectric and irrigation dams along the Ganges that prevents the dolphins from travelling up and down river is the main reason for their reducing population. The Ganges softshell turtle (*Nilssonia gangetica*) is found in the Ganges, Indus, and Mahanadi river systems of Pakistan, northern India, Bangladesh, and southern Nepal. This turtle inhabits deep rivers, streams, large canals, lakes and ponds, with a bed of mud or sand. According to the International Union for Conservation of Nature, freshwater turtle species are

vulnerable. Due to their long lifespan and high trophic level in the aquatic food web, turtles are vulnerable to heavy metals pollution, a major kind of pollution in the Ganges.

Ganges River Dolphins (sci-news.com)

- **WILDLIFE**

The plastic pollution from discarded fishing gear in the Ganges river poses a threat to the wildlife such as the critically endangered three – striped roofed turtle and also the Ganges river dolphin, according to the international team from the wildlife institute of India.

Some of the dams being constructed along the Ganges basin will submerge substantial areas of nearby forest. For example, the Kotli-Bhel dam at Devprayag will submerge 1200 hectares of forest, wiping out the forest area.

The Kotli-Bhel Dam will submerge 1200 hectares of forest, wiping out the forest area. (timesofindia.indiatimes.com)

4. POLICIES BY GOVERNMENT:

4.1 GANGA MAHASABHA

Apprehensive of the possibility of the British completely damming the flow of Ganga at Bhimgauda in Haridwar, Pandit Madan Mohan Malviya sent up the Ganga Mahasabha in 1905. After a long struggle, British India agreed on 5 November 1914 that the uninterrupted flow of the Ganges is the rudimentary right of Hindu believers. The day is known as a 'Aviral Ganga Samjhauta Divas' (Uninterrupted Ganga flow agreement day) in the history of India and the agreement came into existence on 19 December 1916 which is known as Agreement of 1916. The sanctity of the agreement is not preserved by the state and central governments of India after independence though it is legally valid. More and more river water is diverted for irrigation use converting the river into a polluted sewer.

4.2 GANGES ACTION PLAN

The Ganges Action Plan (GAP) was launched by Rajiv Gandhi, the then Prime Minister of India, on June 1986 with covering 25 Class I towns (6 in Uttar Pradesh, 4 in Bihar and 15 in West Bengal) Rs 862.59 crore were spent. Its main objective was to improve the water quality by the interception, diversion, and treatment of domestic sewage and to prevent toxic and industrial chemical wastes from identified polluting units from entering the river. The other objectives of the GAP are as follows:

- **Control of non-point** from human defecation, cattle wallowing, and the disposal of human remains in the river.
- **Research and development** to conserve the biotic diversity of the river to augment its productivity.
- **Rehabilitation of soft-shelled turtles for pollution abatement.**

The Ganga Action Plan focuses on rehabilitation of soft-shelled turtle(wii.gov.in)

- **Resource recovery options** such as methane production for energy generation and use of aquaculture for revenue generation.
- The ultimate objective of the GAP is to **have an approach of integrated river basin management** considering the various dynamic interactions between abiotic and biotic eco-system.

Notwithstanding some delay in the completion of the first phase of the GAP, it has generated considerable interest and set the scene for evolving a national approach towards replicating this program for the other polluted rivers of the country. The Government of India proposed to extend this model with suitable modifications to the national level through a National River Action Plan (NRAP). The NRAP mainly draws upon the lessons learned and the experience gained from the GAP besides seeking the views of the State Governments and the other concerned Departments/Agencies. Under the NRCP scheme, the CPCB had conducted river basin studies and had identified 19 gross polluted stretches and 14 less polluted stretches along 19 rivers, which include 11 stretches situated along 7 rivers of M.P. It was much more effective as compared to the previously launched programs.

Phase II covered 59 towns in five states; Rs 505.31 Cr were spent. Rivers such as Yamuna, Gomti, Damodar, and Mahananda had separate action plans.

4.3 NATIONAL GANGA RIVER BASIN AUTHORITY(NGRBA)

NGRBA was established by the Central Government of India, on 20 February 2009 under Section 3 of the Environment Protection Act, 1986. It declared the Ganges as the "National River" of India. The chair includes the Prime Minister of India and chief ministers of states through which the Ganges flows. In 2011, the World Bank approved $1 billion in funding for the National Ganges River Basin Authority.

The NGRBA DECLARED THE Ganges as the "National River" of India (servicemanager.in)

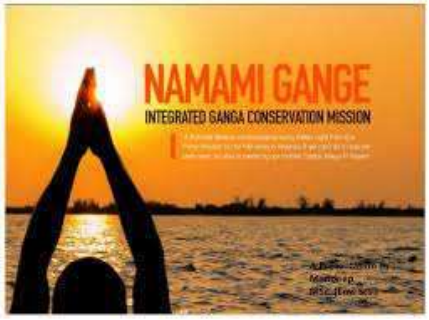
4.4 NAMAMI GANGE PROGRAMME

In the budget tabled in Parliament on 10 July 2014, the then Union Finance Minister Arun Jaitley announced an integrated Ganges development project titled 'Namami Gange' (meaning 'Obeisance to the Ganges river') and allocated ₹2,037 crore for this purpose. The objectives were effective abatement of pollution, conservation, and rejuvenation of the Ganges. Under the project, 8 states are covered. Ministry of Drinking Water Supply and Sanitation proposes to make 1,674 gram panchayats by the Ganges open defecation-free by 2022, at a cost of Rs 1,700 Cr (central share). An estimated Rs 2,958 Crores (US$460 million) have been spent till July 2016 in various efforts in cleaning up of the river.

As a part of the program, government of India ordered the shutdown of 48 industrial units around the Ganges.

The program has a budget outlay of Rs. 20,000 crore for the next five years. This is a significant five-fold increase over the expenditure in the past 30 years (Government of India incurred an overall expenditure of approximately Rs. 4000 crore on this task since 1985). The centre will now take over 100% funding of various activities/ projects under this program. Taking a leaf from the unsatisfactory results of the earlier Ganges Action Plans, the centre now plans to provide for operation and maintenance of the assets for a minimum 10-year period, and adopt a PPP/SPV approach for pollution hotspots.

'Namami Gange' will focus on pollution abatement interventions namely interception, diversion and treatment of waste water flowing through the open drains through bio-remediation / appropriate in-situ treatment / use of innovative technologies / sewage treatment plants (STPs) / effluent treatment plant (ETPs); rehabilitation and augmentation of existing STPs and immediate short term measures for arresting pollution at exit points on river front to prevent inflow of sewage etc.



The Namami Gange Plan (Slideshare.net)

Significantly the approach is underpinned by socio-economic benefits that the program is expected to deliver in terms of job creation, improved livelihoods and health benefits to the vast population that is dependent on the river.

The main pillars of Namami Gange Programme are:

1. Sewerage Treatment Infrastructure
2. River-Front Development
3. River-Surface Cleaning
4. Bio-Diversity
5. Afforestation
6. Public Awareness
7. Industrial Effluent Monitoring
8. Ganga Gram

4.5 CLEAN GANGA FUND

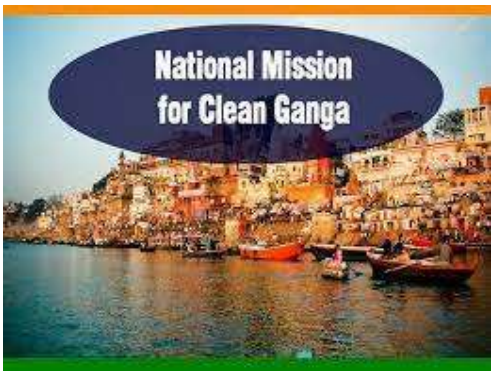
The Union Cabinet gave its approval for setting up of Clean Ganga Fund in September 2014 with the aim of using the collection for various activities under the Namami Gange programme for cleaning the Ganges.

Utilisation of funds:

- Cleaning up of the Ganges
- Setting up of waste treatment plants
- Conservation of biotic diversity of the river
- Development of public amenities
- Activities such as Ghat Redevelopment and Research and Development and innovative projects.

4.6 THE NATIONAL MISSION FOR CLEAN GANGA

The National Mission for Clean Ganga (NMCG) is the implementation wing of National Ganga Council which was set up in October 2016 under the River Ganga (Rejuvenation, Protection and Management) Authorities order 2016. The order dissolved National Ganga River Basin Authority. The aim is to clean the Ganges and its tributaries in a comprehensive manner. **Shri Rattan Lal Kataria** is the present Union Cabinet Minister in Ministry of Jal Shakti.



The NMCG was set up in October 2016.(aninews.in)

5. CONCLUSION

Even though various policies have been implemented by both central government and local government alike, the Ganga is still far from being clean. **The waste treatment facilities and water monitoring stations** prove largely ineffective in improving the quality of water to a safe level for human use. Some of the treatment plants are completely inoperable due to clogged or disconnected pipes unable to be repaired because of the lack of funding and skilled workers. Hence government should give **funding** for the creation of new and effective water treatment plants. **General awareness** should also be spread among people by the government so that they don't dump wastes into the rivers. Campaigns such as these where people work together towards a common goal can help improve the quality of water.

The government should give funding for the creation of new and effective water treatment plants(Pepper+Fuchs.com)

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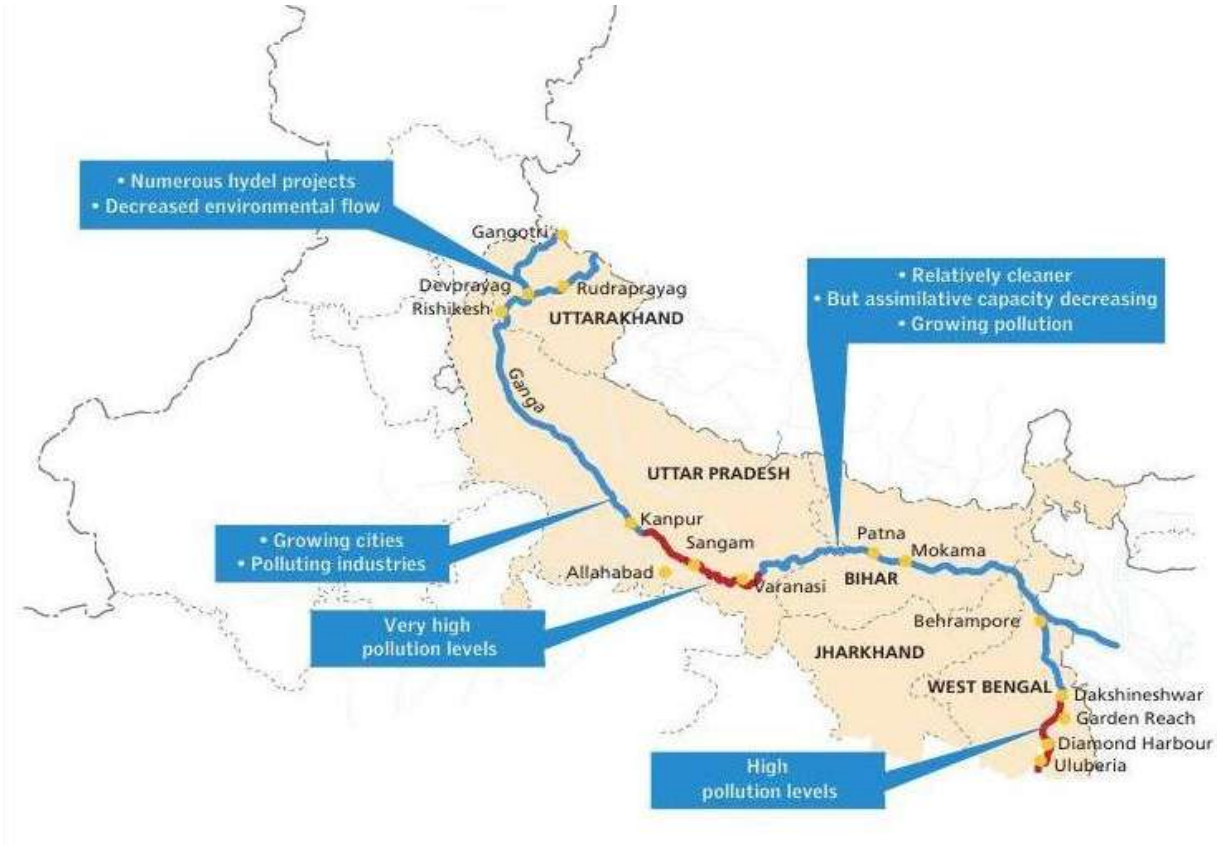
SUBJECT : ENVS

TOPIC : GANGES POLLUTION

Introduction

The **Ganga** is a trans-boundary river of Asia which flows through India and Bangladesh. The 2,525 km river rises in the western Himalayas in the Indian state of Uttarakhand and flows south and east through the Gangetic Plain of North Indiainto Bangladesh, where it empties into the Bay of Bengal. It is the third largest river on Earth by discharge.

The Ganges suffers from extreme pollution levels, caused by the 400 million people who live close to the river. Sewage from many cities along the river's course, industrial waste and religious offerings wrapped in non-degradable plastics add large amounts of pollutants to the river as it flows through densely populated areas. The problem is exacerbated by the fact that many poorer people rely on the river on a daily basis for bathing, washing, and cooking. The World Bank estimates that the health costs of water pollution in India equal three percent of India's GDP. It has also been suggested that eighty percent of all illnesses in India and one-third of deaths can be attributed to water-borne diseases.



Ganga's Route

Causes of Polluted Ganga

- Sewage is the major pollutant. Being a river that is worshipped by people belonging to a larger religious group, every year, countless people dispose of the ashes of their dead ones into the river.
- Large numbers of textile industries, slaughterhouses, hospitals, distilleries, and chemical plants dispose of their untreated waste into the river.
- Cutting off the natural flow of the river, dams are responsible for the pollution of Ganga as well.
- The tremendous amount of fertilisers that are used continuously gets flown into the Ganga along with the rainwater causing hazards to the aquatic organisms.
- Death bodies have been discarded in the recent covid-19 pandemic situation as another reason for Ganges pollution.

The Government of India set up a group known as the **Inter-Ministerial Group** in order to investigate the root of pollution in River Ganga. The report stated that all the resources have indeed been used to set up infrastructure, but the awareness that lies in using this infrastructure remains nil. The report also stated that many cities in India are still lacking the proper infrastructure that can help in building proper sewage systems in the country as well as treat and dispose of the polluted water. This shows that sewage and the water that is being disposed of in the river untreated is the major cause of pollution of River Ganga. More than half of the sewage that is there in the stretch of the river is disposed of in Ganga without being treated first. There is a lack of interconnectedness within the sewage plants as a result of which the treatment of wastewater has remained ineffective ever since.

Effect of Polluted Ganga

- ## Marine life

The results of mercury analysis in various specimens collected along the basin indicated that some fish muscles tended to accumulate high levels of mercury, approximately 50–84% was organic mercury. A strong positive correlation between mercury levels in muscle with food habit and fish length was found.

The Ganga River dolphin is one of few species of freshwater dolphins in the world. Listed as an endangered species, their population is believed to be less than 2000. Hydroelectric and irrigation dams along the Ganges that prevents the dolphins from travelling up and down river is the main reason for their reducing population.[31] The Ganges softshell turtle (*Nilssonia gangetica*), this turtle inhabits deep rivers, streams, large canals, lakes and ponds, with a bed of mud or sand. According to the International Union for Conservation of Nature, freshwater turtle species are vulnerable. Due to their long lifespan and high trophic level in the aquatic food web, turtles are vulnerable to heavy metals pollution, a major kind of pollution in the Ganges.

- ## Wildlife

Some of the dams being constructed along the Ganges basin will submerge substantial areas of nearby forest. For example, the Kotli-Bhel dam at Devprayag will submerge 1200 hectares of forest, wiping out the forest area.

- ## Human beings

An analysis of the Ganges water in 2006 and 2007 showed significant associations between water-borne/enteric disease and the use of the river for bathing, laundry, washing, eating, cleaning utensils, and brushing teeth. Water in the Ganges has been correlated to contracting dysentery, cholera, hepatitis, as well as severe diarrhoea which continues to be one of the leading causes of death of children in India.

Steps To Clean Ganga River

- Promote only decentralised sewage treatment plants at the colony level. Reuse treated wastewater for irrigation and empty into natural drains.
- Develop and restore local storages (ponds, lakes, wetlands) as permanent solutions to both floods and droughts. Only 10 percent of water received during monsoon rainfall is harvested. Restoration of ponds, lakes and wetlands should be an integral part of river restoration and conservation strategy.
- Bring back glory to all natural drains that empty into rivers, and transform and rejuvenate them into healthy water bodies that have been converted to sewage carrying drains by our municipalities and planning bodies.
- Start restoring lower order streams and smaller tributaries in the Ganga Basin. Every river is important. The tributaries that feed the river were overlooked. The Ganga has eight major tributaries (Yamuna, Son, Ramganga, Gomti, Ghagra, Gandak, Kosi and Damodar). The majority of the funds were spent on pollution-abatement measures on the main stem of the Ganga and on the upper Yamuna basin, which constitute just 20 percent of the Ganga basin. Further, these eight major tributaries are joined by smaller rivers, whose restoration is equally important.
- Identify, define and protect ‘river-corridors’ as areas for no cement-concrete structures knowing that rivers have been formed after thousands of years of nature’s work. Infrastructure development and destruction of the river ecosystem through populist measures such as riverfront developments in the name of area and township development projects or urban / smart city development must be stopped to protect and conserve surface water sources.
- Map the entire looped length of each and every tributary of the Ganga and correct the land records. Many of the rivers have been underestimated which causes encroachment and jurisdiction conflicts. The existing methodology to measure river length is flawed and complete mapping of looped lengths is required for proper assessment of water resources and correct revenue maps. This will ensure that active flood plains and river-corridors are free from encroachments.
- The Restored base flows through groundwater recharge. Groundwater contributes significantly to river-flows through base flows (average base flow in the order of 40- 55 per cent) especially during lean seasons in the entire Ganga Basin. The idea of Ganga rejuvenation is also linked to

groundwater rejuvenation. There is a need to have robust planning and regulation of withdrawal and recharge of groundwater across all orders of the river streams to make rivers perennial.

- Evolve new and innovative ways to generate sufficient revenues for operation and maintenance of water and wastewater infrastructure through pricing and valuing water.

Clean up efforts by Government

1. The **Ganga Action Plan** was set in motion by Rajiv Gandhi, the then Prime Minister Of India in 1986. The purpose of the Ganga Action Plan was to improve the quality of the water of River Ganga so that it achieves acceptable standards.

   The objectives of the GAP are as follows:

   - Control of nonpoint from human defecation, cattle wallowing, and the disposal of human remains in the river.
   - Research and development to conserve the biotic diversity of the river to augment its productivity.
   - Development of sewage treatment technology such as Up-flow Anaerobic Sludge Blanket (UASB) and sewage treatment through afforestation.
   - Rehabilitation of soft-shelled turtles for pollution abatement.
   - Resource recovery options such as methane production for energy generation and use of aquaculture for revenue generation.
   - To act as a trendsetter for taking up similar action plans in other grossly polluted stretches in other rivers.
   - The ultimate objective of the GAP is to have an approach of integrated river basin management considering the various dynamic interactions between abiotic and biotic ecosystems.

   The Ganga Action Plan launched by the Government of India has not achieved any success despite expenditure of approximately 2,000 crore rupees. Even though the government claims that the schemes under the Ganga Action Plan have been successful, ground realities tell a different story.

2. The ‘Namami Gange’ programme launched by Prime Minister Narendra Modi, is an Integrated Conservation Mission initiated as a flagship programme by the Union Government with a budget outlay of Rs.20,000 crore in June 2014. The Namami Gange was launched to accomplish the objectives of conservation, rejuvenation and effective reduction of pollution of the National River.

The implementation of Namami Gange is divided into:

- Entry-level activities for immediate impact,
- Medium-term activities that are to be implemented within five years, and
- Long-term activities to be implemented within ten years.

The area of activities undertaken under this programme is based on the pillars of the Namami Gange Programme. The main pillars of this programme are:

- Creating Sewage Treatment Capacity : Around 63 sewerage management projects are established, and 12 new sewerage management projects are under implementation in Uttar Pradesh, Uttarakhand, Jharkhand, Bihar and West Bengal.
- River Surface Cleaning : River Surface cleaning at 11 locations for the collection and disposal of floating solid waste from the river’s surface and Ghats are undertaken under this programme.
- Creating River-Front Development : There is an initiation of 33 entry-level projects and 28 river-front development projects for modernisation, construction and renovation of 118 crematoria and 182 ghats.
- Afforestation : There is an initiation of the forestry interventions for Ganga through Wildlife Institute of India, Central Inland Fisheries Research Institute and Centre for Environment Education for five years (2016-2021).
- Biodiversity Conservation : Many Biodiversity conservation projects such as the Fish and Fishery Conservation in Ganga River, Biodiversity Conservation and Ganga Rejuvenation, Ganges River Dolphin Conservation Education Programme is initiated. There is an establishment of 5 Biodiversity centres at Allahabad, Dehradun,

Varanasi, Narora and Barrackpore to restore identified priority species.

- Industrial Effluent Monitoring : Under this programme, regulation through inspections of the Grossly Polluting Industries (GPIs) is carried out for compliance verification against specified environmental norms. They are also inspected annually for compliance verification of the process modification and pollution norms through third party technical institutes. Action has been taken, and closure directions are issued against 110 non-complying GPIs under the Environment (Protection) Act.
- Public Awareness : For community participation and public outreach, numerous activities such as workshops, events, conferences and seminars were organised. Many awareness activities through campaigns, rallies, exhibitions, cleanliness drives, plantation drives, competitions were organised. For broad publicity, the mass medium such as Radio, TV and print media published advertisements, advertorials, and featured articles.
- Ganga Gram : The Ministry of Drinking Water and Sanitation identified 1,674 Gram Panchayats situated on the banks of the River Ganga in 5 States to construct toilets. A consortium of 7 IITs is engaged to prepare the Ganga River basin Plan, and 13 IITs adopted 65 villages for developing them as model villages.

Conclusion

A study conducted by seven IITs of the country has served as a basis for an ideology that continues to linger in the minds of people from all over the country. This ideology states that the river Ganga is perhaps a holy river and hence cannot be affected with or suffer any kind of pollution. We need to find the very important difference between the words ‘dirty’ and ‘polluted’ which stems from their very intense as well as extreme cultural beliefs. Because of this particular ideology which most people seem to carry in the country, these same people also tend to believe that the River Ganga possesses self-cleaning properties. Ideologies such as these which are found in the people belonging to a larger religious community have perpetuated the lack of knowledge about how polluted the river has become. When the Government of India tries to carry out any action with regards to the reduction of pollution in the river, the people turn inconsiderate about it. We have to go hand in hand with the government in order

to clean Ganga. Time to time the Government should also need to check that the programmes and schemes are working well. We can make it clean again by our efforts.

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বায়ুদূষণ

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সূচীপত্র

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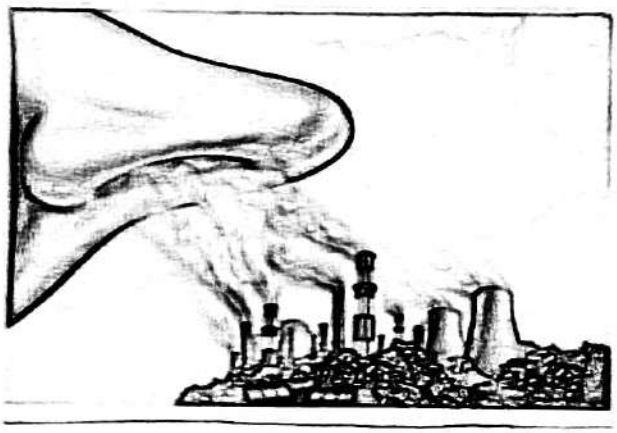

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সূচনা:

—আকাশ, বাতাস, জল, উদ্ভিদজগৎ, প্রাণীজগৎ সবকিছু নিয়ে আমাদের পরিবেশ, মানুষ তার বিদ্যা বুদ্ধি দিয়ে এত অনলস পরিশ্রমে তার চারপাশের পরিবেশকে আরও সুন্দর করে সাজিয়েছে। প্রাকৃতিক পরিবেশ থেকে যেমি মানি মানিসন্য- খাদ্য বস্ত্র- মানুষ -উসর মরুভূমির বুকেও ফুটিয়েছে সোনালি ফসল। কিন্তু অতীতের তুলনায় বর্তমানে তার স্বার্থান্বেষী- কিন্তু মানুষের লোভে প্রাকৃতিক পরিবেশ আজ নানা ভাবে দূষিত হচ্ছে। মানুষের দৈনন্দিন কর্মকাণ্ডে অতিরিক্ত আবর্জনা ও তা নিষ্কাশনের কারণে স্বাভাবিক পরিবেশের উপর প্রভাব পড়লে তাকে পরিবেশ দূষণ বলে। পরিবেশ দূষণ নানা ভাবে হচ্ছে। তার মধ্যে- অন্যতম বায়ুদূষণ।

বিশ্বস্বাস্থ্য- সংস্থা (World Health Organisation) এর মতে " পারিপার্শ্বিক বায়ুমন্ডলের মধ্যে কিছু- অবাঞ্ছিত; অনিষ্টকর বস্তু মিশ্রিত হওয়ার ফলে পরিস্থিতির জন্য মানুষ ও তার পরিবেশ ভীষনভাবে ক্ষতিগ্রস্থ হলে, তাকে বায়ুদূষণ বলে। পরিবেশবিজ্ঞানী Fawkins বলেছেন, " ঘরের বাইরের আবহমন্ডলে এমন বা এমনাধিক পরিমানক বস্তু, যেমন - বিষাক্ত ধোঁয়া, দুর্গন্ধযুক্ত গ্যাস, ধুলোবালি, কালির, ধোঁয়াশা অথবা বাতাসের যে পরিমান উপস্থিতে ও সময়কাল মানুষ, জীবজন্তু অথবা উদ্ভিদ জগতের পক্ষে ক্ষতিকর, তাকেই- বায়ুদূষণ বলে।

—উপরের বক্তব্যগুলি বিশ্লেষণ করলে দেখা যায় মানুষের পারিপার্শ্বিক বায়ুমন্ডলে অবাঞ্ছিত ও দূষিত পদার্থের উপস্থিতি কিংবা দূষক গ্যাস অতিক্রম করলে জীবজগৎ ও প্রাণীজগতের ক্ষতি হয়, তাকে পরিবর্তনভাবে বায়ুদূষণ বলে।

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বায়ুদূষণের কারণ

বায়ুদূষণের কারণ অনেক বিভিন্ন বায়ুদূষক পদার্থের উৎসগুলিকে দুটি শ্রেণিতে ভাগ করা যায়। যথা –

(ক) প্রাকৃতিক কারণ
(খ) মনুষ্যসৃষ্ট বা কৃত্রিম কারণ

(ক) প্রাকৃতিক কারণ (Natural Causes) :

1. আগ্নেয়গিরি : আগ্নেয়গিরি থেকে অগ্ন্যুৎপাতের সময় নির্গত লালরঙের ভাই অক্সাইড (SO_2) কার্বন মনোক্সাইড (CO) নরম হাইড্রোজেন সালফাইড (H_2S) গ্যাস বায়ুদূষণ ঘটায়।

2. দাবানল : বজ্রপাত, লাভার প্রবাহ ইত্যাদি কারণে বনভূমিতে আগুন লেগে গেলে দাবানলের সৃষ্টি হয়, তাতে বনভূমি পুড়ে ভোগ্য উৎপন্ন ছাই ও কার্বন-ডাই অক্সাইড (CO_2) গ্যাস বায়ুদূষণ ঘটায়।

3. ঘূর্ণিঝড় : মরু ও মরুপ্রায় অঞ্চলে দিনের বেলা প্রবল উত্তাপে ঘূর্ণিঝড়ের সৃষ্টি হয়। যেমন – সাহারা মরুভূমি অঞ্চলে মরুর ঘূর্ণিঝড়কে সাইমুম বলে, বায়ুদূষণের সহিত সম্পর্ক কারণ।

4. বাষ্পীভবন : সমুদ্র নদী এবং অন্যান্য জলাশয় থেকে বাষ্পীভবন প্রক্রিয়ায় উৎপন্ন প্রচুর পরিমাণে অতিসূক্ষ্ম কণার বাধা ও বায়ুমণ্ডলের উপাদান হয়ে বায়ুকে দূষিত করে।

5. পচন : মৃত উদ্ভিদ ও জীবদেহের মলে সৃষ্ট মিথেন (CH_4) ও হাইড্রোজেন সালফাইড (H_2S) গ্যাস বায়ুতে বায়ুতে মিশে বায়ুদূষণ ঘটায়।

6. অন্যান্য : জলাভূমির পচা মিথেন গ্যাস উদ্ভিদ থেকে বাষ্পমোচন প্রক্রিয়ায় উৎপন্ন কার্বন ডাই অক্সাইড গ্যাস ইত্যাদিও বায়ুদূষণ করে।

(খ) মনুষ্যসৃষ্ট বা কৃত্রিম কারণসমূহ- (Anthropogenic or Artificial causes)

1. কলকারখানা : বিভিন্ন কলকারখানা থেকে নির্গত সালফার ও বিভিন্ন সূক্ষ্ম কণিন পদার্থ, যেমন- তাপ বিদ্যুৎকেন্দ্র থেকে সালফার ডাই অক্সাইড, কার্বন-মনোক্সাইড, নাইট্রোজেন ডাই অক্সাইড প্রভৃতি গ্যাস নির্গত হয়ে বায়ুতে মেশে, রাসায়নিক শিল্পের কারখানাগুলি থেকে নির্গত হয় অ্যামোনিয়া (NH_3) ক্লোরিন, হাইড্রোজেন ক্লোরাইড প্রভৃতি, এগুলো বায়ুতে মিশে দূষণ ঘটায়।

2. তাপবিদ্যুৎ উৎপাদন : কয়লা বিভিন্ন তাপবিদ্যুৎ কেন্দ্রগুলি থেকে বহির্গমনের অক্সাইডসমূহ, সালফারের অক্সাইডসমূহ, কার্বন-ডাই অক্সাইড সহ বিভিন্ন ক্ষতিকারক গ্যাস ছাড়াও প্রচুর পরিমাণে উড়ন্ত ছাই বাতাসে মিশে পরিবেশ দূষণ ঘটায়।

3. পারমাণবিক বিদ্যুৎ উৎপাদন : পরমাণু কারিকেন্দ্র বিস্ফোরণ ঘটলে বায়ুমণ্ডলে বিভিন্ন তেজস্ক্রিয় পদার্থের বিগমন ঘটে, যুক্তরাজ্যের উইন্ডস্কেল, আমেরিকা জাপানের নাগাসাকি ও পরমাণু-কারিকেন্দ্রে দুর্ঘটনাগুলি-কারণে এই কারিকেন্দ্রগুলি থেকে রেডন-222, প্লুটোনিয়াম-90, কার্বন-14 সহ তেজস্ক্রিয় গ্যাস ও পদার্থ নির্গত হয়ে পরিবেশ দূষণ ঘটায়।

4. মোটরগাড়ির ধোঁয়া : বাস, লরি, গাড়ি, স্কুটার, মোপেড, বাইক, ট্রেকেরা প্রভৃতি যান থেকে নির্গত ধোঁয়ায় কার্বন ডাই অক্সাইড কার্বন মনোক্সাইড বিভিন্ন অক্সাইড দহন না হওয়ায় হাইড্রোকার্বন সীসাঘটিত, কার্বন কণা, প্রভৃতি-পাওয়া যায়, এগুলি বায়ুমণ্ডলে অক্সিজেন ভূমিকা কমিয়ে দেয়।

5. কৃষিকাজে সহায়ক শিল্পায়ন : মানুষ বা অন্যান্য কৃষি সম্পর্কিতে চাষাবাদ করার পূর্বে যেন জমিটি কোপে ও গুড়িয়ে জমি প্রস্তুত করা হয়। আবার জমি থেকে ফসল তোলে নেওয়ার পর অবশেষ গুড়িয়ে দেওয়া হয়। এজন্য বাজারে চাহিদা তাই অত্যাধিক, কারণ কম্পা প্রেভৃতি মিশে মাটিতে,

6. জ্বালানি সহায়ক : গৃহস্থালী রান্নার কাজে, হোটেলের রেস্তোরাঁয় রান্নার কাজে ব্যবহার করা হয় কাঠ, কয়লা, কেরোসিন ইত্যাদি, এসব জ্বালানি পোড়ালে কার্বন তাই-অক্সাইড, সাইট্রোজেন অক্সাইড, কার্বন মনোক্সাইড গ্যাস নির্গত হয়। বায়ুদূষণ ঘটায়, শ্বাসযন্ত্রে সমস্যা-সৃষ্টিসহ হও - তৈরীর সময় যে জ্বালানি পোড়ালে হয় তা থেকে কার্বন মনো-ক্সাইড গ্যাস নির্গত হয়,

7. জঞ্জাল সমস্যা : বড়ো বড়ো শহরের জমাট জঞ্জাল পাচে নিয়ে যে দূষিত গ্যাস ছেড় হয় তা থেকে বায়ুদূষণ ঘটে, আবার অনেক সময় জঞ্জাল বা আবর্জনা পুড়িয়ে ফেলার জন্যও গ্যাস নির্গত হয়,

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প্রধান বায়ু দূষক সমূহ :

প্রধান প্রধান বায়ুদূষক সমূহ মাঝারণত- গ্যাস ও ধোঁয়ার সূক্ষ্ম কারণে বায়ুতে অবস্থান করে, এই দূষকগুলি হল -

1. কার্বন মনোঅক্সাইড (Carbon monoxide):

এই গ্যাস বর্ণহীন ও গন্ধহীন, বায়ুতে এই গ্যাসের ৭০ শতাংশই হল প্রাকৃতিক উৎস, বন, জঙ্গল, খনিজ তেল ও প্রাকৃতিক গ্যাসের অন্তর্ভুক্ত নয়, মানবসৃষ্ট ধোঁয়া, ইলেকট্রিক ও বাত-চুল্লি, গ্যাস-উৎপাদন কারখানা তৈল শোধনাগার ইত্যাদি কার্বন মনোঅক্সাইডের মানুষ্য সৃষ্টি- উৎস। এছাড়াও- হাইড্রোকার্বন ও অ্যালডিহাইডের সঙ্গে বিশেষ ক্ষেত্রে- যেমন। অক্সিজেন সরবরাহে বিঘ্ন ঘটায়, এর ফলে মাথা ব্যথা, শিরার ভাঙ্গন গতি বৃদ্ধি, মানসিক প্রতিবন্ধকতা প্রভৃতি এই- গ্যাসের জন্য, আবার শরীরে প্রবেশ করলে হৃদযন্ত্রের অসুস্থতা, রক্তালস্বতা, শ্বাসকষ্ট হওয়া মানুষের মৃত্যু ও ঘটতে পারে।

2. কার্বন-ডাই-অক্সাইড (CO_2) :

এই গ্যাসটি বায়ুমণ্ডলে অতিরিক্ত ভূমিকা পালন করে। জীবাশ্ম জ্বালানির দহন ও অরণ্য ধ্বংস হওয়ার

কারণে বায়ুতে কার্বন ডাই অক্সাইডের পরিমাণ বৃদ্ধি পায়। শ্বাসকষ্ট থেকে শুরু করে কার্ডিয়াক নানা অসুখের কারণ হল এই গ্যাস।

প্রধান বায়ুদূষকগুলি

শ্রেণি	উদাহরণ
1. কার্বনের অক্সাইড	কার্বন মনো অক্সাইড (CO), কার্বন ডাই অক্সাইড (CO_2)
2. সালফারের অক্সাইড	SO_2, SO_3
3. নাইট্রোজেনের অক্সাইড	(NO), (N_2O), (NO_2)
4. উদ্‌বায়ী জৈব যৌগ	CH_4, C_3H_8, C_6H_6, CFCs
5. ভারী ধাতুর সূক্ষ্মকণা	কঠিন কণা; তরলের স্প্রে ইত্যাদি।
6. ফটোকেমিক্যাল অক্সিডেন্ট	O_3, PANs, H_2O_2, অ্যালডিহাইড
7. তেজস্ক্রিয় পদার্থ	রেডন-222, আয়োডিন-131.
8. বিষাক্ত যৌগ	প্লাম্বাম COOH- বিষাক্ত সীসের নামমাত্র উদাহরণ।

ক্ষতিকর প্রভাব

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3. আলমনার-ডাই-অক্সাইড :

এটি একটি বর্ণহীন ও দুর্গন্ধযুক্ত গ্যাস, এই গ্যাসের প্রাকৃতিক উৎস অগ্ন্যুৎপাত ও উষ্ণ প্রস্রবণ। মনুষ্যসৃষ্ট উৎসের মধ্যে তাপবিদ্যুৎ উৎপাদনে ব্যবহার হয়, ধাতব তৈল শোধন, আলু, কিমোনক, অ্যালুমিনিয়াম নিষ্কাশন শিল্প এবং মানমাপন হিসেবে ব্যবহার। আলমনার-ডাই অক্সাইড অম্লবৃষ্টির জন্য দায়ী, অম্লবৃষ্টির জন্য মাটির উৎপাদন হ্রাস, নদী ও পুকুরের জলজ প্রাণীর মৃত্যু ঘটায়, এই গ্যাস পৃথিবীর উষ্ণতা বৃদ্ধি করে, কাপড় উৎপাদনে নাইট্রোজেনের অক্সাইডগুলি ব্যবহৃত হয়, কালি, নাইট্রোলা ইত্যাদির কারণও এই গ্যাসগুলি দায়ী করে।

4. নাইট্রোজেনের অক্সাইডসমূহ :

নাইট্রোজেনের অক্সাইডগুলির মধ্যে বায়ুতে সবচেয়ে বেশি পাওয়া যায় নাইট্রিক অক্সাইড (NO) ও নাইট্রোজেন ডাই অক্সাইড। নাইট্রিক অক্সাইডের নির্মাণ উৎস বায়ুমণ্ডলের বিদ্যুৎ নাইট্রোজেন-ডাই-অক্সাইড নির্মাণ ব্যবহৃত হয়, মানমাপনের জন্য ও কাজে উৎপাদন রোধ করতে হয়। এই দুই প্রকার গ্যাস অম্লবৃষ্টি ও ধোঁয়াশার সৃষ্টি করে। মানুষের দেহে এই গ্যাসের প্রভাবে দেখা যায় গলায় ও ফুসফুসে প্রদাহ, শ্বাসকষ্ট, নাসিকা, চোখ-কানের সংক্রমণ ইত্যাদি ঘটে।

5. অ্যানেস্থেসিয়া :

বায়ুতে ডোজিমেট্রি ব্যবহার করে, যাতে এটি এবং বিভিন্ন জৈব দ্রবী দ্রবীভূত, যেমন - এসিটোনিট্রাইল; ডাইক্লোরোমিথেন; ক্লোরোফর্ম এবং ইথাইল ইথার। অ্যানেস্থেসিয়া প্রয়োগের পূর্বে রোগীর শরীরের ওজন করে নেওয়া হয়। ডোজমাত্রা নির্ভর করে রোগীর বয়স, ওজন, ঔষধের প্রতি সংবেদনশীলতা ও অন্যান্য রোগের উপর।

6. ডায়াগনোসিস :

পীত জ্বরের তীব্র সংক্রমণকারী সংক্রামক রোগ মানুষের মধ্যে ছড়িয়ে পড়ে। এটি মানবদেহের লিভার, কিডনি, হৃৎপিণ্ড ও অন্যান্য অঙ্গের ক্ষতি করে। ডায়াগনোসিস করা হয়, দীর্ঘস্থায়ী প্রতিরোধের ও অসুস্থতার রক্তক্ষরণ ঘটানোর জন্য।

7. ক্লোরিন :

এটি একটি বিষাক্ত গ্যাস। ক্লোরিন গ্যাসের ঔষধগুলি হল ফ্লোরিনের নিশ্বাস, তেল, পারক্লোরেটের ব্যবহার ও বজ্র বিশ্লেষণকারী ব্যবহার। শ্বাসনালীতে প্রদাহ প্রয়োগে ইত্যাদি ক্লোরিনের জন্য এই গ্যাস।

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বায়ুদূষণের প্রভাব :

সাধারণভাবে বায়ুদূষণের জন্য - চোখের জ্বালা-পোড়া করা, চোখ দিয়ে পানি পড়া, চোখের দৃষ্টি ব্যাহত হওয়া, অবাঞ্ছিত উত্তেজনা বোধ করা, শ্বাসকষ্ট হওয়া, অবাঞ্ছিত হওয়া ইত্যাদি কুপ্রভাবসমূহ উল্লেখ করা যায়।

মানুষের শরীরে অন্যতম রোগের সৃষ্টি হয় বায়ুদূষণে। মানুষের প্রায় সব অঙ্গপ্রত্যঙ্গই এই বায়ুদূষণের শিকার। শ্বাসযন্ত্রের সমস্যা, যেমন হাঁপানি, ব্রঙ্কাইটিস, নিউমোনিয়া, ফুসফুসের ক্যান্সার, শ্বাসকষ্ট, ফুসফুসের রক্তক্ষরণ, ইত্যাদি ধরনের রোগের সৃষ্টিকর্তা হল বায়ুদূষণ, এবং শ্রমিক শ্রেণির লোকজন তাদের ফুসফুসে বিষাক্ত পদার্থ জমে বিভিন্ন রোগের সৃষ্টি করে। অন্যদিকে কলকারখানার শ্রমিকদের শরীরে অ্যাসবেস্টস নামক ক্ষুদ্র পদার্থ প্রবেশ করে অ্যাসবেস্টোসিস রোগের সৃষ্টি করে, ফুসফুসের ক্যান্সার, মেসোথেলিওমা রোগের সৃষ্টি করে।

ধোঁয়া ছাড়া

ভাতের প্রভাব

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বিভিন্ন বস্তুর উপর বায়ুদূষণের ক্ষতিকর প্রভাব :

বস্তু	প্রভাব	প্রধান বায়ুদূষক
1. পাথর ও কংক্রিট	ক্ষয়ে যেয়ে যাওয়া, বিবর্ণ হওয়া, মসৃণতা হওয়া	SO_2, H_2SO_4, HNO_3 ও ধূলিকণা
2. ধাতু	ক্ষয়, অনুজ্জ্বল হওয়া, শক্তির হ্রাস	ক্লোরাইড আয়ন অক্সাইড, সালফিউরিক অ্যাসিড, অতিসূক্ষ্ম ধূলিকণা।
3. সিরামিক ও কাচ	ক্ষয়ে যেয়ে ক্ষয়	হাইড্রোজেন ফ্লুরাইড, অতিসূক্ষ্ম ধূলিকণা.
4. রং	ক্ষয়ে যেয়ে ক্ষয়, বিবর্ণ হওয়া, মসৃণতা হওয়া	ক্লোরাইড, ওজোন, সালফার ডাই অক্সাইড
5. কাপড়	পলকা হওয়া, বিবর্ণ হওয়া	সালফার ডাই-অক্সাইড
6. রবার	ফেটে - যাওয়া, শক্তির হ্রাস	ওজোন

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CU Reg Number - 223-1211-00944.20

বায়ুদূষণ নিয়ন্ত্রণ :

বায়ুদূষণ নিয়ন্ত্রণের বিভিন্ন পদ্ধতি বর্ণনা করে বায়ুদূষণ কমানোর উপায় বলুন। বায়ুদূষণ কমানোর কয়েকটি উপায় হল -

1. কম দূষণযুক্ত জ্বালানির ব্যবহার :

কয়লার জায়গায় বেশি আমদানি তা পরিবেশকে দূষিত করে। কয়লার পরিবর্তে প্রাকৃতিক গ্যাস, বিদ্যুৎশক্তি ইত্যাদির ব্যবহার করলে দূষণের মাত্রা অনেক কমবে। কয়লাকে জ্বালানি করে তবেই কম জ্বালানি কয়লা এবং সাধারণ পেট্রোলের পরিবর্তে মিশ্রজৈবি পেট্রোলের ব্যবহার করলেও বায়ুদূষণ সম্ভব।

2. উন্নত প্রযুক্তির ব্যবহার :

বিভিন্ন শিল্পে উন্নত প্রযুক্তির ব্যবহার ও কারখানার ক্ষেত্রে পরিবেশের পরিবর্তে প্রাকৃতিক গ্যাস থেকে বিভিন্ন কারখানায় কলকারখানার কাজে প্রচুর পরিমাণ প্রাকৃতিক গ্যাসের ব্যবহার করে বায়ুদূষণ অনেকটা কমানো সম্ভব।

3. ছাদ লাগানো :

বায়ুদূষণ রোধ করার জন্য আর একটি গাছে পাতা থাকে এমন প্রজাতির গাছ ছাদের উপরে প্রচুর কলকারখানা চারপাশে বলয়ের আকারে রোপণ করা প্রয়োজন।

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৭. চুম্বক ব্যবহার করে যন্ত্রপাতির দৃষ্টান্ত :

নিম্নলিখিত যন্ত্রপাতি চুম্বকের ব্যবহার করে — উহা থেকে নির্গত হওয়ার পূর্বেই রাসায়নিকবর্জ্য ও পদার্থগুলোর নির্গমনের মাত্রা বা পরিমাণ কমানোর জন্য,

(i) বড়ো কলকব্জা বা যন্ত্রপাতির পদার্থ নিষ্কাশন বা নির্গমন পরীক্ষা করতে তাপবিদ্যুৎ কেন্দ্রের বয়লারে নিরীক্ষার বা ছাঁকনি ব্যবহার করা হয়,

(ii) তাপবিদ্যুৎ কেন্দ্র, রাসায়নিক কারখানা, কলকারখানা, তৈল শোধনাগার প্রভৃতি স্থানে সূক্ষ্ম কণাগুলোকে ধরার জন্য ইলেকট্রোস্ট্যাটিক প্রিসিপিটেটর যন্ত্র ব্যবহার করা হয়,

(iii) সংক্রামক রোগের কারণে দূষিত ঁোঁয়ার কণাগুলোর দূষণ কমাতে ফ্যাব্রিক ও ব্যাগহাউস ধরনের ছাঁকনি ব্যবহার করা হয়,

CU DOU - 002223 - 11-0069
CU Reg - 223 -124- 0044 -20

তথ্যসূত্র :

- পরিবেশ বিদ্যা – ERDRC
  রীতা পাবলিকেশন, 25B, বেনিয়াটোলা লেন
  কলকাতা – 700 009.

- Textbook of Environmental Studies for Undergraduate Courses. – Erach Bharucha.

কৃতজ্ঞতাস্বীকার :

আমার মহাবিদ্যালয়ের পরিবেশ চর্চা কেন্দ্র এই পরিবেশ বিষয়ক সমস্ত তথ্য-বিস্তারের ভার নিয়েছে। আমি তাঁদের নিরলস প্রচেষ্টা ও সুচিন্তিত পরামর্শ-এর জন্য কৃতজ্ঞতা জানাই। ধন্যবাদ।

Scottish Church College

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WATER POLLUTION

Contents

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•What is water pollution?
•What are the cause of water pollution?
•Categories of water pollution
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Introduction

Some 80 percent of the world's wastewater is dumped—largely untreated—back into the environment, polluting rivers, lakes, and oceans. This widespread problem of water pollution is jeopardizing our health. Unsafe water kills more people each year than war and all other forms of violence combined. Meanwhile, our drinkable water sources are finite: Less than 1 percent of the earth's freshwater is actually accessible to us. Without action, the challenges will only increase by 2050, when global demand for freshwater is expected to be one-third greater than it is now..

What Is Water Pollution?

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

What Are the Causes of Water Pollution?

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

Categories of Water Pollution

1.Groundwater

Groundwater gets polluted when contaminants—from pesticides and fertilizers to waste leached from landfills and septic systems—make their way into an aquifer, rendering it unsafe for human use.Once polluted, an aquifer may be unusable for decades, or even thousands of years. Groundwater can also spread contamination far from the original polluting source as it seeps into streams, lakes, and oceans.

2.Surface Water:

More than one-third of our lakes are polluted and unfit for swimming, fishing, and drinking. Nutrient pollution, which includes nitrates and phosphates, is the leading type of contamination in these freshwater sources. While plants and animals need these nutrients to grow, they have become a major pollutant due to farm waste and fertilizer runoff.

3.Point Source and Non point source

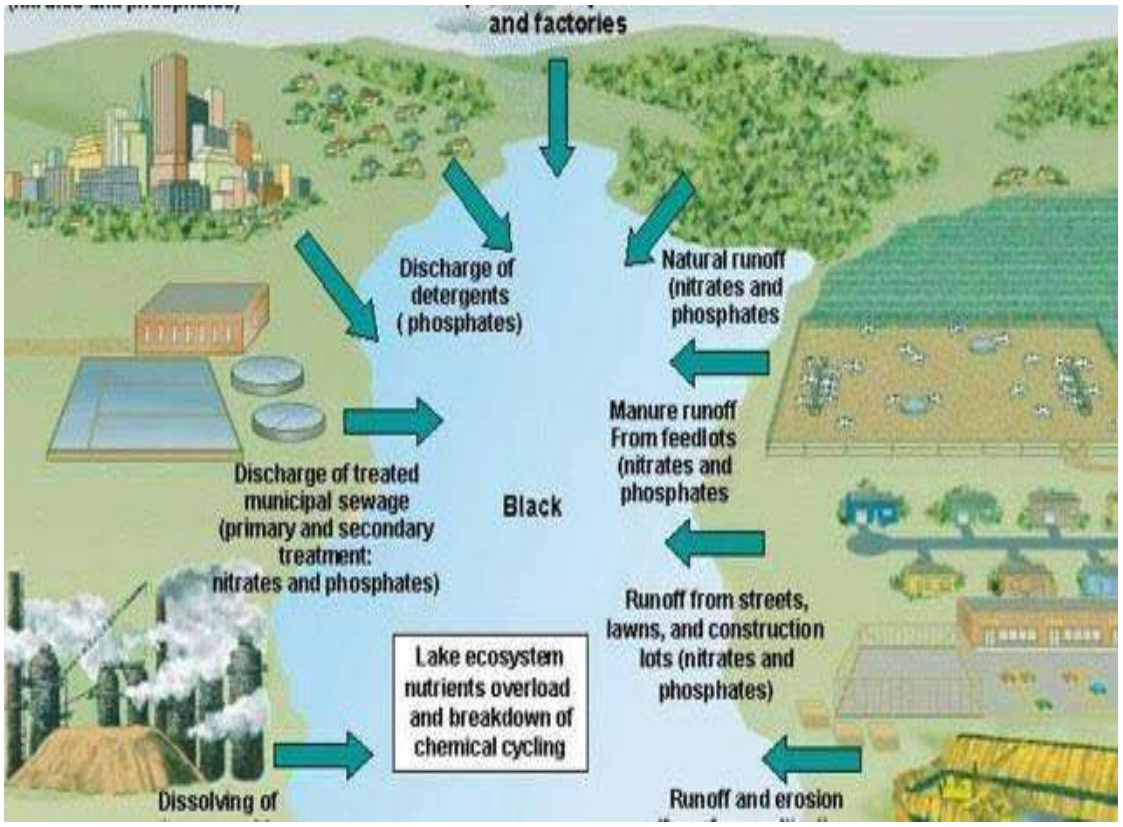
When contamination originates from a single source, it's called point source pollution. Examples include wastewater (also called effluent) discharged legally or illegally by a manufacturer, oil refinery, or wastewater treatment facility, as well as contamination from leaking septic systems, chemical and oil spills, and illegal dumping.

Nonpoint source pollution is contamination derived from diffuse sources. These may include agricultural or stormwater runoff or debris blown into waterways from land.

4.Transboundary

Transboundary pollution is the result of contaminated water from one country spilling into the waters of another. Contamination can result from a disaster—like an oil spill—or the slow, downriver creep of industrial, agricultural, or municipal discharge.

The Most Common Types of Water Contamination



Agricultural

Not only is the agricultural sector the biggest consumer of global freshwater resources, with farming and livestock production using about 70 percent of the earth's surface water supplies, but it's also a serious water polluter. Around the world, agriculture is the leading cause of water degradation. Every time it rains, fertilizers, pesticides, and animal waste from farms and livestock operations wash nutrients and pathogens—such bacteria and viruses—into our waterways. Nutrient pollution, caused by excess nitrogen and phosphorus in water

or air, is the number-one threat to water quality worldwide and can cause algal blooms, a toxic soup of blue-green algae that can be harmful to people and wildlife.

Sewage and wastewater

Used water is wastewater. It comes from our sinks, showers, and toilets (think sewage) and from commercial, industrial, and agricultural activities (think metals, solvents, and toxic sludge). The term also includes stormwater runoff, which occurs when rainfall carries road salts, oil, grease, chemicals, and debris from impermeable surfaces into our waterways.

More than 80 percent of the world's wastewater flows back into the environment without being treated or reused, according to the United Nations; in some least-developed countries, the figure tops 95 percent.

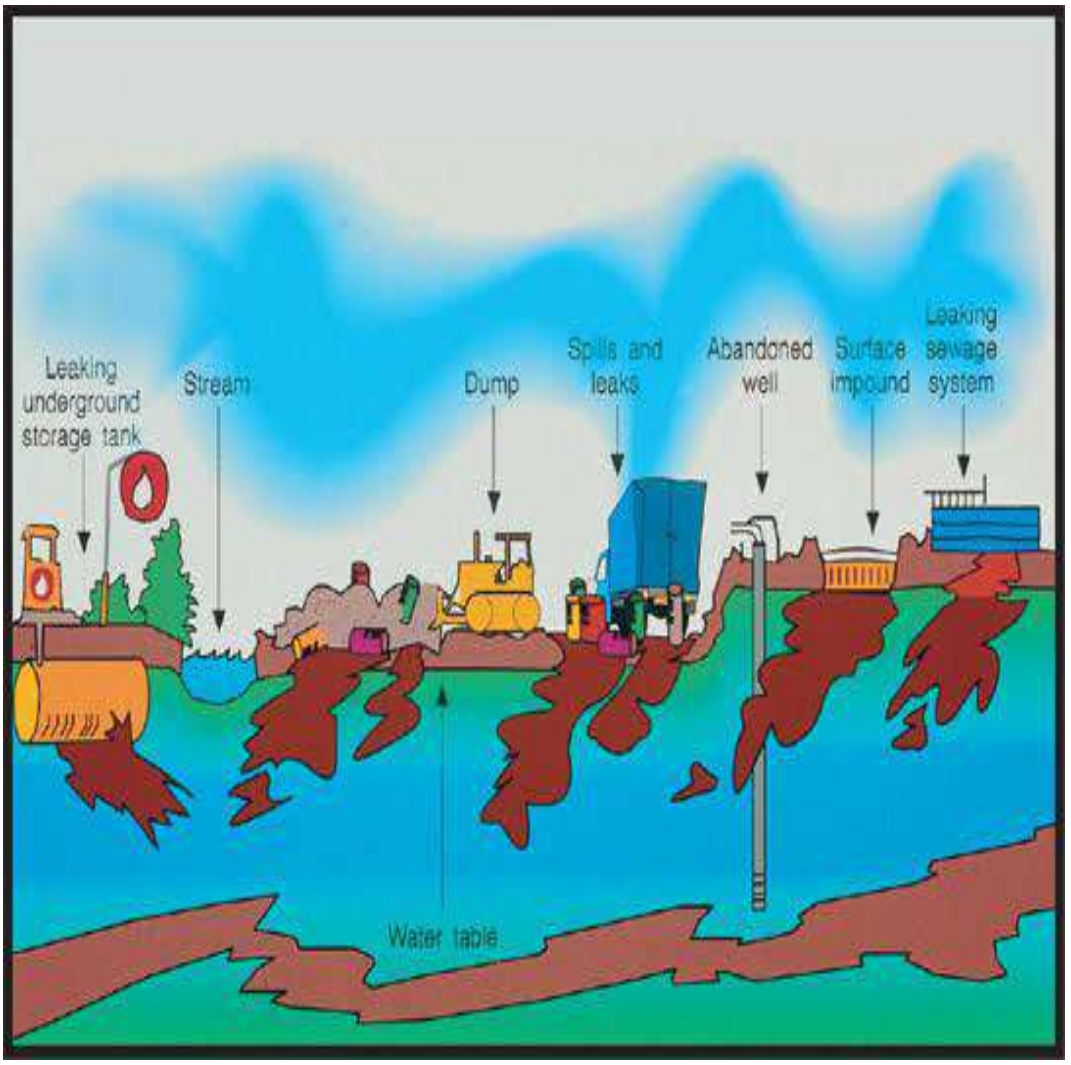
Oil pollution

Big spills may dominate headlines, but consumers account for the vast majority of oil pollution in our seas, including oil and gasoline that drips from millions of cars and trucks every day.
At sea, tanker spills account for about 10 percent of the oil in waters around the world, while regular operations of the shipping industry—through both legal and illegal discharges—contribute about one-third. Oil is also naturally released from under the ocean floor through fractures known as seeps.

Radioactive substances

Radioactive waste is any pollution that emits radiation beyond what is naturally released by the environment. It's generated by uranium mining, nuclear power plants, and the production and testing of military weapons, as well as by universities and hospitals that use radioactive materials for research and medicine. Radioactive waste can persist in the environment for thousands of years, making disposal a major challenge.

Accidentally released or improperly disposed of contaminants threaten groundwater, surface water, and marine resources..



What Are the Effects of Water Pollution?

On Human health

Contaminated water can also make you ill. Every year, unsafe water sickens about 1 billion people. And low-income communities are

disproportionately at risk because their homes are often closest to the most polluting industries. Waterborne pathogens, in the form of disease-causing bacteria and viruses from human and animal waste, are a major cause of illness from contaminated drinking water. Diseases spread by unsafe water include cholera, giardia, and typhoid. Even in wealthy nations, accidental or illegal releases from sewage treatment facilities, as well as runoff from farms and urban areas, contribute harmful pathogens to waterways.

On the environment

Chemicals and heavy metals from industrial and municipal wastewater contaminate waterways as well. These contaminants are toxic to aquatic life—most often reducing an organism's life span and ability to reproduce—and make their way up the food chain as predator eats prey. That's how tuna and other big fish accumulate high quantities of toxins, such as mercury. Marine ecosystems are also threatened by marine debris, which can strangle, suffocate, and starve animals. Much of this solid debris, such as plastic bags and soda cans, gets swept into sewers and storm drains and eventually out to sea, turning our oceans

into trash soup and sometimes consolidating to form floating garbage patches. Discarded fishing gear and other types of debris are responsible for harming more than 200 different species of marine life.

What Can Prevent Water Pollution?

•Reducing plastic consumption and reusing or recycling plastic.

•Properly dispose of chemical cleaners, oils, and non-biodegradable items to keep them from ending up down the drain.

•Maintaining car so it doesn't leak oil, antifreeze, or coolant.

•considering landscaping that reduces runoff and avoid applying pesticides and herbicides.

Conclusion

Earth comprises about 70% of water, where humans and animals consume only 1% of fresh and healthy water for drinking. Humans consume freshwater for daily activities, so we should be serious about protecting it from pollution. Water pollution is a serious environmental problem prevailing in our society. Human-made activities like intensive agriculture, urbanization, deforestation, and industrialization have escalated water bodies' pollution.The disposal of industrial wastes should be meted through the dumping of biologically decomposable wastes and recycling of non-decomposable waste at an industrial and household level.Restrictions on activities such as dumping of feces, washing dirty clothes, and bathing domestic animals is an important step towards water protection. Eutrophication is not a

big issue but cannot be left unattended. Government officials should take appropriate steps and check-ups to prevent and protect water bodies from pollution.

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Air Pollution

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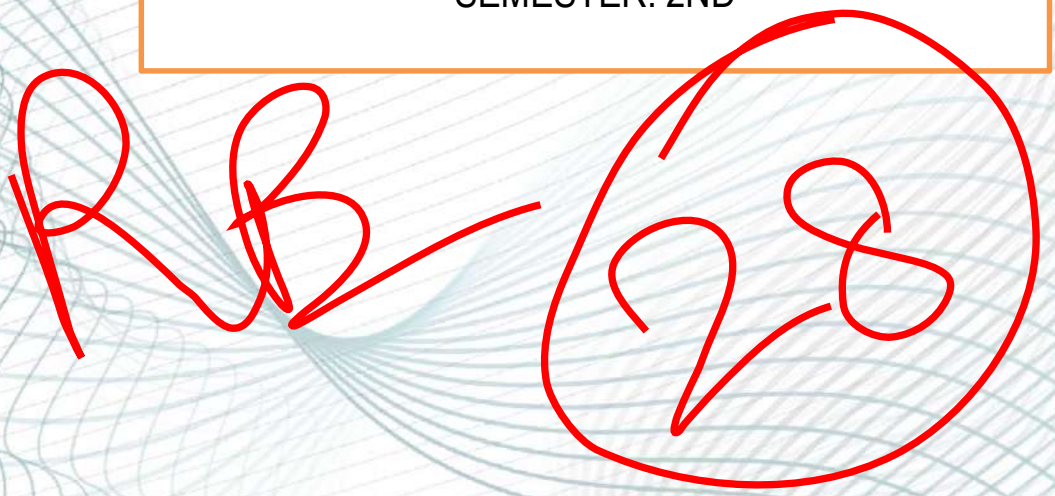

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Air Pollution

Introduction: undesirable solid or gaseous particles in the air bring about air pollution which is harmful to human health and the environment. The air may become polluted by natural causes such as volcanoes which release ash, dust, sulphur and other gases or by forest fires. Occasionally forest fires are caused by lightning. Most forest fires in India occur either due to human carelessness or are created purposely to elicit a fresh flush of grass growth for grazing livestock. However, unlike pollutants created by human activity, naturally occurring pollutants tend to remain in the atmosphere for a short time and do not lead to permanent atmospheric changes.

History of Air Pollution: The origin of air pollution on earth can be traced back to the time when humans started using firewood for cooking and heating. Hippocrates mentioned air pollution in 400 BC. With the discovery and increased use of coal, air pollution became more pronounced, especially in urban areas. It was recognised as a problem 700 years age in London in the form of smoke pollution, which promoted King Edward I to make the first anti-pollution law to restrict people from using coal for domestic heating in the year 1273. In the year 1300, another Act banning the use of coal was passed in England. Defying the law led to imposition of capital punishment. In spite of this, air pollution became a serious problem in London during the Industrial Revolution due to the widespread use of coal in industries. The earliest recorded major disaster was the 'London smog' that occurred in 1952, which resulted in more than 4000 deaths due to the accumulation of air pollutants over the city for five days. Air pollution began to increase in the beginning of the 20th century with the development of transportation systems and the large-scale use of petrol and diesel. Pollution due to auto exhaust remains a serious environmental issue in many developed and developing countries, including India.

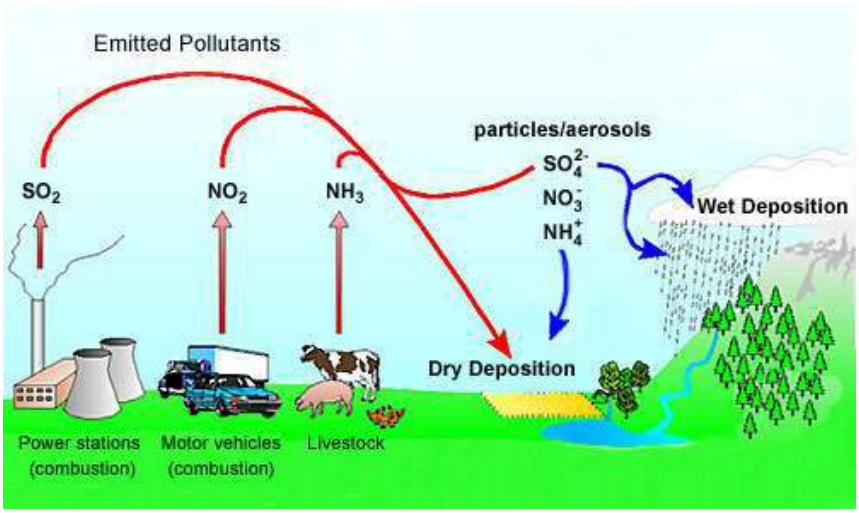
Types of Air Pollution

Outdoor pollution- Pollutants that are emitted directly from identifiable sources are produced both by natural events and by human activities. These are called primary pollutants. There are five primary pollutants (carbon oxides, nitrogen oxides, sulphur oxides, volatile organic compound and suspended particulate matter) that together contributes to about 90% of the global air pollution. Lead is a major air pollutant that remains largely unmonitored and is emitted by vehicles. High lead levels have been reported in the ambient air in metropolitan cities. Leaded petrol is the primary

source of air borne lead emissions in India cities. Unleaded petrol is now used for reducing this pollutant.

Breathing toxic pollutants inside the human body and inhaling pollution as a nose smelling industrial toxins with 3d illustrations elements.

Indoor pollution- pollutants are also found indoors from the infiltration of polluted air from outside and from various chemicals used or produced inside buildings. Both indoor and outdoor air pollution are equally harmful. In India, many homes still use wood or coal for cooking and heating which causes severe respiratory conditions especially in woman and children who spend a lot of time indoors.



Different types of air pollutants

Causes of Air pollution: Air pollution is caused by several human activities. This includes outdoor and indoor pollution. Traffic produces exhausted emissions. All coal and oil fried units lead to air pollution. Industry is a major polluter. Thermal power stations based on coal causes serious levels of air pollution.

Effects of Air Pollution

Effects of Air Pollution on Topography: Normally, as the earth's surface becomes warmed by the sun, the layer of air in contact with ground also gets heated by convection. This warmer air is less dense than the cold air above it, so it rises. Thus, the pollutants produced in the lower layer of air are effectively dispersed. The fog cannot move out of the area due to the surrounding hills. The topographic features resemble a closed chemical reactor in which the pollutants are trapped This condition often continues through the cool night. When the morning sun warms the ground, the air near the ground also gets warm and rises within an hour or two. This may be broken up by strong winds. Such a situation is known as smog (smoke +fog).

The air pollution that causes city smog

Effects of Meteorological Conditions on Air Pollution: Acid deposition has many harmful effects, especially when the pH falls below 5.1 for terrestrial system and below 5.5 for aquatic systems. It causes respiratory diseases such as bronchitis and asthma which may lead to premature death. It also damages statues, buildings, metals and the finish of cars. Acid deposition can damage tree foliage directly, but the most serious effect is the weakening of trees so they become more susceptible to other types of damage. The nitric acid and nitrate salts in acid deposition can lead to excessive soil nitrogen levels. This can oven-stimulate the growth of some plants and intensify the depletion of other important soil nutrients, such as calcium and magnesium, which in turn can reduce tree growth and vigour.

Acid rain and pollution consequences

Effects of Air pollution on Living Organisms: Our respiratory system has a number of mechanisms that help in protecting us from air pollution. The function of the air is so filter out large particles. The upper respiratory tract captures smaller particles. When the upper respiratory system is irritated by pollutants, sneezing and coughing expel the contaminated air and mucus. Prolonged smoking can break down this natural defences, 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 greatest exposure to carbon monoxide. Smoking has been banned in public in India since 2008. Exposure to air containing even 0.001% of carbon monoxide for several hours can causes collapse, coma and reduces the oxygen carrying capacity of blood. This impairs perception and thinking, slows reflexes and causes headache, drowsiness and nausea. Carbon monoxide in heavy traffic causes headache, drowsiness and blurred vision which adds to the risk of road accidents. In large number of carbon monoxide can even cause death.

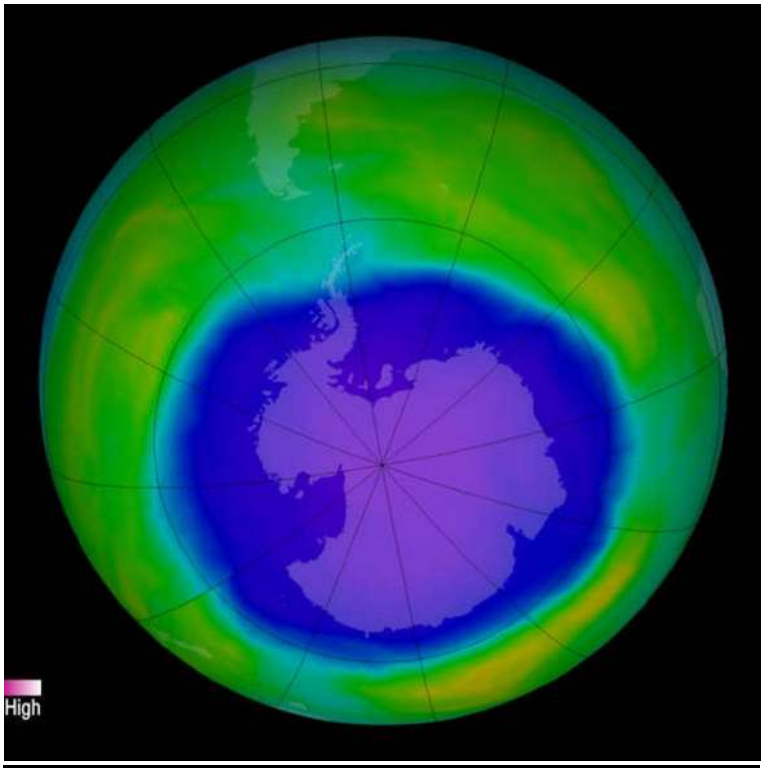
Air pollution impact on human health

Sulphur dioxide, nitrogen dioxides particles in the air aggravate the respiratory tract, leading to bronchitis and asthma. Many volatile organic compounds and toxic can cause mutations in the foetus, reproductive problems or cancer. The repeated inhalation of ozone, a component of photochemical smog, causes coughing, chest pain, breathlessness and irritation of eyes, nose and throat.

Effects of Air Pollution on Materials: Every year, air pollutants cause damage worth billions of rupees. Air pollutants break down the exterior paint on cars and houses. They cause discolouring of irreplaceable monuments, historic buildings, marble statues and other heritage sites and sites of natural beauty.

FIGURE 1: Pollution turning Taj Mahal yellow

Effects of Air Pollution on the stratosphere: The upper stratosphere consists of considerable amounts of ozone, which works as an effective screen for UV light. This region, called the ozone layer. Changes in the ozone layer have serious implications for humans.



Ozone hole created due to CFC

Effects on human health- Sunburn, cataract, ageing of the skin and skin cancer are caused by increased UV radiations as the ozone filter is lost. It weakens the immune system by suppressing the body's resistance to infections such as measles, chickenpox and other viral diseases that elicit rash as well as parasitic diseases introduced the skin

Food production- UV radiation affects the ability of plants to capture light energy during photosynthesis. This reduces the nutrient content and growth potential of plants. This is especially true in the case of legumes and cabbage.

Effect on climate- Atmospheric changes induced by pollution contribute to global warming, a phenomenon caused by the increase in concentration of certain gases such as carbon dioxide, nitrogen oxides, methane and chlorofluorocarbons (CFCs). Observations of the earth have shown beyond doubt that atmospheric constituents such as water vapour, carbon dioxide, methane, nitrogen oxides and CFCs trap heat in the form of infrared (IR) radiation near the earth's surface. This is known as the greenhouse effect. The phenomenon is similar to what happens in a greenhouse. The glass in a greenhouse allows solar radiation to enter, which is absorbed by the objects inside. These objects radiate heat in the form of terrestrial radiation which is trapped in the greenhouse, increasing the temperature inside and ensuring the luxuriant growth of plants. There are several adverse effects of global warming.

With a warmer earth, the polar ice caps are melting, causing a rise in ocean levels and flooding of coastal areas.

In countries like Bangladesh and the Maldives, this would be catastrophic. If the sea level rises by 3 m, the Maldives will disappear completely beneath the waves.

The rise in temperature will bring about a fall in agricultural produce.

Changes in the distribution of solar energy can bring about changes in habitat. A previously productive agriculture area will suffer severe droughts, while torrential rains will fall in locations that were once deserts. This could bring about changes in the species of wild plants, agricultural crops, insects, livestock and microorganisms.

In the polar regions, temperature rise caused by global warming has already shown disastrous effects. A vast quantity of methane is trapped beneath the frozen soil of Alaska. When the permafrost melts, methane is released and accelerates the process of global warming.

Control Measures for Air pollution: Air pollution can be controlled by two fundamental approaches- preventive techniques and effluent control.

One of the effective means of controlling air pollution from industries 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 escape), the use of dry and wet collectors, filters and electrostatic precipitators.

Building higher smoke stacks (chimneys) facilitates the discharge of pollutants as far as away from the ground as possible. Industries should be carefully located in order to minimum the effects of pollution after considering the topography and wind directions. The substitution of raw materials that cause more pollution with those that cause less pollution reduces the level and minimises its effect on human and environmental health.

Conclusion: The objective of SAFAR was to increase awareness among the general public related to the air quality in their city so that mitigation measure and action for improving the air quality and related health issues, could be initiated. The driving forces to realise this objective include educating the public, self-mitigation and development of strategies for public makers. It provides forecasts on the weather, emissions and UV radiation in the region.

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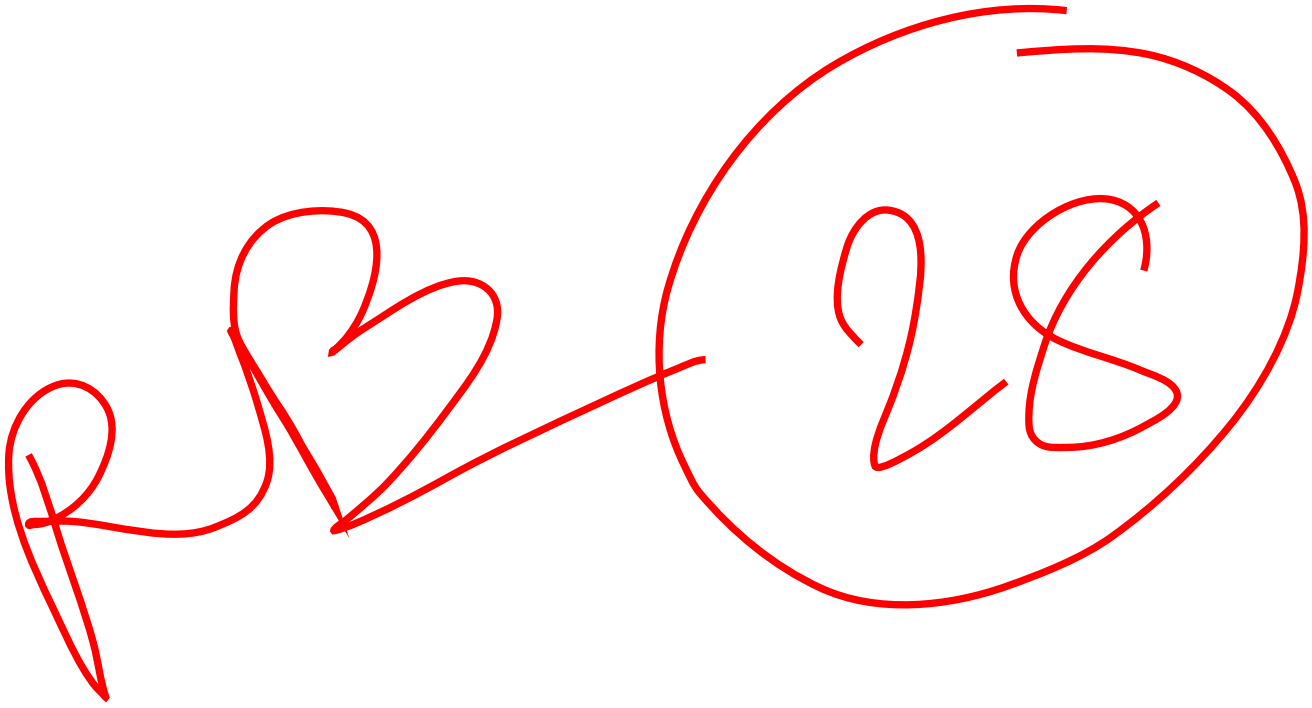

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INTRODUCTION

As the human population is increasing rapidly, demand for food,water,electricity,home,automobile are also increasing creating a huge pressure on nature in turn creating imbalance causing pollution. Pollution is the introduction of contaminants into the natural environment that cause adverse change. In environment there are several types of pollution like air pollution, water pollution, noise pollution etc.

When due to human activities or some natural processes the amount of solid wastes or concentration of gases other than oxygen, increases in the air more than normal percentage of different gases, the air is said to be polluted and this phenomenon is regarded as AIR POLLUTION.

AIR POLLUTION

Air pollution means the presence in the atmosphere, or injection into it ,of substances that are not present naturally or, present naturally but are in much lesser concentration, and that may harm living organisms directly.(Allaby,1955)

SOURCES OF AIR POLLUTION: Various gaseous emission are responsible for air pollution which are injected into the atmosphere from different sources.

1.Emissions from Industrial Chimney- There are many industries which act as the major sources of air pollution. Of those petroleum refinery, cement factory, stone crushers, food processing etc. emit gases through the chimney of the factories. Among those, petroleum refineries are the major sources of SO2 and NO2. Similarly dust releases form cement factories cause health hazard. Smokes of fertilizer and food factories emit various



poisonous gases. Acid vapour is coming from the chemical factories.

2.Thermal Power Station- Both normal and super thermal plants are present in our country and coals are used as fuels in these plants. The fly-ash and other gases and hydrocarbons are regularly released in the air and these make the air polluted and un healthy.

3.Automobile Exhaust- Toxic exhaust of automobiles is a source of considerable air pollution (60%). It contains CO, SO2, NO2 and other toxic substances.

4.Agriculture Practice- Such types of air pollution are not in massive quantities but bear significance due to the harmful substances they release. This is agriculture, which is responsible for pollution through pesticides, insecticide, herbicides.

5.Domestic Combustion- In rural area fire-woods and coals are used as fuels. Combustion of these fuels produces CO,CO2,SO2 and all oxide from nitrogen which though in lesser amount, still pollute the air.

6.Radioactive Elements- Radioactive elements like Uranium, Radium etc., are now being used in research and medical science. After their uses the residue are not always disposed off with care. All these radioactive elements pollute the environment.

CLASSIFICATION OF AIR POLLUTANTS: Air pollutant may be classified into two broad categories:

(A) NATURAL CONTAMINANTS:

1.Plants- Decomposed plant bodies emit methane, hydrogen sulphide, carbon monoxide and other than that plant spores also create air pollution.

2.Aerosol- Minute molecules of solid and liquid substances like dust, smoke, mist, fog and fuel.

3.Soil- Dry soil dust with bacteria, virus, fungus.
4.Volcanos- Sulphur compounds, fly-ash, SO2, SO3, fumes and other gaseous substances.
5.Ocean- Different types of oceanic salts.
6.Cosmic Substances- Cosmic rays, meteor, aerolith, comet dust etc.

(B) MAN-MADE CONTAMINANTS:

1. **Gaseous Substances-** Combustion products of coal, petroleum and fossil fuel, emissions from industries, automobile exhaust like CO, PAN, SO2 etc.
2. **Solid Waste-** Minute dust, SPM from different factories, industries etc.
3. **Radioactive Substances-** Atomic power station, radioactive fuel, atomic explosion, atomic war etc.

TYPES OF AIR POLLUTANTS: The air pollutants released from different sources may be – Primary and Secondary air pollutants.

(A) <u>PRIMARY AIR POLLUTANTS AND THEIR EFFECTS:</u> The main primary pollutants are-

1.Suspended Particulate Matter(SPM)- Expect pure water any particle having the dimension ranging from 0.001 micrometer to 100 micrometer are called as suspended particles. It may include dusts of various type, soot, flyash, smoke or even natural substances like fur, hair, spores etc. Smoke contains suspension of carbon and other particles given off due to burning of organic matter. Some of their effects are-

The smoke and dust particles deposit on plants and clog stomach and also enter our respiratory tract and produce allergy and asthma.

- Emission from Iron mill, flour mill, mines, cement causes emphysema, pheumoconiosis etc.
- Sometimes pollen spores cause severe allergies in human.

2. Carbon Monoxide(CO)- Incomplete combustion of organic matter and metallurgical activities are main producers of carbon monoxide. Automobiles releases CO at a high rate. In closed room or congested area, if coal or any fuel is burned, CO is produced which is extremely harmful as it may diffuse into blood and react with haemoglobin to form carboxy haemoglobin.

3. Carbon Dioxide- The major green house gas. Increasing concentration of CO2 is posing a great problem of global warming.

4. Sulphur Oxide- The main form of oxide of Sulphur is SO2. It is produced during smelting of metallic ores and burning of fossil fuels. SO2 when present in excess amount in the air , combines with rain water and forms acids , causing acid rain.

5. Nitrogen Oxides(N2O,NO,NO2,N2O4)- Several sources are there which emit nitrogen oxides. Electric stromes, high energy radiation, solar flames, combustion in industries and nitrogen fertilizer plants.

6. Fluorides- Refineries are the main source of emission of fluoride. It can cause chlorosis .

7. Volatile Organic Carbon(VOC)- These are produced naturally like marsh gas or by man made products like paints, emulsion etc. Chemically they contain polyneuclear aromatic hydrocarbon and formaldehyde.

8. Chlorofluorocarbons- They are used as coolants in refrigerator, propellants, air conditioner etc. It is released by jet aeroplanes as aerosols while flying at great heights. It is the main cause of ozone depletion

9. Other Pollutants- Mercury through burning of coal, phosgene through pesticide and dye manufacturing industries, methyl isocyanate from pesticide manufacturing plants and lead through burning of commercial petroleum are added to atmosphere hazards causing huge to the nature.

10. Pollens And Microbes- These are natural attributes to the atmosphere. But excess amounts of these cause severe

disorder. Microbes can cause several diseases in both plants and animals.

(B) **<u>SECONDARY POLLUTANTS AND THEIR EFFECTS:</u>** These are pollutants that are produced due to photochemical reactions between nitrogen oxides and unsaturated hydrocarbons.

1. **Ozone-** It is an extremely strong oxidants and has the ability to destroy the chlorenchyma and produce necrosis in plants.

NO_2 ---------- NO + [O]	**O_2 + [O] ---------- O_3**
(Nitrogen Di oxide) (Nitrogen oxide) (nascent oxygen)	**(Oxygen) (nascent Oxygen) (ozone)**

2. **Proxy Acyl Nitrate(PAN)-** They are formed when hydrocarbons react with nitrogen oxides present in the atmosphere. It can cause silvering, bronzing etc.

NO + HC + O_2 --------- NO_2 + PAN

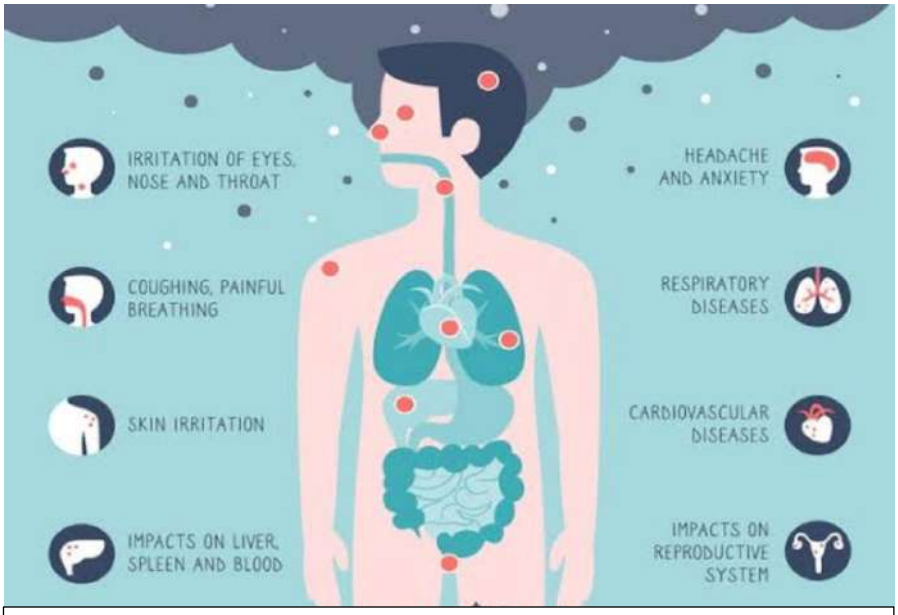
These Secondary pollutants aggregate and form an opaque dark fog condensed with water vapour, dust, smoke and gases called **smog**. Some famous smog occurred over world are **Los Angeles smog(1946), London smog(1952), New York smog (1970).** Main types of smog are-

- **Classical Smog (London)-** It contains gases like Sulphur Dioxide, hydrogen sulphide, smoke and dust particles. It is dark brown thus opaque and has reducing environment. Such fog is formed when water vapour condense along with these harmful gases. But Secondary pollutants are not present. It occurred in London in December 1952, where it affected 50% of population and killed 4000 people.
- **Photochemical Smog(Los Angeles)-** It contains secondary pollutants or photochemical pollutants. It does not contain smoke. It is Grey or yellowish brown opaque smog having oxidising environment. It occurred in Los Angeles in 1940. Photochemical Smog is formed at high temperatures. In intense solar radiations photochemical smog forms brown air while in case of low radiations of sun, smog forms grey air.

The effects of air pollution on human health are described below:

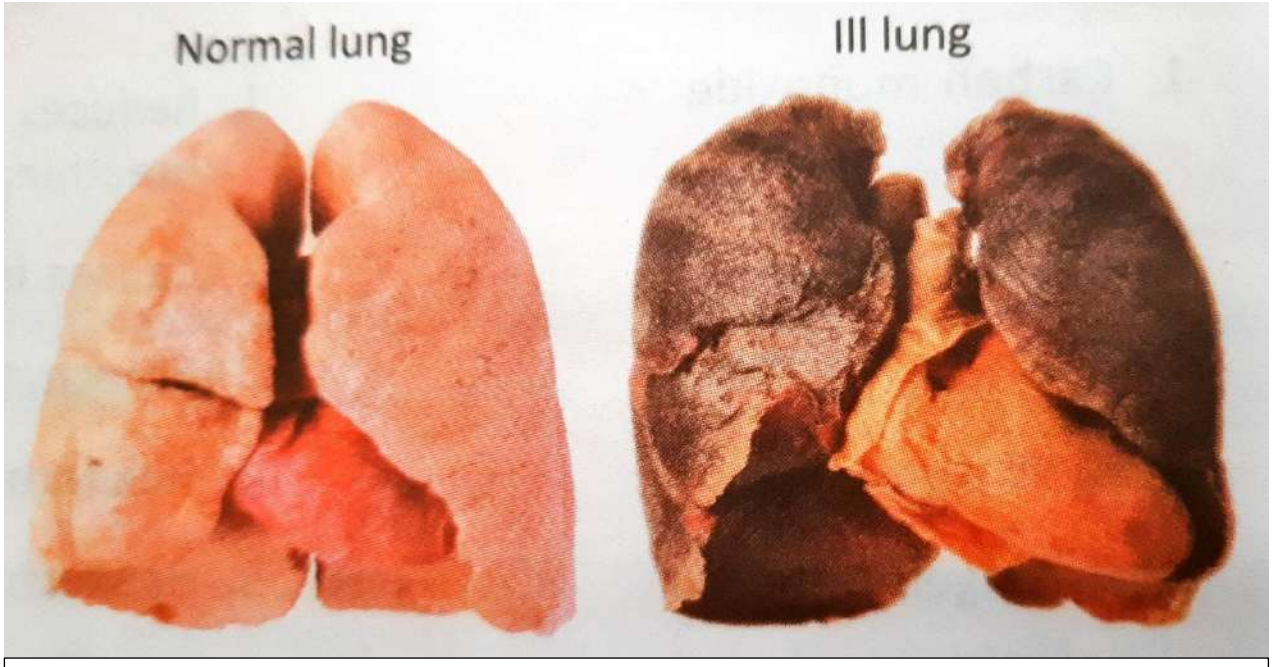
Air Pollutants	**Their Effects**
1.Carbon monoxide	1. Reduces oxygen carrying capacity of haemoglobin

2.Sulphur dioxide	2. Irritation of eye, lung cancer
3.Nitrogen dioxide	3. Bronchitis, pneumonia
4.Hydrogen sulphide	4. Headache, nausea,diarrhea
5.Hydrogen cyanide	5. Headache, reduced eyesight
6.Ammonia gas	6. Irritation of eyes, inflammation
7.Chlorine	7. Whole respiratory system affected
8.Aldehyde	8. Inflammation of trachea
9.Chloroflurocarbon(CFC)	9. It destroyes the ozone layer, thus living organisms exposed to UV rays resulting skin cancer
10.Arsenic	10. Oxygen carrying capacity of blood decrease
11.Hydrogen fluoride	11. Inflammation of various organs



Effects of air pollution on Human health

Asthma



Effects of air pollution on lung (1. Normal lung, 2. I'll lung)

CONTROL OF AIR POLLUTION: Different kinds of air pollution can be controlled by modern technology. Emission from factories and power plants can be made free from gaseous pollutants by three methods-

1.Absorption Technique- Here, scrubbers with packing materials are used to absorb gaseous pollutants. A fine spray of water is applied that dissolves NH3, SO2 etc. Sometimes a bed of lime is also employed to absorb SO2.

2.Combustion Techniques- Only oxidisable pollutants can be removed by this method. Emission are burnt at very high temperatures. This process is applied in petrochemical and paint industries.

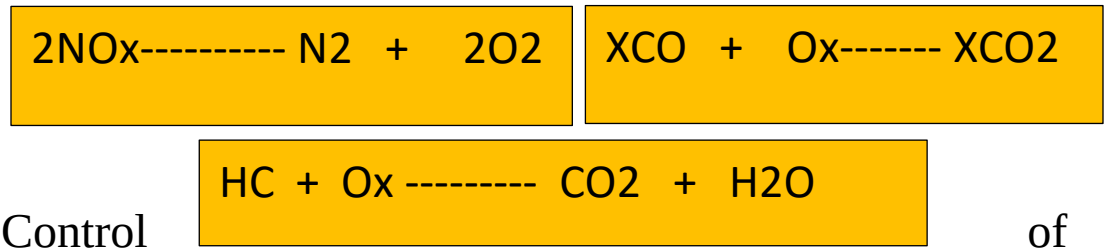
3.Adsorption Techniques- Activated charcoal, a chief adsorption material, is employed in this technique. It can absorb toxic vapours, gases and other harmful matters.

Following steps have to be taken to control pollution at source as well as after the release of pollutants in the atmosphere.

1.Prevention and Control of Vehicular Pollution- For prevention and controlling air pollution created by vehicles, the following measures are to be adopted:

- Curbing the pollutant emission from Vehicular exhaust by using various devices, such as positive crankcase, ventilation valve and catalytic converter. Catalytic converter consists of metals like palladium, platinum and rhodium as catalyst. The exhaust gases, when passed through unburnt hydrocarbons are oxidized to

produce CO2 and water , CO converted to CO2 and nitrogen oxides are converted to nitrogen gas.



- Control of evaporation from fuel tank and carburettor by several mechanical and chemical processes.
- Filters can be used to capture and recycle the hydrocarbons from the engine.
- Periodic checking of vehicles for pollution control.
- Increased use of CNG cam lower the amount of pollutants.

2.Prevention and Control of Industrial pollution- It involves the use of the following equipments-

- **Cyclone Collector-** This used for centrifugation of waste gas containing particles. It can remove upto 70% of the particles.
- **Electrostatic Precipitators (ESP)-** To remove the suspended particles from gas stream, the electrical forces are applied within the chamber in the precipitator. ESPs can remove 99% of the Particulate pollutants from the chimney exhaust.
- **Wet System-** These are used in washing towers in which alkali fluid circulates continuously. This liquid reacts with SO2 to produce a precipitate.

- **Dry Systems-** Here, the gas pollutants are allowed to react with an absorbent under a dry phase. Lime , limestone are placed in the way of the flowing gas.


Cyclone Separator


Catalytic Converter


Electrostatic precipitator

CASE STUDY OF DELHI: Delhi ranks highest in the number of vehicles in India. According to the record of 1990, the number of cars in Delhi were more than total of West Bengal and Gujrat. Due to this, Delhi ranked fourth in the 41 most polluted cities of the world. Residents of Delhi were mostly suffering from burning eyes and respiratory problems. A public interest litigation(PIL) was filed in the Supreme Court. Supreme Court ordered the Government to take measures against pollution by:

- Using CNG in public transport instead of petrol.
- Replacing old vehicles.
- Using unleaded petrol and diesel with reduced Sulphur content.
- Making emission check up compulsory for all vehicles.
- Fitting of catalytic converters.

Delhi first introduced usage of CNG for auto rickshaws by 2002. Its use are-

- It is cheaper
- Burns completely
- Does not cause smoke
- Can not be adultered like petrol diesel

CONCLUSION: In our country government tries to control the level of air pollution by making several laws and taking various measures Both at State and Central Government like Bengal Smoke Nuisance Act (1905), The Air Prevention and Control of Pollution Act (1981), Recently On 28 October the government of **India** enacted the Commission for **Air Quality** Management in National Capital Region and Adjoining Areas Ordinance, 2020 to set up a panel to coordinate the **air pollution** response between state governments of Delhi, Haryana, Punjab, Rajasthan, and Uttar Pradesh. By taking this measures strictly by the Government the level of pollution caused by different pollutants decreased substantially.

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Arthur Tansley (1871 – 1955)

ECOLOGY AND ECOSYSTEM

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INTRODUCTION

"though the organism may claim primary interest…we cannot separate them from their special environment with which they form on physical system"

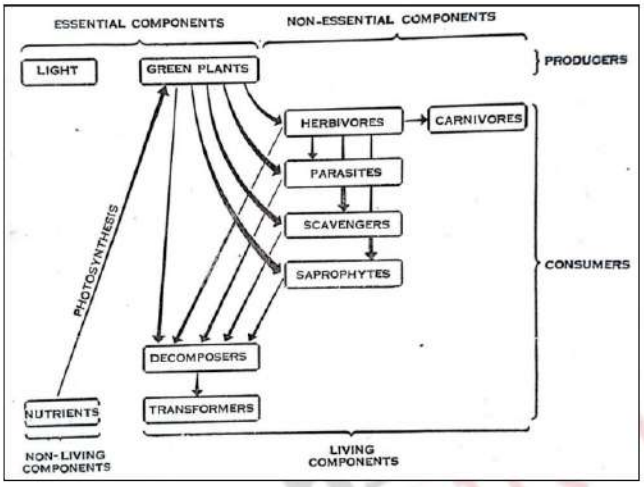
Arthur Tansley (1871 – 1955)

Ecology is concerned with the study of interrelationships between organisms and their environments. Two distinct components of environment can be identified: Abiotic (nonliving or nonorganic, sometime called the physical environment) and Biotic (living or organic). These two components, are, however, very much interdependent and sometime it becomes difficult to separate biotic components from the abiotic ones, especially when environment is looked at as a factor for determining man's biology and culture (Odum, and Barrett, 2005). Ecology is a purely scientific discipline which aims to understand the relationships between organisms and their wider environment. Like any science, the outcomes of ecological studies do not dictate ethical or political actions. It is important to make this distinction because the environmental movement has endowed the word 'ecology' with political connotations. It is right that ecology should inform politics, but as a student of ecology it is imperative to consider ecological research from a rigorous scientific viewpoint.

The term 'ecosystem' was proposed by a British ecologist A.G. Tansley in the year 1935. The ecosystem represents the basic functional unit of ecology which comprises of the biotic communities mutually related with their nonliving or abiotic environment. Thus a biotic community and its abiotic environment together represent an ecosystem. Ecosystem, therefore, includes both the living organisms (biotic community) and the nonliving environment (abiotic environment) which are inseparably inter-related and interact upon each other (Tansley, 1935.)

Odum has defined the ecosystem as the basic fundamental unit of ecology which includes both the organisms and the nonliving environment, each influencing the properties of the other and each is necessary for the maintenance of life (Odum, 1971).
Mathavan (1974) has given another definition of ecosystem according to which ecosystem is the sum total of living organisms, the environment and the processes of interaction between the various components of the system (Odum, and Barrett, 2005).

The concept of ecosystem can be best illustrated by the fact that holozoic animals cannot synthesize their food and depend upon plants either directly or indirectly. Even plants which are capable of synthesizing their own food depend upon the abiotic environment from which they receive light, water, carbon dioxide and mineral salts, other inorganic and organic substances of absolute necessity for the synthesis of food. The organic substances and some of the inorganic compounds are accumulated in the soil by the dead and the decaying organisms and the excreta of living individuals.



ECOSYSTEM

Structure of an Ecosystem

An ecosystem has two components the biotic components consisting of living things, and the abiotic portion, consisting of elements that are not alive. The non living constituents are said to include the following category, habitat, gases, solar radiation, temperature, moisture and inorganic and organic nutrients. The living organisms may be sub divided into producers, consumers and decomposers. Abiotic Components include basic inorganic and organic components of the environment or habitat of the organism. The inorganic components of an ecosystem are carbon dioxide, water nitrogen, calcium phosphate all of which are involved in matter cycle (biogeochemical cycles). The organic components of an ecosystem are proteins, carbohydrates, lipids and amino acids, all of which are synthesized by the biota (flora and fauna) of an ecosystem and are reached to ecosystem as their wastes, dead remains etc. the climate 'microclimate' temperature, light soil etc. are abiotic components of the ecosystems.

Functions of an Ecosytem

Ecosystem function is the capacity of natural processes and components to provide goods and services that satisfy human needs, either directly or indirectly. Ecosystem functions are subset of ecological processes and ecosystem structures. Each function is the result of the natural processes of the total ecological sub-system of which it is a part. Natural processes, in turn, are the result of complex interactions between biotic (living organisms) and abiotic (chemical and physical) components of ecosystems through the universal driving forces of matter and energy. There are four primary groups of ecosystem functions (1) regulatory functions, (2) habitat functions, (3) production functions and (4) information functions. This grouping concerns all ecosystems, not only for forests.

Components of Ecosystem

The components of the ecosystem can be categorised into abiotic or non-living and biotic or living components:

a) Energy : basically from the sun is essential for maintenance of life. In the case of plants, the sun directly supplies the necessaty energy. Since animals cannot use solar energy directly they obtain it indirectly by eating plants or animals or both. Energy determines the distribution-prganisms in the environment.

b) Materials: (a) organic compound\oteins, carbohydrates, lipids, humic substances which are formed from inorganic into them on decomposition. (b) inorganic carbon, carbon dioxide, water, sulphur, nitrates, phosphates, and ions of vari-tals are essential for organisms to survive.

c) Climatic factors: light, heat, temperature, wind, humidity, rainfall, snowfall etc.

d) Edaphic factors (structure and composition of soil along with its physical and chemical characteristics) : also exert significant influence on the organisms.

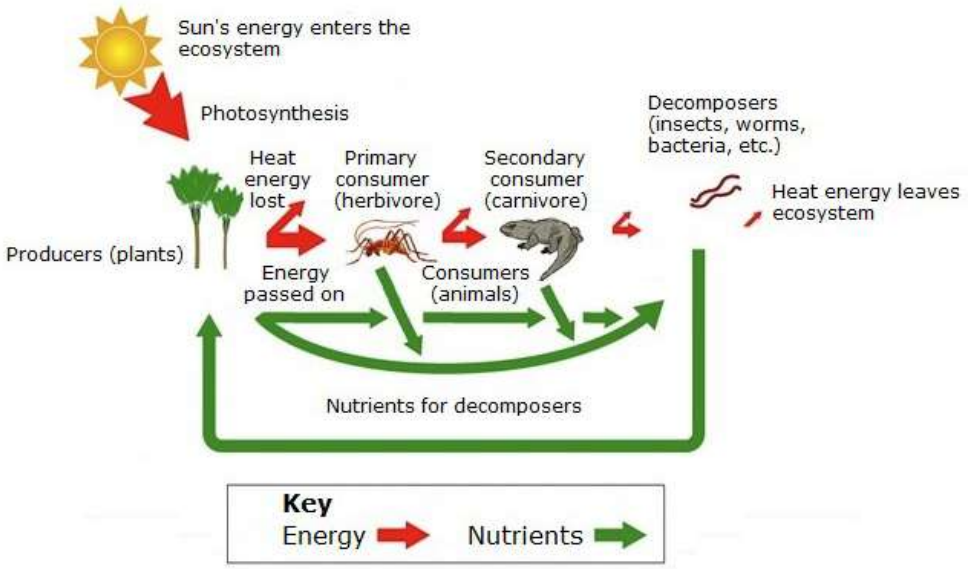
Biotic components : Biotic components include living organisms comprising plants, animals and decomposers and are classified according to their functional attributes into producers and consumers.

a) Producers - Autotrophs (self-nourishing) are green plants as they synthesise carbohydrates from simple inorganic raw materials like carbon dioxide and water in the presence of sunlight by the process of photosynthesis for themselves, and indirectly for other non-producers.

In terrestrial ecosystem, producers are basically herbaceous and woody plants while in marine and fresh water ecosystems producers are various species of microscopic algae. Chemosynthetic bacteria are also producers.

However, unlike plants which constitute the major producers, these bacteria, which are found in deep ocean trenches where sun energy is absent, derive energy by the process of chemosynthesis from the hydrogen sulphide seeping through cracks in the sea floor.

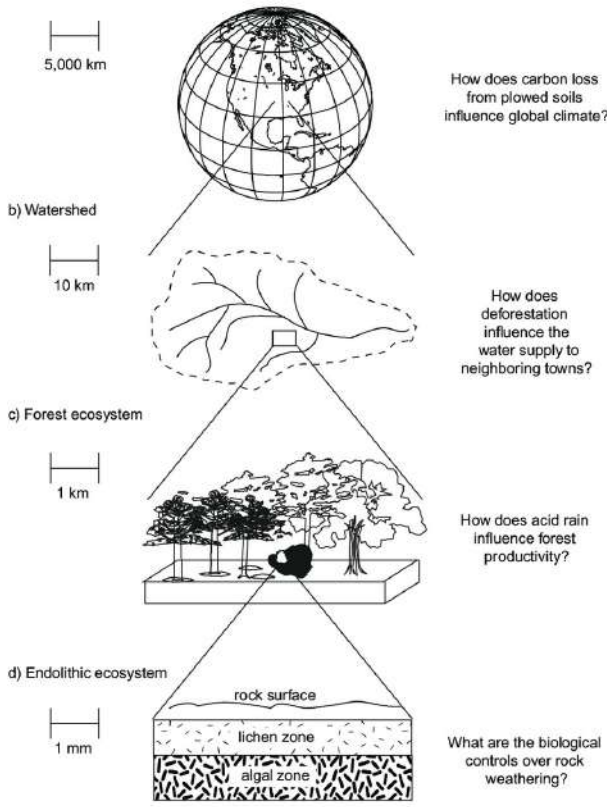
b) Consumers - Heterotrophs (other nourishing) are incapable of photosynthesis and depend on organic food derived from animals, plants or both. Consumers can be divided into two broad groups namely macro and micro consumers. (i) Macro consumers or phagotrophs feed on plants or animals or both and are categorised on the basis of their food'sources. Herbivores are primary consumers which feed mainly on plants e.g. cow, rabbit. Carnivores feed only on animals. Secondary consumers feed on primary consumers e.g. wolves. Carnivores which feed on secondary consumers are called tertiary consumers e.g. lions which can eat wolves. Organisms which consume both plants and animals are called omnivores e.g. men. (ii) Micro consumers - Saprotrophs (decomposers or osmotrophs) are chiefly bacteria and fungi which obtain energy and nutrients by decomposing dead organic substances (detritus) of plant and animal origin. Some of the products of decomposition such as inorganic nutrients released in the ecosystem are reused by producers and thus recycled. t Earthworm and certain soil organisms such as nematodes, and arthropods are also detritus feeders and help in the decomposition of organic matter.



1st trophic level -- Primary producers ▪ photosynthetic autotrophs, some chemosynthetic autotrophs
2nd tropic level -- Primary consumers ▪ heterotrophs consume primary producers (herbivores)
3rd trophic level -- Secondary consumers ▪ heterotrophs consume primary consumers (carnivores)
4th trophic level --Tertiary consumers ▪ heterotrophs consume secondary consumers (carnivores)
Decomposers -- mostly bacteria & fungi ▪ heterotrophs that consume dead organisms (detritivores)

Size of Ecosystem

An ecosystem may be as small and as simple as a cow dung pad or as complex and large as an ocean or the biosphere itself, comprising a wide variety of species. An interesting point to observe is that ecosystems occur within ecosystem. To take an example, cow dung ecosystem may be contained in a forest ecosystem which is contained in the biosphere. In some cases, like a pond ecosystem, the boundaries are well defined. In the case of forests, grasslands and deserts there are no sharp boundaries. These ecosystems often are separated I , from adjacent ecosystems by a transition zone or a diffused boundary zone called ecotone. Organisms of adjacent ecosystems intermingle in the ecotone zone; consequently they may have greater diversity of species than the neighbouring ecosystems.



Productivity in the Environment:

The productivity of an ecosystem is the rate at which solar energy is fixed by the vegetation of the ecosystem; it is further classified into primary productivity, secondary productivity and net productivity. Primary productivity refers to the rate at which radiant energy is stored by photosynthetic and chemosynthetic activity of producers; it is further distinguished as gross primary productivity (GPP) and net primary productivity (NPP). It is expressed in terms of weight (g/m2 /yr) or energy (kcal/m2). Secondary productivity refers to the rates of energy storage at consumer levels. An understanding of ecology is essential in the management of modern industrialized societies in ways that are compatible with environmental preservation and enhancement. The branch of ecology that deals with predicting the impacts of technology and development and making recommendations such that these activities will have minimum adverse impacts, or even positive impacts, on ecosystems may be termed as Applied Ecology. It is a multidisciplinary approach .

Interactions among living organisms are grouped into two major groups viz.,
• Positive interactions • Negative interactions

I. Positive interactions
Here the populations help one another, the interaction being either one way or reciprocal. These include (i) Commensalism, (ii) Proto co-operation and (iii) mutualism.

1. Commensalism
In this one species derives the benefits while the other is unaffected.
Eg. (i) Cellulolytic fungi produce a number of organic acids from cellulose which serve as carbon sources for non-cellulolytic bacteria and fungi.
(ii) Growth factors are synthesised by certain microorganisms and their excretion permits the proliferation of nutritionally complex soil inhabitants.
2. Proto-cooperation
It is also called as non-obligatory mutualism. It is an association of mutual benefit to the two species but without the co-operation being obligatory for their existence or for their performance of reactions. Eg. N2 can be fixed by Azotobacter with cellulose as energy source provided that a cellulose decomposer is present to convert the cellulose to simple sugars or organic acids.

3. Mutualism Mutually beneficial interspecific interactions are more common among organisms. Here both the species derive benefit. In such association there occurs a close and often permanent and obligatory contact more or less essential for survival of each. Eg. (i) Pollination by animals. Bees, moths, butterflies etc. derive food from hectar, or other plant product and in turn bring about pollination. (ii) Symbiotic nitrogen fixation: Legume - Rhizobium symbiosis. Bacteria obtain food from legume and in turn fix gaseous nitrogen, making it available to plant.

II. Negative interactions
Member of one population may eat members of the other population, compete for foods, excrete harmful wastes or otherwise interfere with the other population. It includes (i) Competition, (ii) Predation, (iii) Parasitism and (iv) antibiosis.

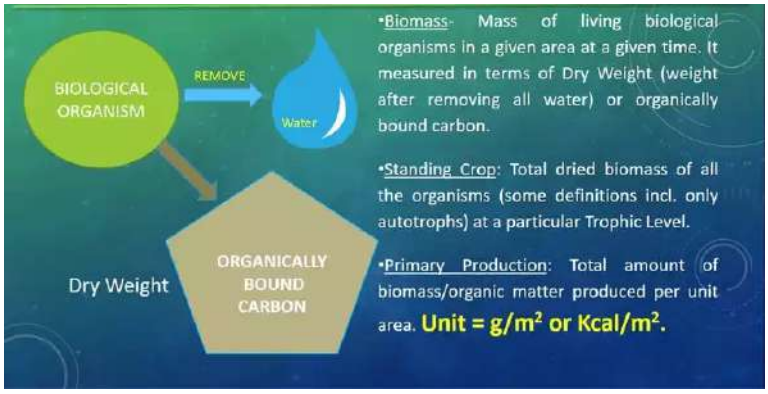
(i) Competition
It is a condition in which there is a suppression of one organism as the two species struggle for limiting quantities of nutrients O2 space or other requirements. Eg. Competition between Fusarium oxysporum and Agrobacterium radiobacter.

(ii) Predation
A predator is free living which catches and kills another species for food. Most of the predatory organisms are animals but there are some plants (carnivorous) also, especially fungi, which feed upon other animals.
Eg. (i) Grazing and browsing by animals on plants. (ii) Carnivorous plants such as Nepenthes, Darligtoria, Drosera etc. consume insects and other small animals for food. (iii) Protozoans feeding on bacteria.

(iii.) Parasitism
A parasite is the organism living on or in the body of another organisms and deriving its food more or less permanently from its tissues. A typical parasite lives in its host without killing it, whereas the predator kills its upon which it feeds. Eg. Species of Cuscuta (total stem parasite) grow on other plants on which they depend for nourishment. Parasitism may occur even with in the species. Hyperparasites which are chiefly fungi growing parasitically on other parasites, (ie) Parasite on a parasite. Eg. Cicinnobolus cesatii is found as hyperparasite on a number of powdery mildew fungi.

(iv) Antibiosis

The phenomenon of the production of antibiotic is called as antibiosis. Antibiotic is an organic substance produced by one organism which in low concentration inhibits the growth of other organism. Eg. Streptomycin - S.griseus , Penicillin - P. notatum , Trichoderma harzianum inhibits the growth of Rhizoctonia sp.

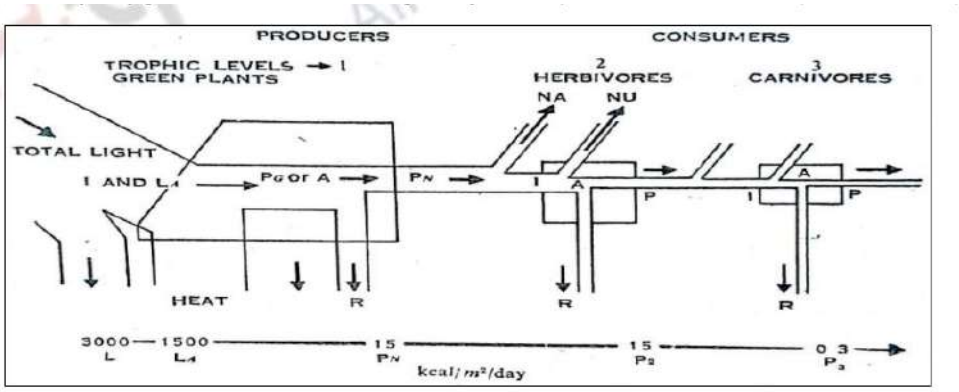


The existence of living world depends upon the flow of energy and circulation of materials through the ecosystem. The energy is required for the performance of all the life activities. The source of this energy is sun. The solar energy enters the space in the form of light rays. Approximately 57 per-cent of solar energy is absorbed in the atmosphere and scattered in space. About 36 per-cents are expended in heating water and land and in evaporating water. Nearly 8 per cent of light energy strikes the plants, of which 80-85 per cent is absorbed, and only fifty per-cent of it is utilized in photosynthesis (Odum and Barrett, 2005).;Benson, 2000).

This energy is captured by plants and is stored in the form of potential energy in foodstuffs. These are known as producers and represent first trophic level in the ecosystem. The energy stored by the plants is passed along through the community or ecosystem in a chain. A food chain consists of maximum four steps, the producers, primary consumers, secondary consumers and tertiary consumers. The energy flows from the producers to consumers. At each transfer a large proportion (80 to 90 per-cent) of potential energy is dissipated as heat produced during the process of respiration and other ways (Miller, et.al, 2003). The energy flow through an ecosystem can be represented diagrammatically in a simplified manner. In the fig, the boxes represent the trophic levels and the pipes depict the energy flow in and out at each level.

Only about half the average light energy impinging upon the green plants is absorbed in the photosynthetic machinery, out of which 1 to 5 per cent is converted into food energy and the rest of it passes out as heat in the atmosphere. Energy accumulated by plants or the producers in an ecosystem is called primary production and is represented by PG or A and the energy left after respiration and stored as organic matter in the producers is the net primary production represented by Pn. Net primary production actually represents food potentially available to primary consumers, which feed upon plants(Miller, et.al, 2003).

The primary consumers, therefore, take in chemical potential energy in the form of plant food. Most of it dissipates in the form of heat (produced during respiration) and is lost out of the ecosystem. Only a small part of the energy is fixed in the form of chemical potential energy in the protoplasm. The same process is repeated at the secondary consumers (primary carnivorous) level and so on. Therefore, at each step in the transfer of energy from one trophic level to another a large amount of energy is degraded into heat and never returns back to the ecosystem(Miller, et.al, 2003).



The boxes represent biomass or population mass and the pipes show the path of flow of energy between living units. The relative size of blocks suggests the quantity of energy flowing through each pipe. I=Total energy input; LA=light absorbed by plants; PG= Primary gross production; A= Total assimilation; PN= Net primary production; P=Secondary production; NU=Energy not used; NA=Energy not assimilated by consumers; R=Respiration.

ECOLOGY

History of Ecology

The roots of ecology lie in Natural History, which is as old as human civilisation itself. As a matter of fact man indulged in ecology in a practical sort of way, though unknowingly, since early history. In primitive societies every individual was required to have intimate knowledge of his environment for survival, i.e., of the forces of nature and of plants and animals around him. Primitive tribes, which were dependent on hunting, fishing and food gathering needed detailed knowledge of their environment to obtain their sustenance. Later, the adoption of settled agricultural life further stressed the need to learn practical ecology for the successful domestication of plants and animals.

Our ancient Indian texts are full of references to ecological principles. The classical texts of the Vedic period (1500 BC-600 BC) such as the Vedas, the Samhitas, the Brahmanas and the Aranyakas-Upanishads contain many references to ecological concepts.

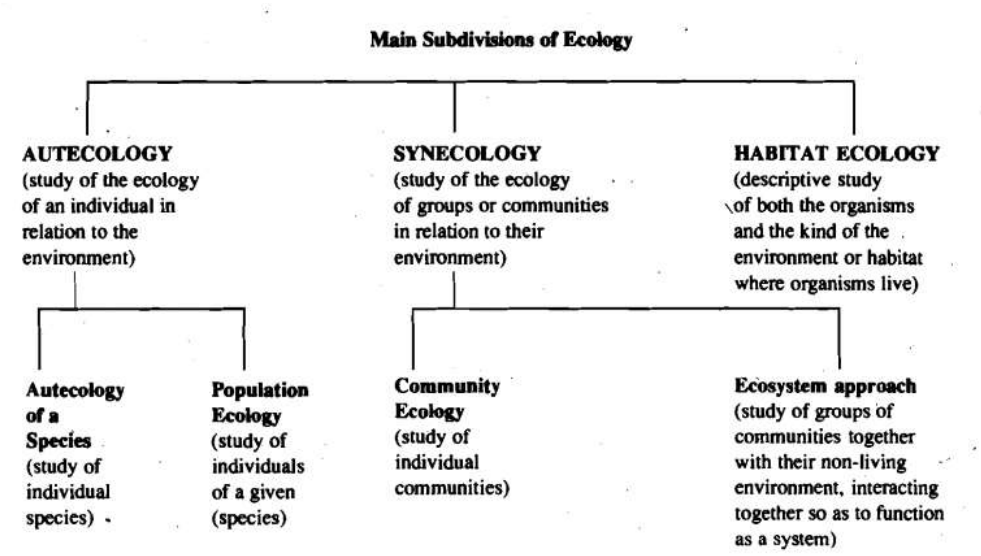
The Indian treatise on medicine, the Caraka-Samhita (I st Century AD4th Cenklry AD) Charaka i.e. T5 and and the surgical text Susruta-Samhita (1st Century AD-4th Century AD), show that people 'Susruta' as Sushruta i.e. during this period had a good understanding of plant and animal ecology. These texts contain classification of animals on the basis of habit and habitat, land in terms of nature of soil, climate and vegetation; and description of plants typical to various localities.

CarakaSamhita contains information that air, land, water and seasons were indispensable for life and that polluted air and water were injurious for health. Similar awareness of ecological issues was prevalent in Europe in the 4th Century BC. The early Greek philosophers were well aware of the importance of environmental studies. Hippocrates in his work 'On Airs, Waters and Places' stressed the need for ecological background for medicdl students, as he emphasised the effect of water, air and locality on health and diseases in man.

Aristotle classified animals on the basis of habit and habitat. Theophrastus (370-250 BC) was the first person to introduce ecological approach long before the term ecology was coined. He studied plant types and forms in relation to altitude, moisture and light exposure.

Subdivisions of Ecology

Ecology was earlier divided into plant and animal ecology. However, modem ecology does not make any such distinction since plants and animals are intimately interconnected and interdependent amongst themselves and on their environment. The three main subdivisions of ecology today are given below: i) Autecology, ii) Synecology, iii) Habitat ecology.



i) Autecology:
It is the study of individual species or individuals in relation to the environment. There are two approaches to autecological studies (a) autecology of species where individual species are studied (b) population ecology where individuals of the same species are studied.

ii) Synecology: It is the study of the community of living organisms as a unit. The difference between autecology and synecology could be explained by the following example. If a neem tree (or several peem trees) or a crow (or several crows) are studied in relation to the environment then this would be an autecological study. However, if the Ecok .nd Eeosynk study deals with a forest community as a whole in which many different buds, trees and animals share the same area, then it would be called a synecological approach.

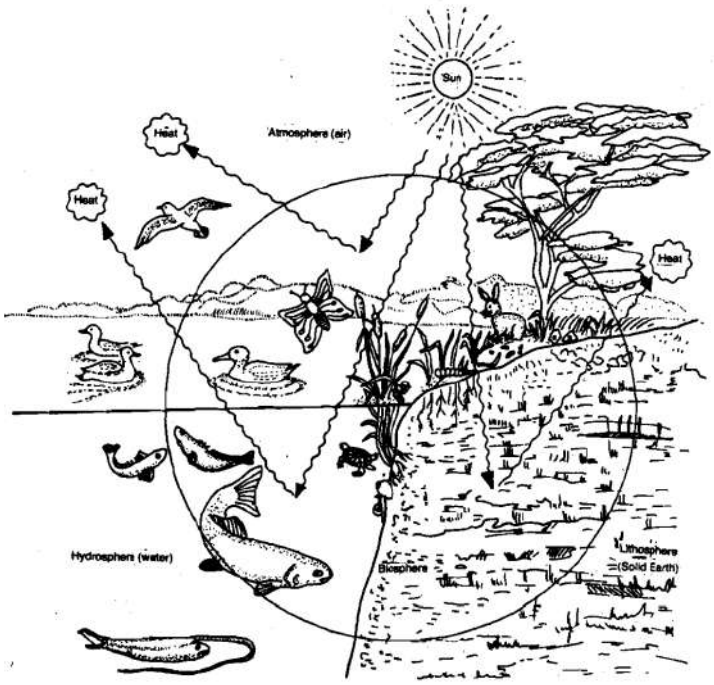
Synecological studies can be of two types. a) community ecology is concerned with the study of biotic (living) community comprising of interdependent plants and animals in a particular area, b) ecosystem ecology which is a recent development in ecology. It deals with the community of living organisms and their environment as an integrated unit of nature.

iii) Habitat ecology :
It is the study of the habitat or environment of organisms and its effect on the organisms. In this approach different types of habitats such as terrestrial, fresh water, marine, and estuarine are the focus of study.

Deep Ecology and cultivating Ecological Consciousness

In contrast to the preceding scenarios, deep ecology presents a powerful alternative. Deep ecology is emerging as a way of developing a new balance and harmony between individuals, communities and all of Nature. It can potentially satisfy our deepest yearnings: faith and trust in our most basic intuitions; courage to take direct action; joyous confidence to dance with the sensuous harmonies discovered through spontaneous, playful intercourse with the rhythms of our bodies, the rhythms of flowing water, changes in the weather and seasons, and the overall processes of life on Earth. We invite you to explore the vision that deep ecology offers. The deep ecology movement involves working on ourselves, what poet-philosopher Gary Snyder calls "the real work," the work of really looking at ourselves, of becoming more real.

This is the work we call cultivating ecological consciousness. This process involves becoming more aware of the actuality of rocks, wolves, trees, and rivers - the cultivation of the insight that everything is connected. Cultivating ecological consciousness is a process of learning to appreciate silence and solitude and rediscovering how to listen. It is learning how to be more receptive, trusting, holistic in perception, and is grounded in a vision of nonexploitive science and technology. This process involves being honest with ourselves and seeking clarity in our intuitions, then acting from clear principles. It results in taking charge of our actions, taking responsibility, practicing selfdiscipline and working honestly within our community. It is simple but not easy work. Henry David Thoreau, nineteenth-century naturalist and writer, admonishes us, "Let your life be a friction against the machine."



We believe that humans have a vital need to cultivate ecological consciousness and that this need is related to the needs of the planet. At the same time, humans need direct contact with untrammeled wilderness, places undomesticated for narrow human purposes. Many people sense the needs of the planet and the need for wilderness preservation. But they often feel depressed or angry, impotent and under stress. They feel they must rely on "the other guy," the "experts." Even in the environmental movement, many people feel that only the professional staff of these organizations can make decisions because they are experts on some technical scientific matters or experts on the complex, convoluted political process. But we need not be technical experts in order to cultivate ecological consciousness. \

Cultivating ecological consciousness, as Thoreau said, requires that "we front up to the facts and determine to live our lives deliberately, or not at all." We believe that people can clarify their own intuitions, and act from deep principles. Deep ecology is a process of ever-deeper questioning of ourselves, the assumptions of the dominant worldview in our culture, and the meaning and truth of our reality. We cannot change consciousness by only listening to others, we must involve ourselves. We must take direct action.

"There is a basic intuition in deep ecology that we have no right to destroy other living beings without sufficient reason. Another norm is that, with maturity, human beings will experience joy when other life forms experience joy and sorrow when other life forms experience sorrow. Not only will we feel sad when our brother or a dog or a cat feels sad, but we will grieve when living beings, including landscapes, are destroyed. In our civilization, we have vast means of destruction at our disposal but extremely little maturity in our feelings. Only a very narrow range of feelings have interested most human beings until now."

Conclusions

Unfortunately human activities have already depleted several ecosystems and drastically changed others. The planet "Earth" as we knew it fifty years ago no longer exists. We have changed the chemistry of the atmosphere irreversibly. We have made the oceans much more acidic. We have exterminated thousands of species and depleted fish stocks, brought several species of birds and animals to the verge of extinction and cut down more than half of the rain forests of the world. We have accumulated enormous amounts of more or less toxic garbage, and added persistent, accumulating and very poisonous chemicals to all food-chains. We have already changed the climate, bringing more droughts, floods and violent storms than we have been used to. We have severely depleted vital freshwater resources by pumping up fossil water from deep underground acquifers. Many lakes and rivers are polluted and suffer from eutrophication. Huge areas of land suffer from soil depletion and have become deserts.

The human ecological footprint has increased drastically the last thirty years, and we keep building up an ecological debt that will be increasingly difficult to handle. Unless we manage to change our way of life in a more sustainable direction, this negative trend will accellerate.

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GREENHOUSE EFFECT

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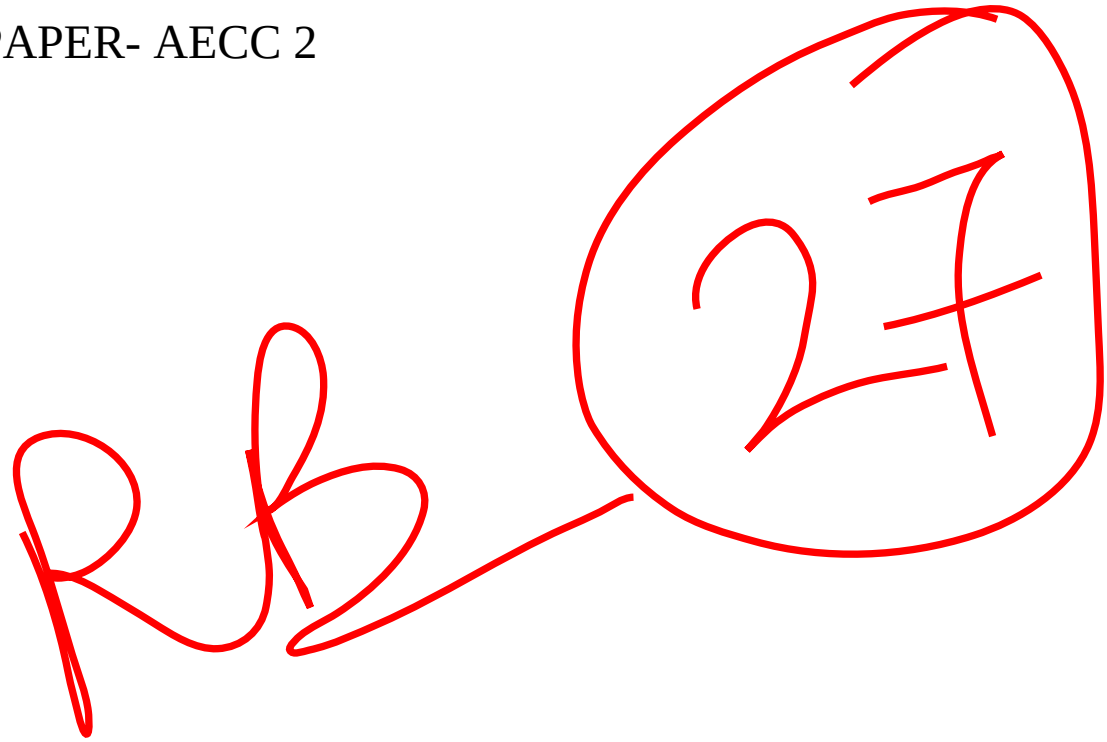

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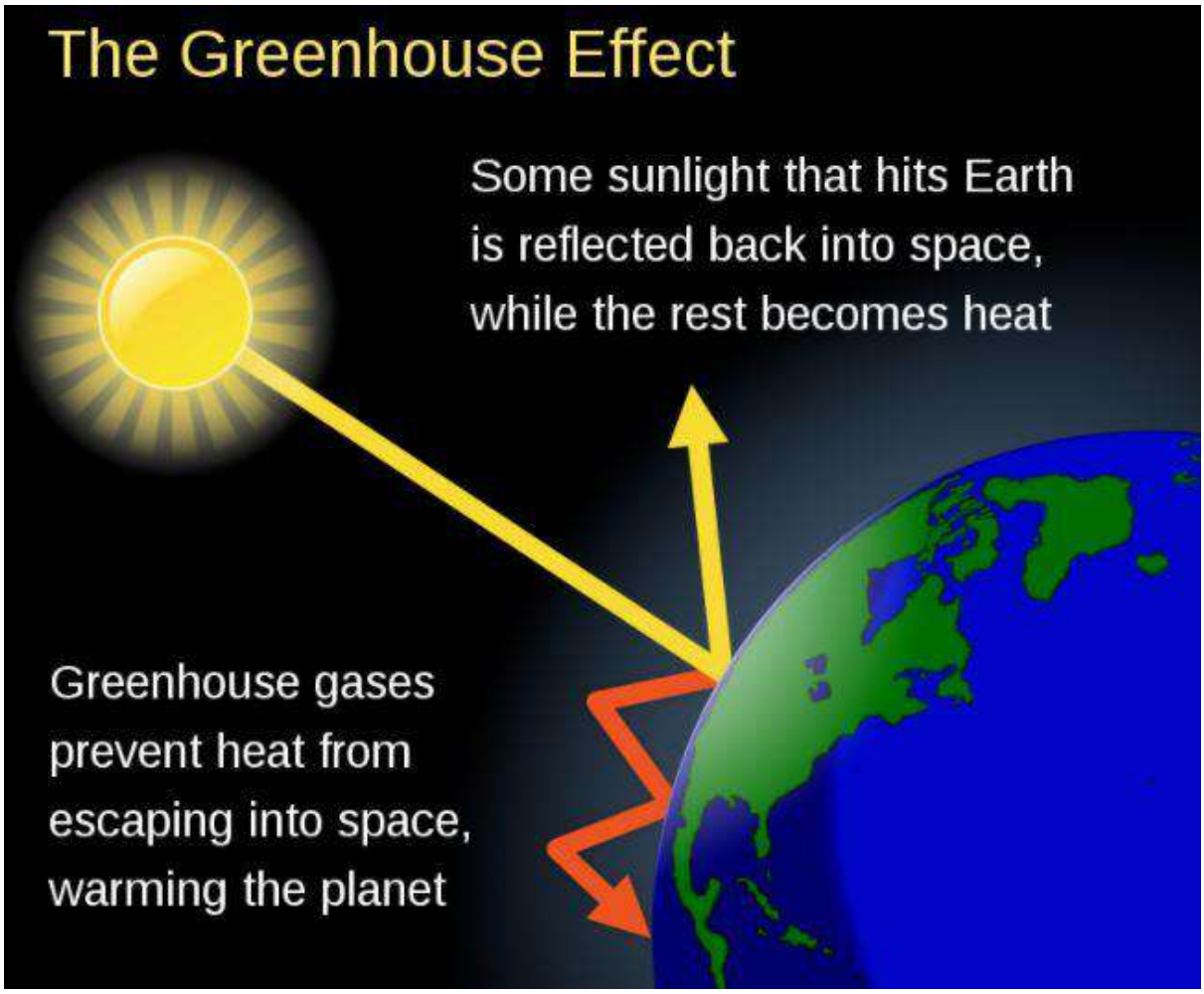
INTRODUCTION

Over the centuries, the Earth has been subjected to innumerable changes. One which is so relevant to the existence and well being of all living beings and eco-systems is climate change. Many factors have contributed to the rising temperatures of the Earth over the centuries like intensified agriculture, deforestation, increased use of fossil fuels and many more. However, one of the most significant factors which has to a great extent been responsible for climate change and the rise in Earth's temperature is the enhanced Greenhouse Effect.

THE GREENHOUSE EFFECT

The Greenhouse Effect in its simplest form is a natural phenomenon that warms the Earth's surface and the Troposphere. When the Sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases. The greenhouse gases include water vapour, carbon dioxide, methane, nitrous oxide, ozone and some artificial chemicals such as chloroflurocarbons (CFCs). The absorbed energy warms the atmosphere and the surface of the Earth. This process maintains the Earth's temperature at around 33 degrees Celsius warmer than it would otherwise have been, allowing life on Earth to exist.

So, it is clear that the Greenhouse Effect is completely natural and not to mention, an essential phenomenon in the context of survival of life on Earth. However, the problem is that due to human activities; particularly burning fossil fuels (coal, oil and natural gas), intensive agriculture, deforestation and land clearing, the concentration of greenhouse gases in the atmosphere is increasing at an alarming rate. Since greenhouse gases trap the solar radiation, the greater the concentration of greenhouse gases in the atmosphere, the more the amount of heat that will be trapped inside the Earth's atmosphere. This enhanced Greenhouse Effect is trapping extra heat and increasing the temperature of the Earth beyond what is considered as conducive to life on Earth.



A diagram showing the Greenhouse Effect (source- www.wikipedia.org).

CAUSES OF THE GREENHOUSE EFFECT

BURNING FOSSIL FUELS – Burning fossil fuels produces huge quantities of carbon dioxide, which is a greenhouse gas. Fossil fuels like coal, oil and natural gas have become an integral part of our daily life. They are used on a large scale to produce electricity and for transportation of all kinds. When they are combusted, the carbon stored inside them is released (carbon emissions from vehicle exhausts) which combines with atmospheric oxygen to create carbon dioxide. With the increase in population, the number of vehicles have also

increased and this has resulted in an increase in the concentration of carbon dioxide in the atmosphere. Apart from that, electricity-related emissions are high because we are heavily dependent on coal for the generation of electricity which releases large quantities of carbon dioxide into the atmosphere. Coal is still the primary source of fuel for generating electricity. Carbon dioxide, along with other greenhouse gases like methane, nitrous oxide and chloroflurocarbons are changing the composition of the atmosphere and are adding to the Greenhouse Effect.

Large scale carbon emission from vehicle exhausts (source- www.ipac-co2.com).

DEFORESTATION- Forests constitute a major green area on planet Earth. Plants and trees take in carbon dioxide and release oxygen into the atmosphere through the process of photosynthesis, which is perhaps the most crucial phenomenon of all because no living creature can survive without oxygen. Large scale development and urbanisaton has led humans to chop down trees and clear forests to avail space for the human population. It is obvious that trees play a very important role in maintain the balance between the level of oxygen and carbon dioxide in the atmosphere, by taking in carbon dioxide and releasing oxygen. It thus implies that trees help to keep in check the concentration of greenhouse gases

in the atmosphere. So, when forests are being cleared and trees are chopped, the increase in the concentration of carbon dioxide in the atmosphere is inevitable, thus fueling the greenhouse Effect. Also, when the wood is burnt after cutting down trees, it releases carbon dioxide.

A picture showing deforestation (source- www.nationalgeographic.com).

INCREASE IN HUMAN POPULATION-

Over the last few decades, there has been a population explosion. This has resulted in an increased demand for food, clothing, shelter and all other kinds of things that we humans need in our daily life. To cater to such humongous demands, hundreds of factories and manufacturing hubs have sprang up in the cities and urban areas. These factories and hubs release a variety of harmful gases into the atmosphere which increases the Greenhouse Effect. Also, more people means more usage of fossil fuels which in turn has aggravated the problem.

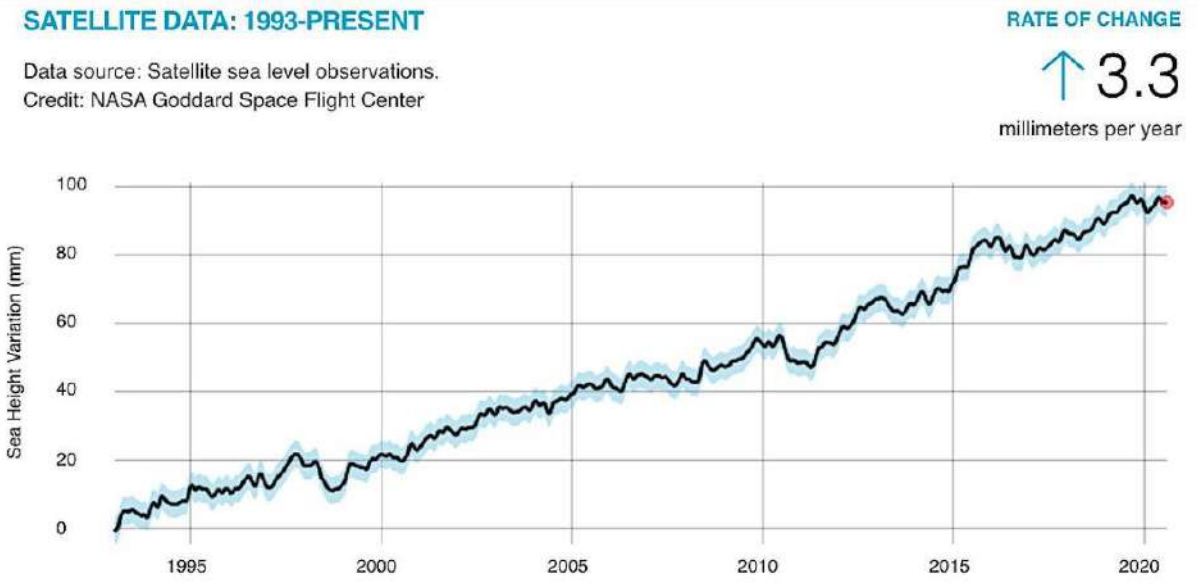
A picture showing large scale emission from factories (source- www.theconversation.com).

INDUSTRIAL WASTE AND LANDFILLS- Industries which are involved in the production of cement, use of fertilsers on land, coal mining activities, extraction of oil- all produce harmful greenhouse gases. Also, landfills filled with garbage produce carbon dioxide and methane, contributing significantly to the Greenhouse Effect.

FARMING- Nitrous oxide is a greenhouse gas which is used in fertilisers. Modern farming thrives in the use of a varied range of fertilisers, and this contributes to the Greenhouse Effect.

WHAT EFFECTS DOES THE GREENHOUSE EFFECT HAVE?

GLOBAL WARMING- Perhaps one the most consequential among the effects of the enhanced Greenhouse Effect is Global Warming. Global Warming is the long term heating of the Earth's climate, caused due to human activities, primarily fossil fuel burning, which increases the heat-trapping greenhouse gas levels in the atmosphere. Because of this, the glaciers are melting and ice at Earth's poles are also depleting. This has led to a global rise in sea level, which alarmingly puts islands and coastal cities in danger of being flooded. According to Intergovernmental Panel on Climate Change (IPCC,2014), during the period between 1901 to 2010, the global average sea level rose 19 centimetres. It is estimated that by 2100, the sea level will rise by between 15 to 90 centimetres, which will threaten 92 million people. Because of Global Warming, the ice-caps on mountains are also melting away, which can lead to increased risk of floods.



Satellite observations of rise in sea level from 1993 to present (source- www.wikipedia.org).

HURRICANES WILL BE MORE FREQUENT AND DEVASTATING- The intensification of the Greenhouse Effect increases the temperature of Earth's climate which in turn also heats up the seas and oceans. Hurricane formation are connected with sea temperature- they only form over waters that have a temperature of at least 26.51 degrees Celsius. So an increase in the temperature of the sea water will inevitably lead to more frequent and more intense hurricanes.

MIGRATION OF SPECIES- Many animal species will be forced to migrate in order to survive the changes in the main climatic patterns altered by the progressive increase in temperatures. Human beings will also have to move. According to the World Bank, by 2050, the number of people forced to flee their homes due to extreme drought or violent floods could reach 140 million.

DESERTIFICATION OF FERTILE AREAS- The Greenhouse Effect causes Global Warming. This in turn is having a profound impact on the process of soil degradation and is contributing to the desertification of areas on the planet, a phenomenon that destroys all the biological potential of the affected regions, turning them into barren and unproductive land. As recognised by the United Nations on the occasion of the World Day to Combat Desertification in 2018, 30 % of land has been degraded and lost its real value.

IMPACT ON AGRICULTURE AND LIVESTOCK- The increase in the climate temperature has already altered the length of growing season in large parts of the planet. Changes in temperatures and seasons are also influencing the proliferation of insects, invasive weeds and diseases that can affect crops. The same is happening with livestock. Climate changes are directly affecting important species in multiple ways- reproduction, metabolism, diseases, etc.

The two effects mentioned above imply that indirectly, the intensified Greenhouse Effect may lead to serious food shortages.

HOW CAN WE CHECK THE RISING LEVEL OF GREENHOUSE GASES IN THE ATMOSPHERE?

Lastly, I would just like to mention a few points on how we can control the level of greenhouse gases in the atmosphere.

1) – We must take steps to use less electricity, especially when it comes from burning coal or natural gas, because worldwide electricity use is responsible for a quarter of all emissions.

2) – Generating electricity without emissions is also a great step. Renewable sources of energy like solar energy, geothermal energy, wind energy (using wind turbines), ocean wave and tidal energy, biomass energy and hydropower do not release greenhouse gases into the atmosphere while generating electricity.

3) – Our heavy reliance on automobiles for transportation is a major contributing factor towards the Greenhouse Effect because all automobiles burn fossil fuels for transportation. If more and more people can switch to vehicles like bicycles, electric cars or even walking more often, it would greatly reduce emission of greenhouse gases. Using public transport more will also lead less emission of greenhouse gases.

4) – Taking steps to take carbon dioxide out of the air will be a great step to reduce the level of greenhouse gases in the air. We can do this by planting more and more trees and preserving forests, because plants take in carbon dioxide and release oxygen during photosynthesis.

5) – Carbon is also held in soil. So, farming methods such as planting cover crops and crop rotation keeps the soil healthy so that they are effective carbon sinks (Places where carbon dioxide is pulled out of the air.).

6) – Promoting ecological awareness among citizens and administers is also a good start.

7) – We must commit to recycling and the circular economy.

8) – Consuming organic products will also lead to less emission of greenhouse gases.

CONCLUSION

I would conclude by saying that the Greenhouse Effect is a very current topic of discussion and debate because the consequences of this phenomenon when intensified is causing global changes in climate and it poses a serious threat to life on Earth if left unchecked. It shows how a completely natural and essential phenomenon has been turned into a global problem and an ominous threat by the lack of consideration for preserving nature on the part of humans. However, we can still protect the nature and avert any more damage by following a few simple steps in our daily life.

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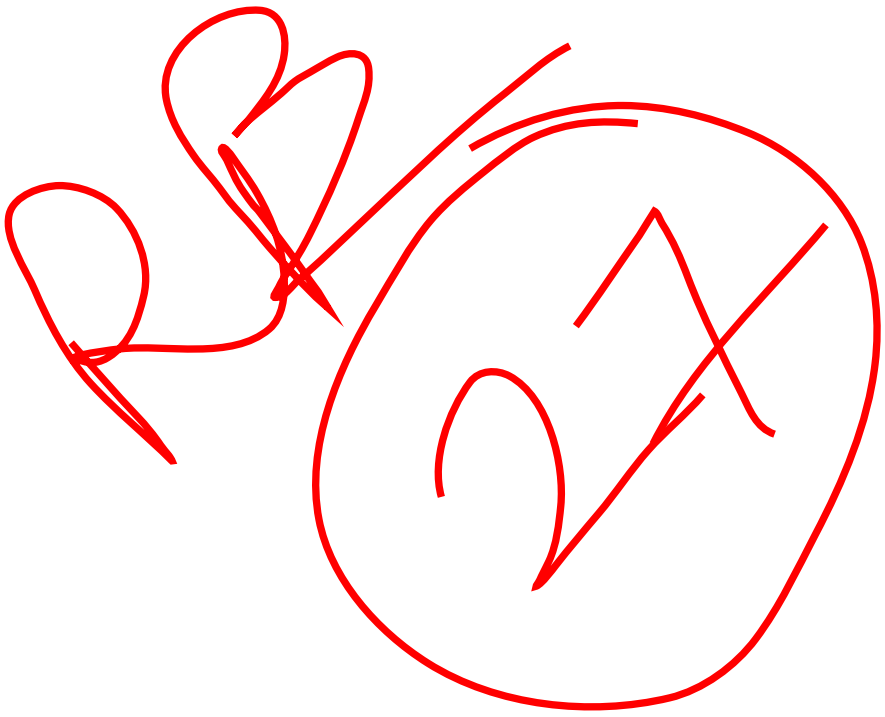
Semester- 2

Honours subject – HISTORY

Subject for Tutorial- AECC ENVS

Tutorial Topic – WATER POLLUTION

Batch- 2020-23



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INTRODUCTION

Water pollution is a broad term that describes any kind of contamination of bodies of water such as rivers, lakes or wetlands with substances that can pose threats to human health or the natural environment.
Such pollution is a major source of death and disease worldwide, especially in developing nations. Even in wealthier nations where piped water supplies mean that water pollution poses fewer direct threats to human health, many lakes and rivers are polluted.

Pollution can come from various sources but the primary sources could be point source and non point source . Point source pollution has single identifiable source, whether it is a wastewater pipe or a ship dumping waste. Nonpoint source pollution comes from water runoff picking scattered pollutants off the ground.

Examples of water pollution include: chemical, industrial waste, fertilizers and pesticides that run off agricultural land into rivers; sewage that enters rivers and seas, Metals that leach out of the ground, or plastics that degrade in water.

Other forms of water pollution include the presence of microbes that can harm human health, an excess of suspended particles that can block light and harm aquatic life .These combined forms of water pollution pose grave threats to human health.

Water pollution is more likely in places where environmental protection laws are weak or poorly enforced, where infrastructure is lacking, and where there is a little awareness of the dangers of allowing harmful substances to enter water bodies such as lakes or rivers.

Most household wastewater generated in less-industrialized countries is released untreated into water courses. This is a major contributor to the nearly two million deaths of children under the age of five every year from water born disease.

Agricultural land is another major source of water pollution, including pesticides, fertilizers and animal waste. In 1995, when about 20 million gallons of waste spilled from a pig farm in North Carolina, United kingdom

killed thousands of fish in local rivers and polluted drinking water for nearby commen.

The Causes of Water Pollution

Water is one of the most important elements on Earth when it comes to sustaining life. Unfortunately, it is also extremely susceptible to pollution. This is largely because water is a universal solvent that can dissolve many substances. While this is a wonderful quality that we take advantage of for everyday tasks such as cooking, cleaning and taking medication, it is also the exact quality that causes water to become polluted so easily.

There are many causes of water pollution. Below, we will focus on seven of the most important ways by which water can become polluted.

1. Industrial Waste

Industrial sites across the world are a major contributor to water pollution. Many industrial sites produce waste in the form of toxic chemicals and pollutants, and though regulated, some still do not have proper waste management systems in place. In those rare cases, industrial waste is dumped into nearby freshwater systems.

CHEMICALS POLLUTES THE OCEAN/SEA

Industrial waste from agricultural sites, mines and manufacturing plants can make its way into rivers, streams and other bodies of water that lead directly to the sea. The toxic chemicals in the waste produced by these industries not only have the potential to make water. It can also cause the

temperature in freshwater systems to change, making them dangerous for many water dwelling organisms.

2. Marine Dumping

The is exactly what it sounds like, dumping garbage into the waters of the ocean. It might seem crazy, but household garbage is still collected and dumped into oceans by many countries across the world. Most of these items can take anywhere from two to 200 years to decompose completely. This kind of pollution can have serious economic and health impacts by killing marine life and damaging habitats and ecosystems. Toxins from pesticides, fertilizers, and other chemicals used on farms contaminate nearby rivers that flow into the ocean, which can cause extensive loss of

marine life in bays and estuaries leading to the creation of dead zones. The dumping of industrial, nuclear and other waste into oceans was legal until the early 1970's when it became regulated; however, dumping still occurs illegally everywhere.

3. Sewage and Wastewater

Harmful chemicals, bacteria and pathogens can be found in sewage and wastewater even when it's been treated. Sewage and wastewater from each household is released into the sea with fresh water. The pathogens and

bacteria found in that wastewater breed disease, and therefore are a cause of health-related issues in humans and animals alike.

4. Oil Spills

Oil is an ancient fossil fuel that we use to heat our homes, generate electricity, and power large sectors of our economy. But when oil accidentally spills into the ocean, it can cause big problems. Just as the saying states, water and oil do not mix, and oil does not dissolve in water. Large oil spills and oil leaks, while often accidental, are a major cause of water pollution. Leaks and spills often are caused by oil drilling operations in the ocean or ships that transport oil. wildlife.

6. Global Warming

Rising temperatures due to global warming are a major concern in terms of water pollution. Global warming causes water temperatures to rise, which can kill water-dwelling animals. When large die-offs occur, it further pollutes the water supply, exacerbating the issue.

There are many everyday ways you can reduce global warming which will in turn help lower water pollution. These methods include recycling, carpooling and using CFL bulbs in your home.

7. Radioactive Waste

Radioactive waste from facilities that create nuclear energy can be extremely hazardous to the environment and must be disposed of

properly. This is because uranium, the element used in the creation of nuclear energy, is a highly toxic chemical.

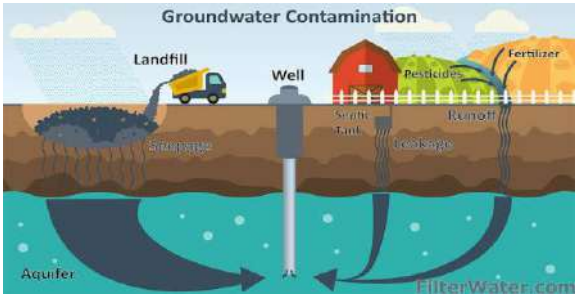
Unfortunately, accidents still occur at these facilities, and toxic waste is released into the environment. The coal and gas industries are, in many ways, no better. This is one of the major impetuses behind the development of alternative, clean sources of energy, including solar and wind.

Various Sources of Water Pollution

There are various classifications of water pollution, which are discussed as follows.

Groundwater Pollution

Groundwater is one of our least visible but most critical natural resources. With rainfall, it becomes groundwater as it sweep deep into the earth,



filling up cracks, crevices, and porous spaces of an aquifer, which is an underground storehouse of water. Groundwater is then pumped to the earth's surface for drinking water.

Groundwater can get polluted such as fertilizers, pesticides, and waste leaching from landfills and septic systems, making their way into an aquifer. Once polluted, an aquifer becomes unsafe for humans and remains unusable for decades, or even thousands of years

Surface Water

Surface water covers about 70% of earth,filling our oceans, lakes, rivers, and including all blue bits on the world map. Surface water from freshwater sources other than the sea accounts for more than 30% of the water delivered to our homes. Nutrient water that includes nitrates and phosphates, which plants and animals need to grow, causes water pollution in the freshwater sources due to farm waste and fertilizer runoff.

Ocean Water

80% of ocean pollution or marine pollution originates on land along the coast or far inland. Streams and rivers carry contaminants such as chemicals, nutrients, and heavy metals that are carried from farms, factories, and cities into our bays and estuaries, and from there, they reach the ocean.

Point Source

When contamination occurs from a single source, it's called point state pollution. Though this pollution originates from a specific place, it can affect miles of waterways and ocean.

Point sources include wastewater, which is known as effluent, legally or illegally discharged from a manufacturing unit, oil refinery, or wastewater treatment facility.

Nonpoint Source

Nonpoint source pollution is contamination derived from multiple or diffused sources. These may include contaminated water traveled after rains, agricultural or stormwater runoff, or debris blown into waterways from the land.

Transboundary

A boundary line cannot contain water pollution on a map. Transboundary pollution happened when contaminated water from one country spilled into

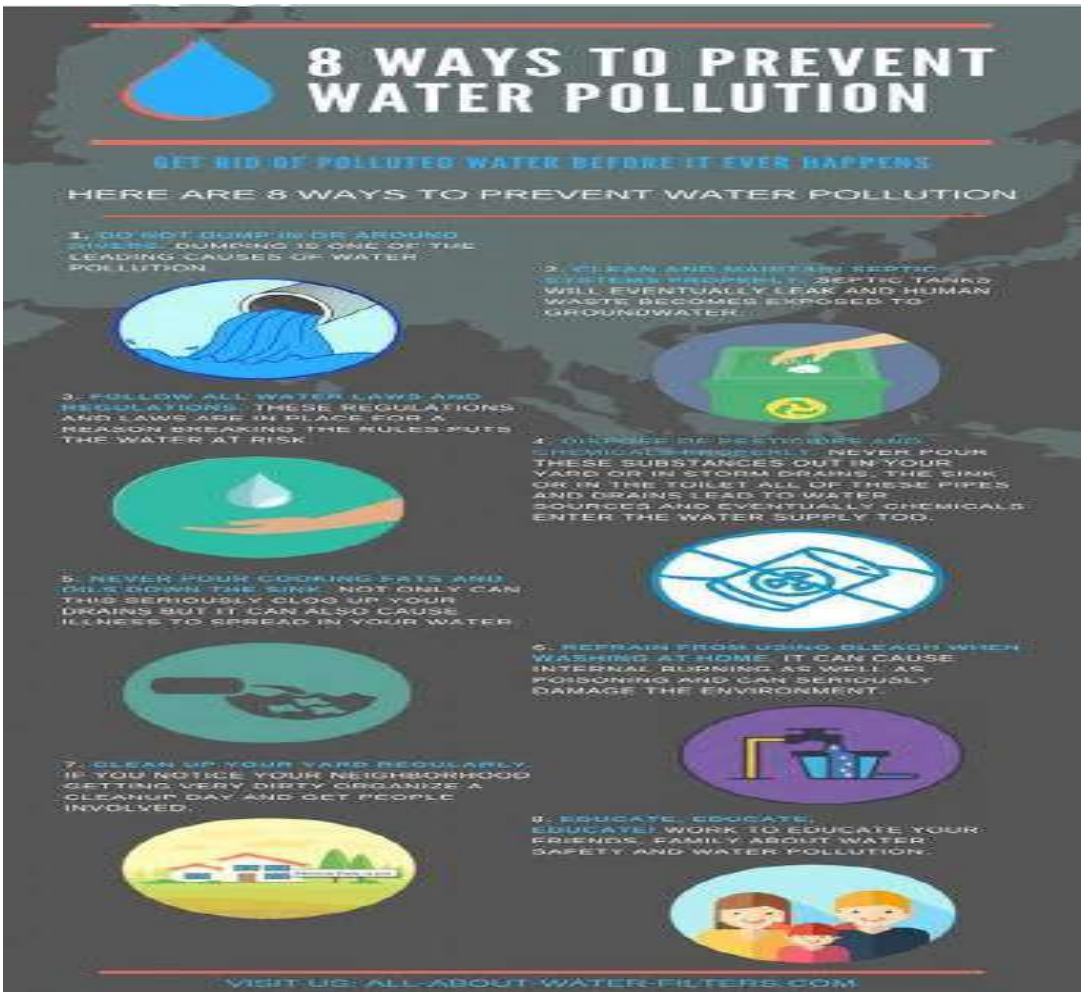
other countries' waters. It can result from a disaster like an oil spill or the slow, downriver creep of industrial, agricultural, or municipal discharge.

PREVENTION

LESS USAGE OF WATER - Clean, fresh water may seem plentiful, but there is a limited amount available on earth. Use water-saving devices on sinks, in toilets, and in showers. Take short showers instead of baths. Do not run the water constantly while brushing your teeth. Wash clothes when you have a full load of laundry. Only water your lawn and plants when absolutely necessary.

NO POURING OF CHEMICALS INTO THE OCEAN/SEA- Use fewer chemicals and cleaners around the home. Not only will you cut down on indoor air pollution, but also on the amount of chemicals entering the water system ◑ If necessary, use biodegradable cleaners. Do not pour oil or other chemicals into the drainage system on the street.

TRY TO AVOID CONTAMINATED WATER : Many homes have lead pipes or lead around connections on the pipes which carry water to their homes.



Since this lead may enter your drinking water and cause medical problems

in young children, you might want to have the water tested. If lead is present, installing a filter may solve the problem

.OUTDOOR WATER SOURCES SHOULD NOT BE POLLUTED- Do not pour oil or other chemicals into the drainage system on the street. A little oil can kill many plants and animals. Do not litter, especially near water. Litter may be eaten as food by animals and cause harm to them. Do not use pesticides on lawns, or use only organic ones. Use less fertilizer, also. All these can enter our water sources.Enjoy water for eating,drinking cleaning etc. Just remember to use it carefully. Do not waste or pollute this limited precious resource.

CONCLUSION

Water pollution stems from many sources and causes, only a few of which are discussed here. Rivers and streams demonstrate some capacity to recover from the effects of certain pollutants, but lakes, bays, ponds, sluggish rivers, and oceans have little resistance to the effects of water pollution. We have a long history of introducing pollutants into aquatic environments, and have had only partial success at repairing the damage that has already been done and curbing the activities that result in environmental degradation. Nonpoint source pollution continues to be a serious threat to receiving waters, as does the continued release of sewage and industrial effluents throughout the world. As we have seen with mercury contamination in fishes, environmental pollution can have widespread and lasting consequences.

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INTRODUCTION

It is an established fact that our metro cities are not good enough to live in. They offer neither pure , safe drinking water nor a healthy , fresh air to breathe. The noise of ever-increasing numbers of vehicles does not allow us to sleep even at night . All our important cities have been found to be the worst polluted cities in the world . It is , therefore, not surprising that major health problems have become recurring occurances. In order to overcome the problem it is important to identify the source of the problem.

Pollution is the addition of unwanted substances into the environment that can damage our Earth. There are 4 main types of Pollution; water pollution, air pollution, soil pollution, and noise pollution. All kinds of Pollution are a result of careless activities by man.Water is another necessity which , again , we get in a highly polluted form. It is easy to isolate the sources of Pollution here.

Water pollution is a broad term that describes any kind of contamination of bodies of water such as rivers, lakes or wetlands with substances that can pose threats to human health or the natural environment.

WATER POLLUTION

Water pollution can be defined in many ways. Usually, it means one or more substances have built up in water to such an extent that they cause problems for animals or people. Oceans, lakes, rivers, and other inland waters can naturally clean up a certain amount of pollution by dispersing it harmlessly. If you poured a cup of black ink into a river, the ink would quickly disappear into the river's much larger volume of clean water. The ink would still be there in the river, but in such a low concentration that you would not be able to see it. At such low levels, the chemicals in the ink probably would not present any real problem. However, if you poured gallons of ink into a river every few seconds through a pipe, the river would quickly turn black. The chemicals in the ink could very quickly have an effect on the quality of the water. This, in turn, could affect the health of all the plants, animals, and humans whose lives depend on the river.

●*CAUSES OF WATER POLLUTION*

Most water pollution doesn't begin in the water itself. Take the oceans: around 80 percent of ocean pollution enters our seas from the land. Virtually any human activity can have an effect on the quality of our water environment. When farmers fertilize the fields, the chemicals they use are gradually washed by rain into the groundwater or surface waters nearby. Sometimes the causes of water pollution are quite surprising. Chemicals released by smokestacks (chimneys) can enter the atmosphere and then fall back to earth as rain, entering seas, rivers, and lakes and causing water pollution. That's called atmospheric deposition. Water pollution has many different causes and this is one of the reasons why it is such a difficult problem to handle.

1.) **SEWAGE** - With billions of people on the planet, disposing of sewage waste is a major problem.

According to 2017 figures from the World Health Organization, some 2 billion people (about a quarter of the world's population) don't have access to safe drinking water or the most basic sanitation, 3.4 billion (60 people of the population) lack "safely managed" sanitation (unshared, with waste properly treated). Although there have been great improvements in securing access to clean water, relatively little, genuine progress has been made on improving global sanitation in the last decade. Sewage disposal affects people's immediate environments and leads to water-related illnesses such as diarrhoea that kills 525,000 children under five each year (Back in 2002, the World Health Organization estimated that water-related diseases could kill as many as 135 million people by 2020; in 2016, the WHO was still estimating the annual death toll from poor water and sanitation at close to a million people a year.) In developed countries, most people have flush toilets that take sewage waste quickly and hygienically away from their homes.

In theory, sewage is a completely natural substance that should be broken down harmlessly in the environment: 90 percent of sewage is water. In practice, sewage contains all kinds of other chemicals, from the pharmaceutical drugs people take to the paper, plastic, and other wastes they flush down their toilets. When people are sick with viruses, the sewage they produce carries those viruses into the environment. It is possible to catch illnesses such as hepatitis, typhoid, and cholera from river and sea water .

2.) **WASTE WATER -** A few statistics illustrate the scale of the problem that waste water chemicals washed down drains and discharged from factories can cause. Around half

of all ocean pollution is caused by sewage and waste water. Each year, the world generates perhaps 5–10 billion tons of industrial waste, much of which is pumped untreated into rivers, oceans, and other waterways. In the United States alone, around 400,000 factories take clean water from rivers, and many pump polluted waters back in their place. However, there have been major improvements in waste water treatment recently. Since 1970, in the United States, the Environmental Protection Agency (EPA) has invested about $70 billion in improving water treatment plants that, as of 2015, serve around 88 percent of the US population (compared to just 69 percent in 1972). However, another $271 billion is still needed to update and upgrade the system.

Factories are point sources of water pollution, but quite a lot of water is polluted by ordinary people from nonpoint sources; this is how ordinary water becomes waste water in the first place. Virtually everyone pours chemicals of one sort or another down their drains or toilets. Even detergents used in washing machines and dishwashers eventually end up in our rivers and oceans. So do the pesticides we use on our gardens. A lot of toxic pollution also enters waste water from highway runoff. Highways are typically covered with a cocktail of toxic chemicals—everything from spilled fuel and brake fluids to bits of worn tires

(themselves made from chemical additives) and exhaust emissions. When it rains, these chemicals wash into drains and rivers. It is not unusual for heavy summer rainstorms to wash toxic chemicals into rivers in such concentrations that they kill large numbers of fish

overnight. It has been estimated that, in one year, the highway runoff from a single large city leaks as much oil into our water environment as a typical tanker spill. Some highway runoff runs away into drains; others can pollute groundwater or accumulate in the land next to a road, making it increasingly toxic as the years go by.

3.) **PLASTIC -** If you've ever taken part in a community beach clean, you'll know that plastic is far and away the most common substance that washes up with the waves. There are three reasons for this: plastic is one of the most common materials, used for making virtually every kind of manufactured object from clothing to automobile parts; plastic is light and floats easily so it can travel enormous distances across the oceans; most plastics are not biodegradable (they do not break down naturally in the environment), which means that things like plastic bottle tops can survive in the marine environment for a long time. (A plastic bottle can survive an estimated 450 years in the ocean and plastic fishing line can last up to 600 years.)While plastics are not toxic in quite the same way as poisonous chemicals, they nevertheless present a major hazard to seabirds, fish, and other marine creatures. For example, plastic fishing lines and other debris can strangle or choke fish. (This is sometimes called ghost fishing.) About half of all the world's seabird species are known to have eaten plastic residues. In one study of 450 shearwaters in the North Pacific, over 80 percent of the birds were found to contain plastic residues in their stomachs. In the early 1990s, marine scientist Tim Benton collected debris from a 2km (1.5 mile) length of beach in the remote Pitcairn islands in the South Pacific. His study recorded approximately a

thousand pieces of garbage including 268 pieces of plastic, 71 plastic bottles, and two dolls heads.

4.) **OIL POLLUTION -** When we think of ocean pollution, huge black oil slicks often spring to mind, yet these spectacular accidents represent only a tiny fraction of all the pollution entering our oceans. Even considering oil by itself, tanker spills are not as significant as they might seem: only 12 percent of the oil that enters the oceans comes from tanker accidents; over 70 percent of oil pollution at sea comes from routine shipping and from the oil people pour down drains on land. However, what makes tanker spills so destructive is the sheer quantity of oil they release at once — in other words, the concentration of oil they produce in one very localized part of the marine

environment. The biggest oil spill in recent years (and the biggest ever spill in US waters) occurred when the tanker Exxon Valdez broke up in Prince William Sound in Alaska in 1989. Around 12 million gallons (44 million litres) of oil were released into the pristine wilderness—enough to fill your living room 800 times over! Estimates of the marine animals killed in the spill vary from approximately 1000 sea otters and 34,000 birds to as many as 2800 sea otters and 250,000 sea birds. Several billion salmon and herring eggs are also believed to have been destroyed.

5.)CHEMICAL WASTE - Detergents are relatively mild substances. At the opposite end of the spectrum are highly toxic chemicals such as polychlorinated biphenyls (PCBs). They were once widely used to manufacture electronic circuit boards, but their harmful effects have now been recognized and their use is highly restricted in many countries. Nevertheless, an estimated half million tons of PCBs were discharged into the environment during the 20th century. [9] In a classic example of trans boundary pollution, traces of PCBs have even been found in birds and fish in the Arctic. They were carried there through the oceans, thousands of miles from where they originally entered the environment. Although PCBs are widely

banned, their effects will be felt for many decades because they last a long time in the environment without breaking down.

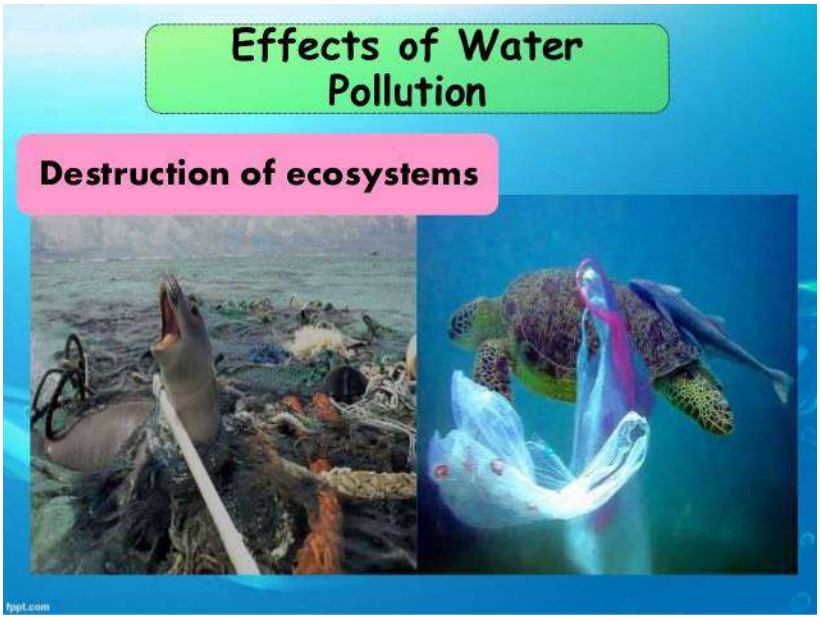
Another kind of toxic pollution comes from heavy metals, such as lead, cadmium, and mercury. Lead was once commonly used in gasoline (petrol), though its use is now restricted in some countries. Mercury and cadmium are still used in batteries (though some brands now use other metals instead). Until recently, a highly toxic chemical called tributyltin (TBT) was used in paints to protect boats from the ravaging effects of the oceans. Ironically, however, TBT was gradually recognized as a pollutant: boats painted with it were doing as much damage to the oceans as the oceans were doing to the boats.

6.)RADIOACTIVE WASTE People view radioactive waste with great alarm—and for good reason. At high enough concentrations it can kill; in lower concentrations it can cause cancers and other illnesses. The biggest sources of radioactive pollution in Europe

are two factories that reprocess waste fuel from nuclear power plants: Sellafield on the north-west coast of Britain and Cap La Hague on the north coast of France. Both discharge radioactive waste water into the sea, which ocean currents then carry around the world. Countries such as Norway, which lie downstream from Britain, receive significant doses of radioactive pollution from Sellafield. [19] The Norwegian government has repeatedly complained that Sellafield has increased radiation levels along its coast by 6–10 times. Both the Irish and Norwegian governments continue to press for the plant's closure.

●*EFFECT OF WATER POLLUTION*

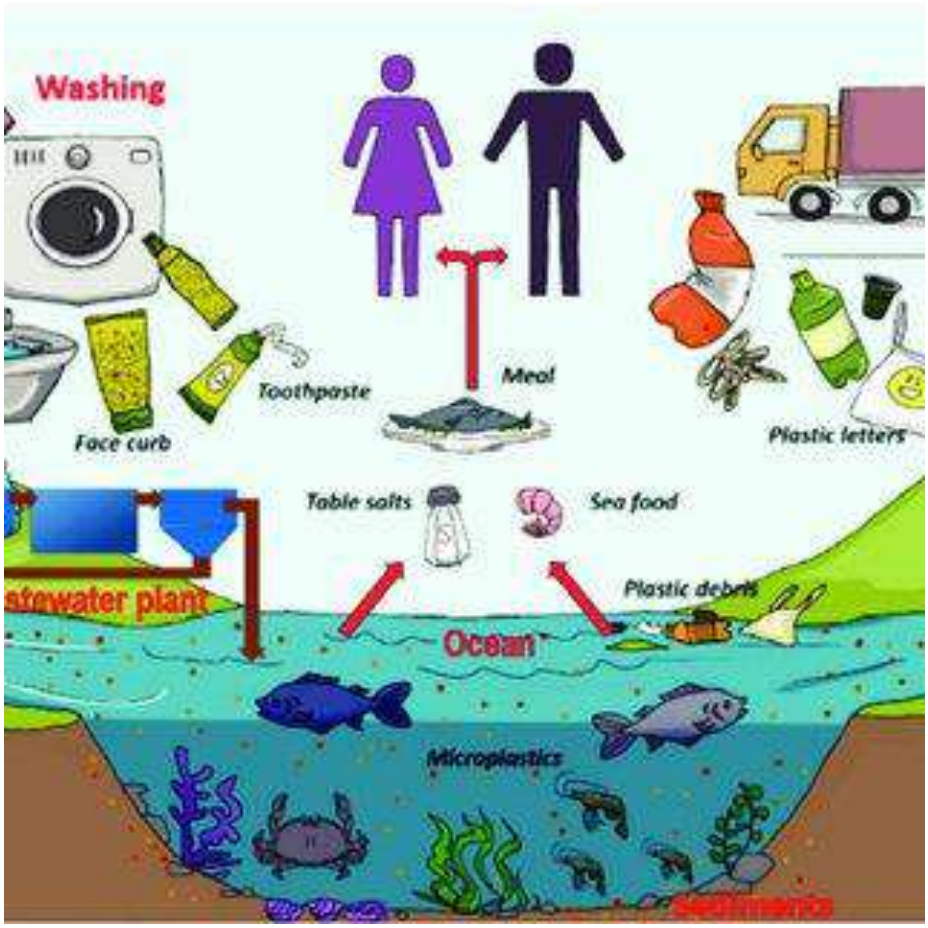
1.) **DISEASES –** In humans, drinking or consuming polluted water in any way has many disastrous effect on our human health. It causes many diseases like typhoid , cholera , hepatitis and various other harmful diseases **2.) 2.) 2.)DESTRUCTION OF ECOSYSTEM –** Ecosystems are very dynamic and even responds to even small changes in the environment. Water pollution can let the entire Ecosystem collapsed if left unchecked.



3.)EUTROPHICATION- Eutrophication is a big word that describes a big problem in the nation's estuaries. Harmful algal blooms, dead zones, and fish kills are the results of a process called eutrophication — which occurs when the environment

becomes enriched with nutrients, increasing the amount of plant and algae growth to estuaries and coastal waters.

EFFECT ON FOOD CHAIN - The effects of many forms of water pollution multiply as they move up the food chain. This gives us no choice but to be concerned about them. After all, we are at the top of the food chain. A pollutant's damage to the food chain depends on various factor. Pollution disrupts the natural food chain as well. Pollutants such as lead and cadmium are eaten by tiny animals. Later, these animals are consumed by fish and shellfish, and the food chain continues to be disrupted at all higher levels.



Steps to prevent further water pollution

There is no easy way to solve water pollution; if there were, it wouldn't be so much of a problem. Broadly speaking, there are three different things that can help to tackle the problem—education, laws, and economics—and they work together as a team.

A) **EDUCATION-** Making people aware of the problem is the first step to solving it. In the early 1990s, when surfers in Britain grew tired of catching illnesses from water polluted with sewage, they formed a group called Surfers Against Sewage to force governments and water companies to clean up their act. People who've grown tired of walking the world's polluted beaches often band together to organize community beach-cleaning sessions. Anglers who no longer catch so many fish have campaigned for tougher penalties against factories that pour pollution into our rivers. Greater public awareness can make a positive difference.

B) **LAWS-** One of the biggest problems with water pollution is its trans boundary nature. Many rivers cross countries, while seas span whole continents. Pollution discharged by factories in one country with poor environmental standards can cause problems in neighbouring nations, even when they have tougher laws and higher standards. Environmental laws can make it tougher for people to pollute, but to be really effective they have to operate across national and international borders. This is why we have international laws governing the oceans, such as the 1982 UN Convention on the Law of the Sea (signed by over 120 nations), the 1972 London (Dumping) Convention, the 1978 MARPOL International Convention for the Prevention of Pollution from Ships, and the 1998 OSPAR Convention for the Protection of the Marine Environment of the North East Atlantic. The European Union has water-protection laws (known as directives) that apply to all of its member states. They include the 1976 Bathing Water Directive (updated 2006), which seeks to ensure the quality of the waters that people use for recreation. Most countries also have their own water pollution laws. In the United States, for

example, there is the 1972 Clean Water Act and the 1974 Safe Drinking Water Act.

C) **ECONOMICS-** Most environmental experts agree that the best way to tackle pollution is through something called the polluter pays principle. This means that whoever causes pollution should have to pay to clean it up, one way or another. Polluter pays can operate in all kinds of ways. It could mean that tanker owners should have to take out insurance that covers the cost of oil spill clean-ups, for example. It could also mean that shoppers should have to pay for their plastic grocery bags, as is now common in Ireland, to encourage recycling and minimize waste. Or it could mean that factories that use rivers must have their water inlet pipes downstream of their effluent outflow pipes, so if they cause pollution they themselves are the first people to suffer. Ultimately, the polluter pays principle is designed to deter people from polluting by making it less expensive for them to behave in an environmentally responsible way.

CONCLUSION

Life is ultimately about choices—and so is pollution. We can live with sewage-strewn beaches, dead rivers, and fish that are too poisonous to eat. Or we can work together to keep the environment clean so the plants, animals, and people who depend on it remain healthy. We can take individual action to help reduce water pollution, for example, by using environmentally friendly detergents, not pouring oil down drains, reducing pesticides, and so on. We can take community action too, by helping out on beach cleans or litter picks to keep our rivers and seas that little bit cleaner. And we can take action as countries and continents to pass laws that will make pollution harder and the world less polluted. Working together, we can make pollution less of a problem—and the world a better place.

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GLOBAL WARMING

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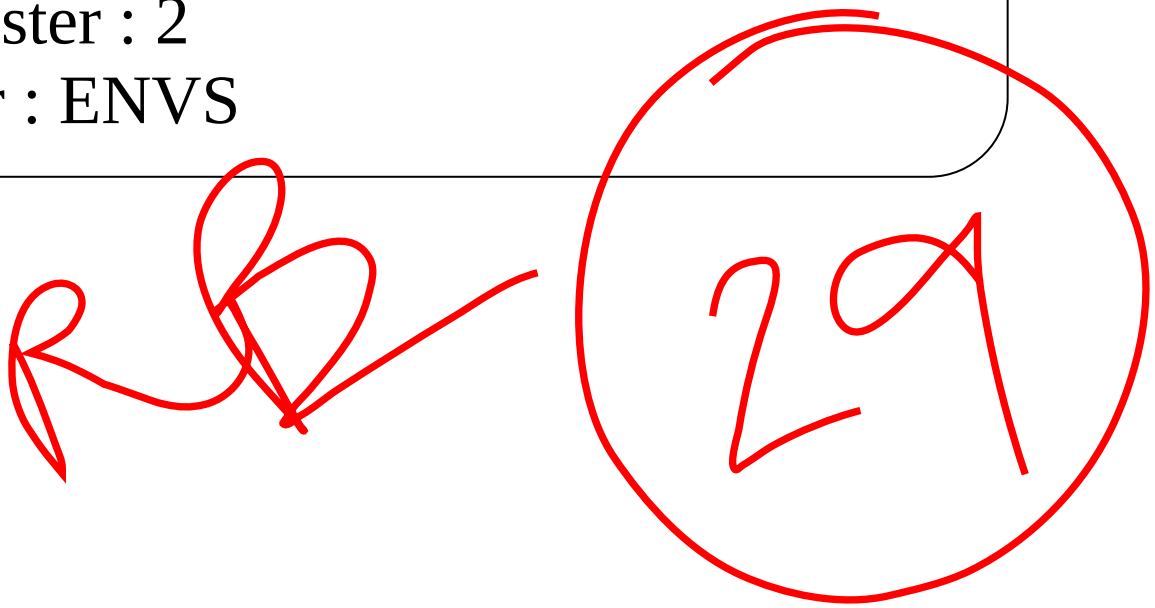
Semester : 2
Paper : ENVS



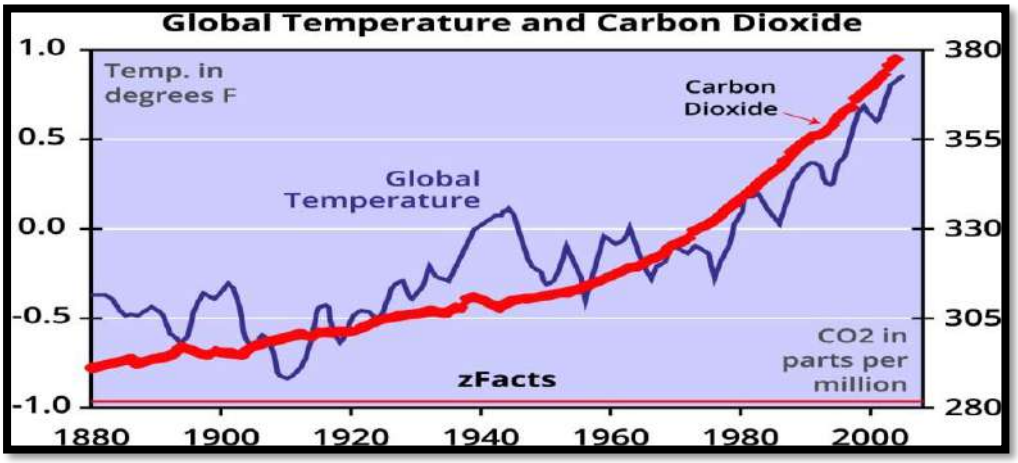
Global Warming

Global warming is the long-term heating of Earth's climate system observed since the pre-industrial period (between 1850 and 1900) due to human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth's atmosphere. The term is frequently used interchangeably with the term climate change, though the latter refers to both human- and naturally produced warming and the effects it has on our planet. It is most commonly measured as the average increase in Earth's global surface temperature.

Since the pre-industrial period, human activities are estimated to have increased Earth's global average temperature by about 1 degree Celsius (1.8 degrees Fahrenheit), a number that is currently increasing by 0.2 degrees Celsius (0.36 degrees Fahrenheit) per decade. Most of the current warming trend is extremely likely (greater than 95 percent probability) the result of human activity since the 1950s and is proceeding at an unprecedented rate over decades to millennia.

The following graph demonstrates that carbon has been rising in the atmosphere long before 1960. With the introduction of fossil fuels, carbon began rising at the beginning of the Industrial Revolution around 1880.

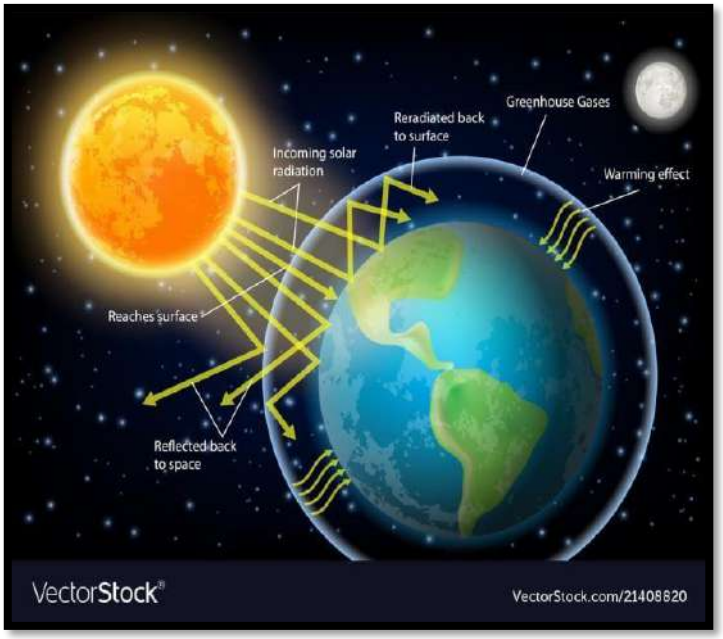
In the graph below, you will notice that the curve of carbon increasing in the atmosphere proceeds from about 1880 to 1950 in a gradual linear progression. From 1950 to 2000 and beyond, carbon increases in the atmosphere in a far steeper, more exponential curve.



since the beginning of the Industrial Revolution. In 1750, there were 280 ppm of carbon dioxide in the atmosphere, but by 2005, the levels of carbon dioxide had risen to 380 ppm, an increase of over one-third. And much of this increase has occurred in recent years, since 1959, as world energy usage has expanded dramatically. The United States is responsible for almost a quarter of the world's greenhouse gas emissions, and China is the second-largest emitter. Other countries with high emissions include members of the European Union, while the lowest emissions come from various nations in Africa.

Greenhouse effect

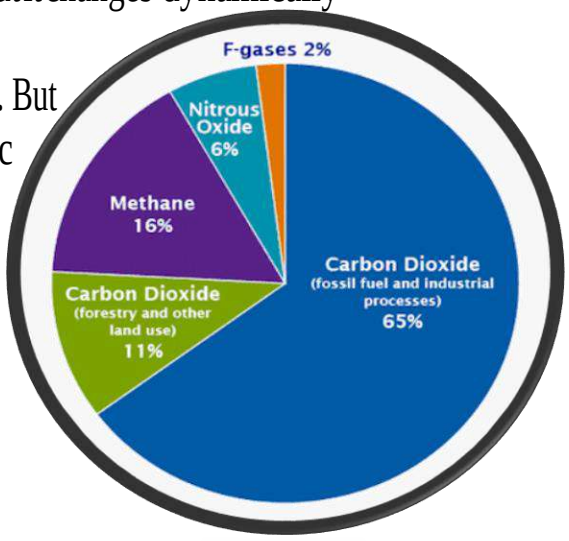
The greenhouse effect is a good thing. It warms the planet to its comfortable average of 59 degrees Fahrenheit (15 degrees Celsius) and keeps life on earth, well, liveable. Without it the world would be a frozen, uninhabitable place, more like Mars. The problem is, mankind's voracious burning of fossil fuels for energy is artificially aping up the natural greenhouse effect. The result? An increase in global warming that is altering the planet's climate systems in countless ways.



Sunlight makes the earth habitable. While 30 percent of the solar energy that reaches our world is reflected back to space, approximately 70 percent passes through the atmosphere to the earth's surface, where it is absorbed by the land, oceans, and atmosphere, and heats the planet. This heat is then radiated back up in the form of invisible infrared light. While some of this infrared light continues on into space, the vast majority—indeed, some 90 percent—gets absorbed by atmospheric gases, known as greenhouse gases, and redirected back toward the earth, causing further warming.

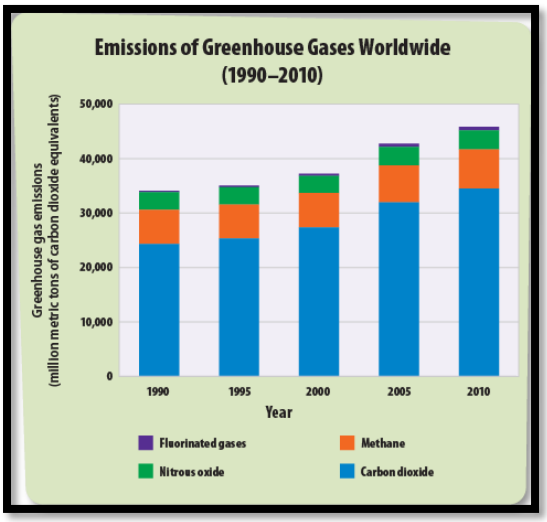
For most of the past 800,000 years—much longer than human civilization has existed—the concentration of greenhouse gases in our atmosphere was between about 200 and 280 parts per million. (In other words, there were 200 to 280 molecules of the gases per million molecules of air.) But in the past century, that concentration has jumped to more than 400 parts per million, driven up by human activities such as burning fossil fuels and deforestation. The higher concentrations of greenhouse gases—and carbon dioxide in particular—is causing extra heat to be trapped and global temperatures to rise.

The climate change issue doesn't begin and end with carbon dioxide; it is one of many greenhouse gases. The most prevalent is water vapour, but it changes dynamically with temperature and so reinforces the role that carbon dioxide plays in climate change. But several other greenhouse gases have become problematic over the last century as a result of human activity.



Methane or CH_4 is produced in many combustion processes and also by anaerobic decomposition. Methane breaks down in approximately 10 years, but is a precursor of ozone, itself an important GHG. CH_4 has a GWP of 28-36. The gas is different from carbon dioxide because it presents us with more of a flow problem than a stock problem due to its breakdown in the atmosphere. Methane is naturally emitted, but human activities have added to this. The largest anthropogenic sources are agricultural methane from belching cows as they digest food, rice paddies and fossil methane (natural gas) from fugitive sources in the global oil, gas and coal industry.

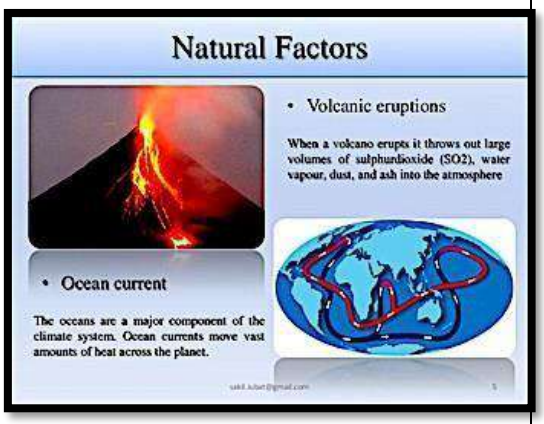
Nitrous oxide in parean (laughing gas), NO/N2O or simply NOx is a by-product of fertilizer production and use, other industrial processes and the combustion of certain materials. Nitrous oxide lasts a very long time in the atmosphere, but at the 100-year point of comparison to CO_2, its GWP is 265-298.



Fluorinated gases were created as replacements for ozone depleting refrigerants, but have proved to be both extremely long lasting and extremely warming GHGs. They have no natural sources, but are entirely man-made. At the 100-year point of comparison, their GWPs range from 1,800 to 8,000 and some variants top 10,000.

Sulphur hexafluoride or SF_6 is used for specialized medical procedures, but primarily in what are called dielectric materials, especially dielectric liquids. These are used as insulators in high voltage applications such as transformers and grid

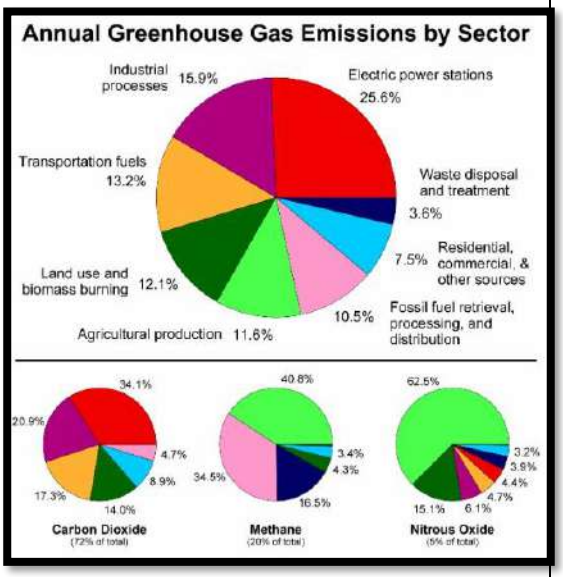
switching gear. SF6 will last thousands of years in the upper atmosphere and has a GWP of 22,800.



Black carbon (BC) is tiny particles of carbon released as a result of the incomplete combustion of fossil fuels, biofuels and biomass. These particles are extremely small, ranging from 10 µm (micrometres, PM10), the size of a single bacterium to less than 2.5 µm (PM2.5), one thirtieth the width of a human hair and small enough to pass through the walls of the human lung and into the bloodstream.

Although BC – think of the plume of smoke from a chimney or a fire – falls out of the lower atmosphere in days, while it is suspended in the air, it absorbs the sun's heat millions of times more effectively than CO2. When wind carries BC over snow, glaciers or ice caps where it falls out onto the white, normally reflective surface, it is particularly damaging because it contributes directly to melting. Overall, BC is considered the second biggest contributor to global warming after CO2.

Fossil fuel and related uses of coal and petroleum are the most important sources of GHGs and black carbon (power generation, industry, transportation, buildings).



Agriculture is the second most important source (animals – cows and pigs), feed production, chemical intensive food production, and flooded paddy rice production, as well as deforestation driven by the desire to expand cultivated areas.

(New studies suggest that agriculture is the largest contributor of particulate emissions in the US and other developed agricultural countries.)

Natural sources of GHGs and black carbon include forest fires, savanna fires and volcanos.

On Earth, human activities are changing the natural greenhouse. Over the last century the burning of fossil fuels like coal and oil has increased the concentration of atmospheric carbon dioxide (CO2). This happens because the coal or oil burning

process combines carbon with oxygen in the air to make CO_2. To a lesser extent, the clearing of land for agriculture, industry, and other human activities has increased concentrations of greenhouse gases.

The consequences of changing the natural atmospheric greenhouse are difficult to predict, but some effects seem likely:

- On average, Earth will become warmer. Some regions may welcome warmer temperatures, but others may not.

- Warmer conditions will probably lead to more evaporation and precipitation overall, but individual regions will vary, some becoming wetter and others dryer.

- A stronger greenhouse effect will warm the ocean and partially melt glaciers and ice sheets, increasing sea level. Ocean water also will expand if it warms, contributing further to sea level rise.

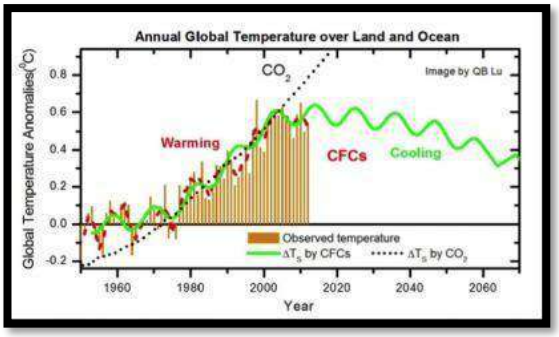
- Outside of a greenhouse, higher atmospheric carbon dioxide (CO_2) levels can have both positive and negative effects on crop yields. Some laboratory experiments suggest that elevated CO_2 levels can increase plant growth. However, other factors, such as changing temperatures, ozone, and water and nutrient constraints, may more than counteract any potential increase in yield. If optimal temperature ranges for some crops are exceeded, earlier possible gains in yield may be reduced or reversed altogether. Climate extremes, such as droughts, floods and extreme temperatures, can lead to crop losses and threaten the livelihoods of agricultural producers and the food security of communities worldwide. Depending on the crop and ecosystem, weeds, pests, and fungi can also thrive under warmer temperatures, wetter climates, and increased CO_2 levels, and climate change will likely increase weeds and pests.

Finally, although rising CO_2 can stimulate plant growth, research has shown that it can also reduce the nutritional value of most food crops by reducing the concentrations of protein and essential minerals in most plant species. Climate change can cause new patterns of pests and diseases to emerge, affecting plants, animals and humans, and posing new risks for food security, food safety and human health.

Effects Of Global Warming

1. On biodiversity: The increase of temperatures and the climate upheavals disturb the ecosystems, modify the conditions and cycles of plant reproduction. The scarcity of resources and climate change are changing life habits and migratory cycles of animals. We are already witnessing the disappearance of many species - including endemic species - or, conversely, the intrusion of invasive species that threaten crops and other animals. Global warming therefore impacts biodiversity. It is the balance of biodiversity that is modified and threatened. According to the IPCC, a 1.5°C (34.7°F) average rise might put 20-30 % of species at risk of extinction. If the planet warms by more than 2°C, most ecosystems will struggle.

2. On oceans: Because of global warming, permafrost and ice are melting massively at the poles, increasing the sea level at a rate never known before. In a century, the increase reached 18 cm (including 6 cm in the last 20 years). The worst-case scenario is a rise of up to 1m by 2100. The acidification of the oceans is also of great concern. In fact, the large amount of CO2 captured by the oceans makes them more acidic, arousing serious questions about the adaptability of seashells or coral reefs.



3. On humans: Human beings are not spared by these upheavals. Climate change is affecting the global economy. It is already shaking up social, health and geopolitical balances in many parts of the world. The scarcity of resources like food and energy gives rise to new conflicts. Rising sea levels and floods are causing population migration. Small island states are in the front line. The estimated number of climate refugees by 2050 is 250 million people.

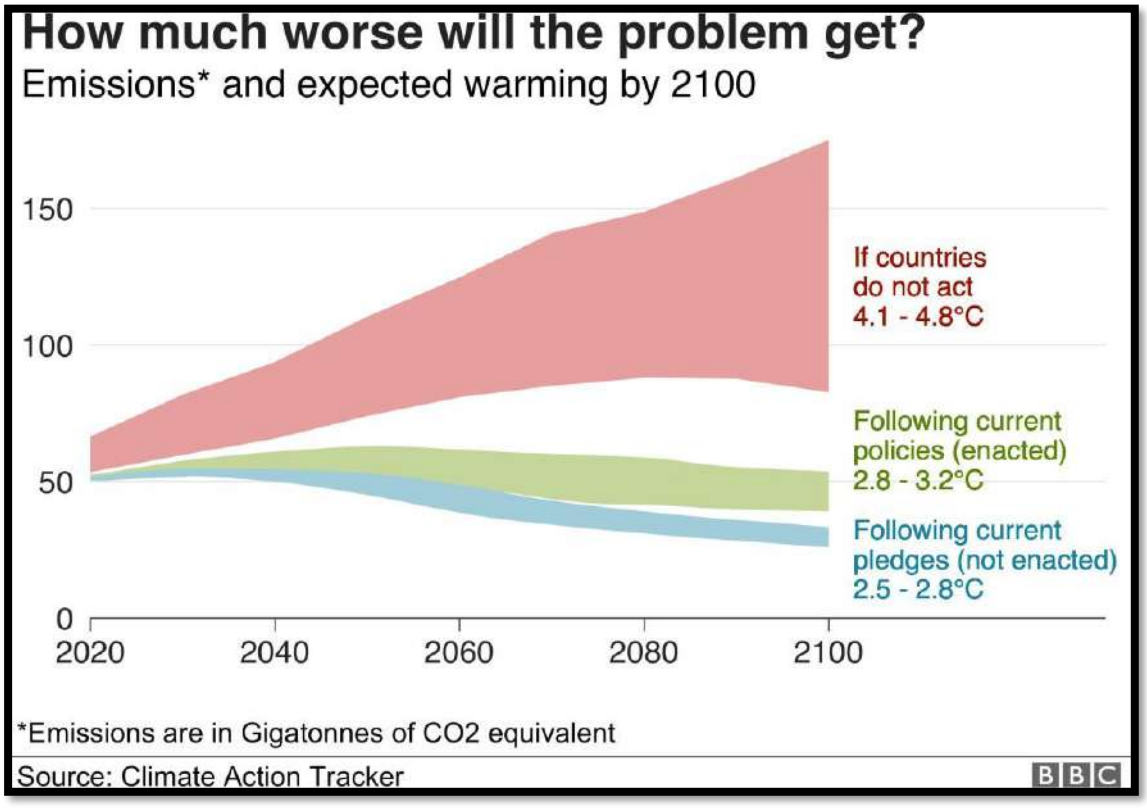
4. On the weather: For decades now, meteorologists and climatologists around the world have been watching the effects of global warming on the weather phenomena. And the impact is huge: more droughts and heatwaves, more precipitations, more natural disasters like floods, hurricanes, storms and wildfires, frost-free season, etc.

Scientists have high confidence that global temperatures will continue to rise for decades to come, largely due to greenhouse gases produced by human activities. The Intergovernmental Panel on Climate Change (IPCC), which includes more than 1,300 scientists from the United States and other countries, forecasts a temperature rise of 2.5 to 10 degrees Fahrenheit over the next century.

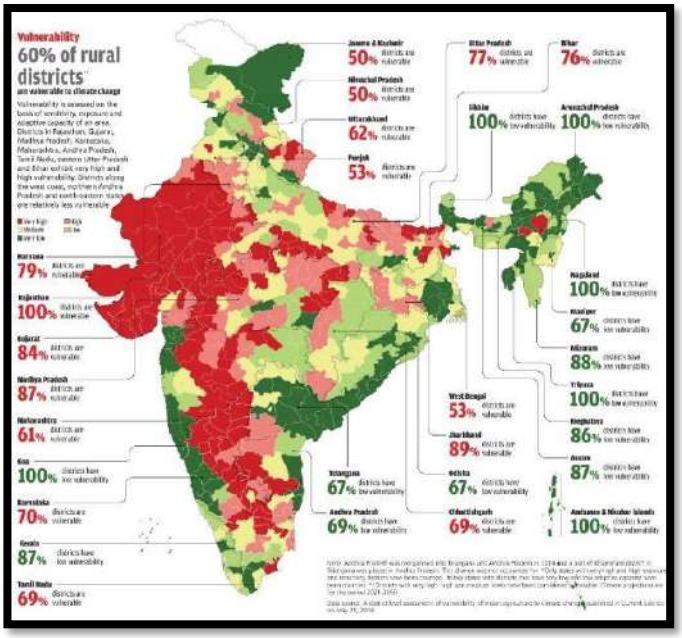
According to the IPCC, the extent of climate change effects on individual regions will vary over time and with the ability of different societal and environmental systems to mitigate or adapt to change.

The IPCC predicts that increases in global mean temperature of less than 1.8 to 5.4 degrees Fahrenheit (1 to 3 degrees Celsius) above 1990 levels will produce beneficial impacts in some regions and harmful ones in others. Net annual costs will increase over time as global temperatures increase.

"Taken as a whole," the IPCC states, "the range of published evidence indicates that the net damage costs of climate change are likely to be significant and to increase over time."



IMPACT OF GLOBAL WARMING ON INDIA



An introduction to the profile of India:

India is the second most populous country of the world with a population over 1.2 billion. India lies to the north of the equator between 6° 44′ and 35° 30′ north latitude and 68° 7′ and 97° 25′ east longitude. It shares a coastline of 7517 km with the Indian Ocean, the Arabian Sea and the Bay of Bengal. It has land boundaries with Pakistan, China, Nepal, Bhutan, Burma and Bangladesh.

Climate of India:

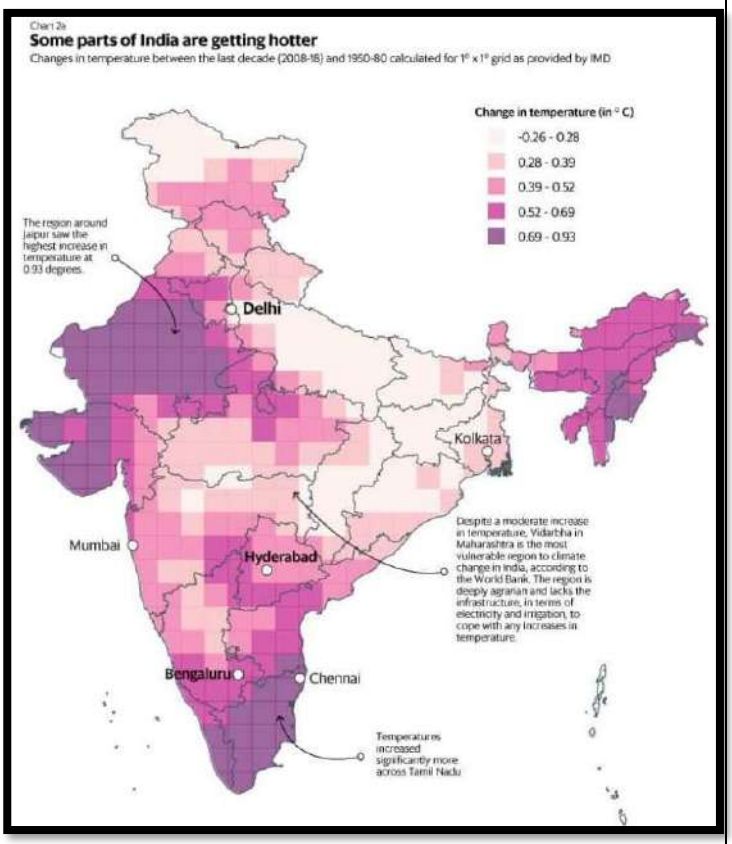
India exhibits a wide diversity of temperatures. The Himalayas participate in warming by preventing the cold winds from blowing in, and the Thar desert attracts the summer monsoon winds, which are responsible for making the majority of the monsoon season of India. However, the majority of the regions can be considered climatically tropical.

The climate of India is dominated by the monsoon season, which is the most important season of India, providing 80 % of the annual rainfall. The season extends from June to September with an average annual rainfall between 750–1,500 mm across the region. The monsoon of India is regarded as the most productive wet season on the earth.

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.



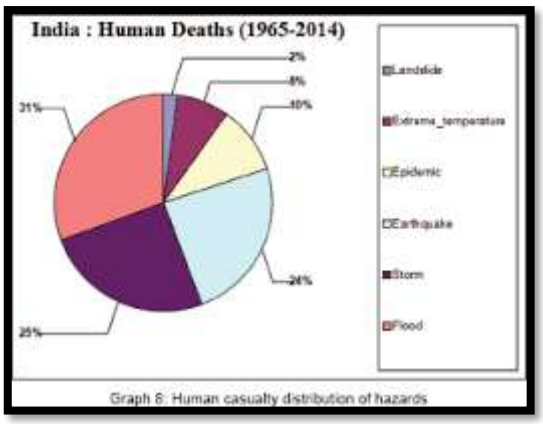
According to surveys, in the year 2007-2008, India ranked the third highest in the world regarding the number of significant disasters, with 18 such events in one year, resulting in the death of 1103 people due to these catastrophes.

The anticipated increase in precipitation, the melting of glaciers and expanding seas have the power to influence the Indian climate negatively, with an increase in incidence of floods, hurricanes, and storms.

Global warming may also pose a significant threat to the food security situation in India.

According to the The **I**ndira **G**andhi **I**nstitute of **D**evelopment **R**esearch, if the process of global warming continues to increase, resulting climatic disasters would cause a decrease in India's GDP to decline by about 9 %, with a decrease by 40 % of the production of the major crops. A temperature increase of 2°C in India is projected to displace seven million people, with a submersion of the major cities of India like Mumbai and Chennai.

Recent climatic disasters in India due to global warming:

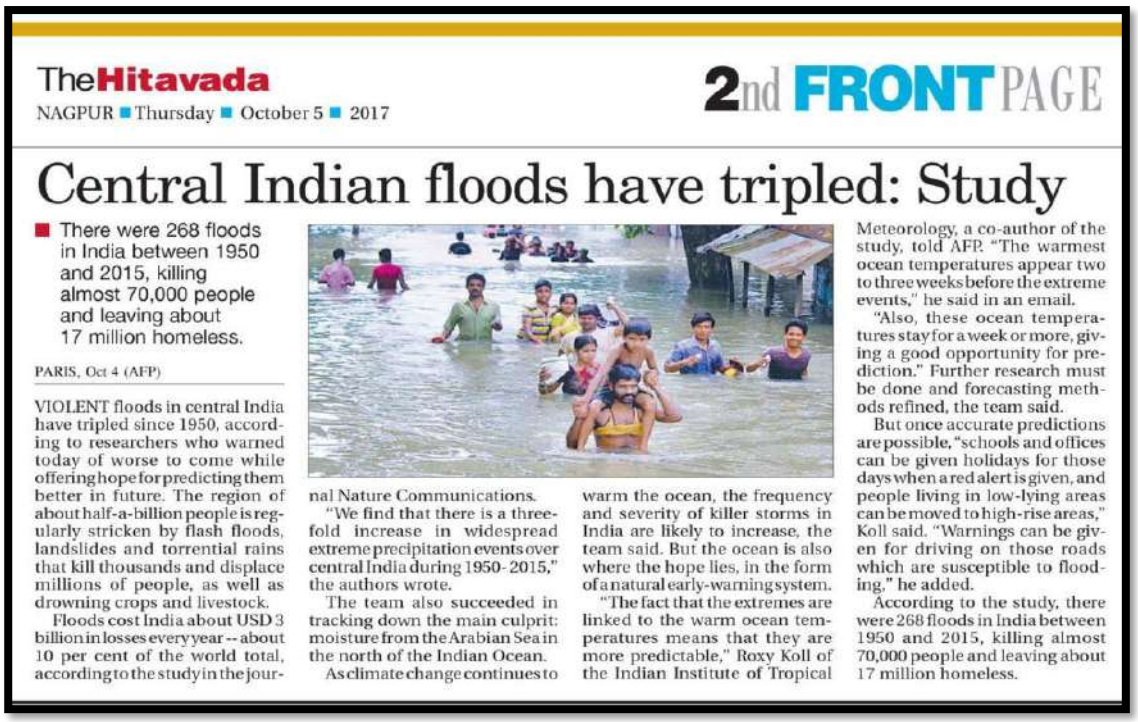


Graph 6: Human casualty distribution of hazards

Floods in India: India is the most flood distressed state in the world after Bangladesh, accounting for 1/5th of the global deaths every year with 30 million people displaced from their homes yearly. Approximately 40 million hectares of the land is vulnerable to floods, with 8 million hectares affected by it. Unprecedented floods take place every year at one place or the other,

with the most vulnerable states of India being Uttar Pradesh, Bihar, Assam, West Bengal, Gujarat, Orissa, Andhra Pradesh, Madhya Pradesh, Maharashtra, Punjab and Jammu & Kashmir. The climatic history of India is studded with a very large number of floods, which have wreaked havoc on the country's economy.

The top floods in India's history:



The Hitavada
NAGPUR ■ Thursday ■ October 5 ■ 2017

2nd FRONT PAGE

Central Indian floods have tripled: Study

■ There were 268 floods in India between 1950 and 2015, killing almost 70,000 people and leaving about 17 million homeless.

PARIS, Oct 4 (AFP)

VIOLENT floods in central India have tripled since 1950, according to researchers who warned today of worse to come while offering hope for predicting them better in future. The region of about half-a-billion people is regularly stricken by flash floods, landslides and torrential rains that kill thousands and displace millions of people, as well as drowning crops and livestock.

Floods cost India about USD 3 billion in losses every year -- about 10 per cent of the world total, according to the study in the journal Nature Communications.

"We find that there is a three-fold increase in widespread extreme precipitation events over central India during 1950-2015," the authors wrote.

The team also succeeded in tracking down the main culprit: moisture from the Arabian Sea in the north of the Indian Ocean.

As climate change continues to warm the ocean, the frequency and severity of killer storms in India are likely to increase, the team said. But the ocean is also where the hope lies, in the form of a natural early-warning system.

"The fact that the extremes are linked to the warm ocean temperatures means that they are more predictable," Roxy Koll of the Indian Institute of Tropical Meteorology, a co-author of the study, told AFP. "The warmest ocean temperatures appear two to three weeks before the extreme events," he said in an email.

"Also, these ocean temperatures stay for a week or more, giving a good opportunity for prediction." Further research must be done and forecasting methods refined, the team said.

But once accurate predictions are possible, "schools and offices can be given holidays for those days when a red alert is given, and people living in low-lying areas can be moved to high-rise areas," Koll said. "Warnings can be given for driving on those roads which are susceptible to flooding," he added.

According to the study, there were 268 floods in India between 1950 and 2015, killing almost 70,000 people and leaving about 17 million homeless.

1987 Bihar Flood: The flood of 1987 in Bihar was so destructive that it left a total of 1400 people and more than 5000 animal dead. A total of 67,881+680.86 lac INR was the damage to the state; affecting more than 29 million people. After this flood, the River Koshi has been named as" Sorrow of Bihar" (Bihar kashok).

2008 Bihar floods: The 2008 Bihar floods are considered as one of the most disastrous floods in the state's history. The flood affected more than 2 million people. The flooded and affected areas were Supaul, Araria, Madhepura, Saharsa, Champaran and Purnea.

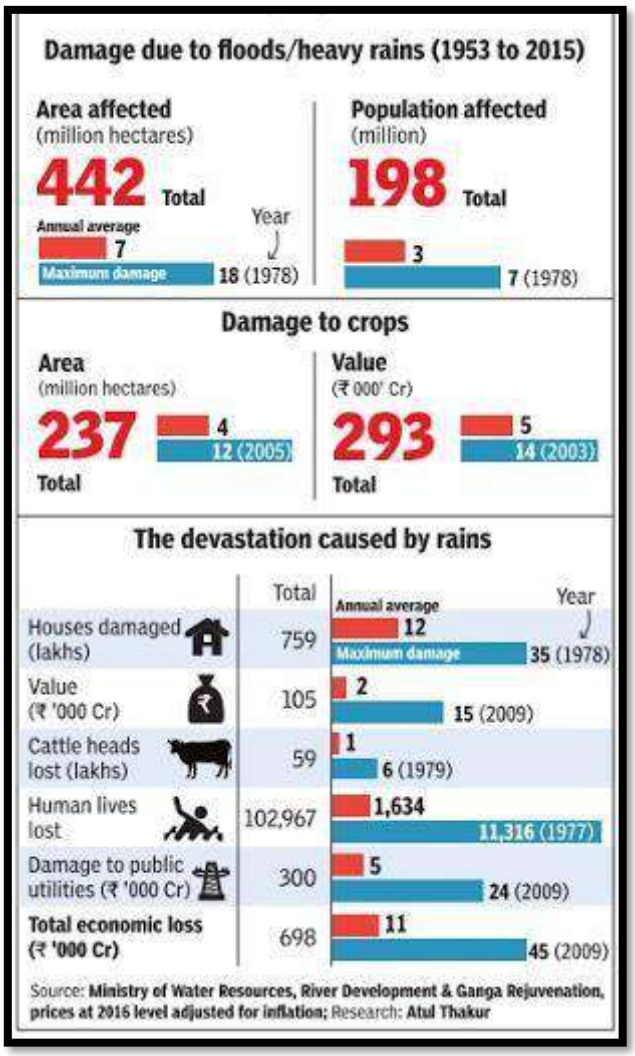
Other major floods in India

2005: Maharashtra flood: In 2005, a major climatic catastrophe occurred in the state of Maharashtra in the form of massive floorings, leading to a death toll of 5000 people. The areas of Mumbai, Chiplun, Khed, Kalyan, Ratnagiri and Raigad were

completely flooded, hence naming the date 26 July 2005 as the BLACK DAY in the history of Mumbai.

2005: Gujarat Floods: The wave of floods in Maharashtra reached the state of Gujarat as well, accounting for one of the worst floods in the Indian History as it caused a financial loss of more than Rs.800 million. This disaster took place in a row of days from 30th June to July 11, killing more than 123 people and a total of 250k people were evacuated. Infrastructure of the state also suffered badly as train services, Road Operations and communications were destroyed.

2009 Indian floods: The 2009 India floods affected various states of India in July 2009. The most affected states were Karnataka, Orissa, Kerala, Gujarat and North-East Indian states, with over 200 people reported dead, and a million homes destroyed.



2010 Ladakh floods: On 6th August 2010, Leh and many other villages of the Ladakh range were drowned by a downpour that killed at least 255 people, and resulted in a state loss of Rs. 133 crores. The unexpected heavy rainfall was attributed to the climatic changes resulting from global warming.

2011 Indian floods: The 2011 surge of severe precipitation affected India savagely, with surging flood waters in Northern and Eastern India affecting more than 10 million people as the swollen rivers washed away roads and towns, particularly in the states of West Bengal, Bihar, Kerala and Assam.

2012 Northern Indian floods: The year 2012 is also included in the continuous chain of years of floods in India. In Assam, at least 27 people died and 900,000 were forced to evacuate their homes as monsoon rains drowned large areas. Starting on 4 Aug, unremitting showers fell on the northern states of Uttarakhand, Himachal Pradesh

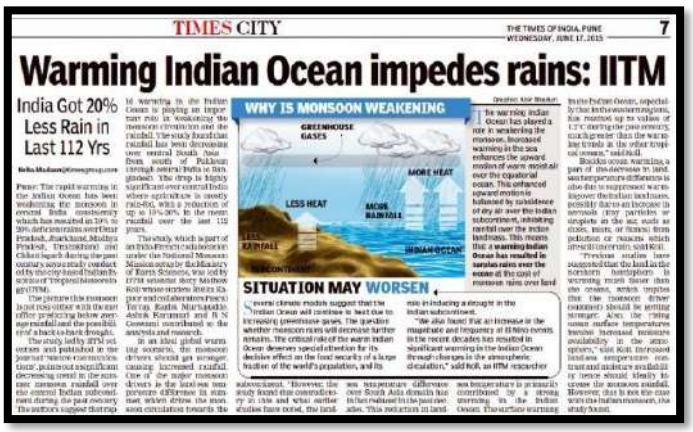
and Jammu, resulting in landslides, cloudbursts and flash floods. At least 34 people were killed and hundreds were made homeless.

2018 kerela floods: For centuries, Kerala's geography was its USP. It was blessed with moderate climate and scenic locations. The narrow strip of land, 35 to 125 km wide and 580 km long, is wedged between the Western Ghats and Arabian Sea. The state had never bothered about global warming induced climatic changes, but the consecutive floods in August 2018 and 2019 have prompted a rethink. The 2018 August floods, the worst in about a century, destroyed Rs 31,000 crore worth of infrastructure and livelihoods and killed 453 persons.

In 2019 too, floods caused by the southwest monsoon have played havoc in the state. Till now, 121 lives have been claimed by the floods and another 21 are reported missing after the northern parts of Kerala were hit by the monsoon fury. Massive landslides were reported in Wayanad, Palakkad and Malappuram districts. Over the last few days, Kochi, the state's commercial capital, was flooded during the northeast monsoon, a phenomenon never experienced in the past.

The India Meteorological Department data reveals that the 2,309.8 mm rainfall the state received was 13 per cent more than normal for the southwest monsoon and the 326.5 mm rainfall the state received from October 1 to 23 was 40 per cent above normal. "This year, the southwest monsoon overran to mid-October and the northeast monsoon set in without a break. The monsoon calendar has changed and its intensity too," says an IMD official who did not want to be named.

Other climatic disasters in India:



TIMES CITY

THE TIMES OF INDIA, PUNE 7

WEDNESDAY, JUNE 17, 2015

Warming Indian Ocean impedes rains: IITM

India Got 20% Less Rain in Last 112 Yrs

WHY IS MONSOON WEAKENING

GREENHOUSE GASES

MORE HEAT

LESS HEAT

MORE RAINFALL

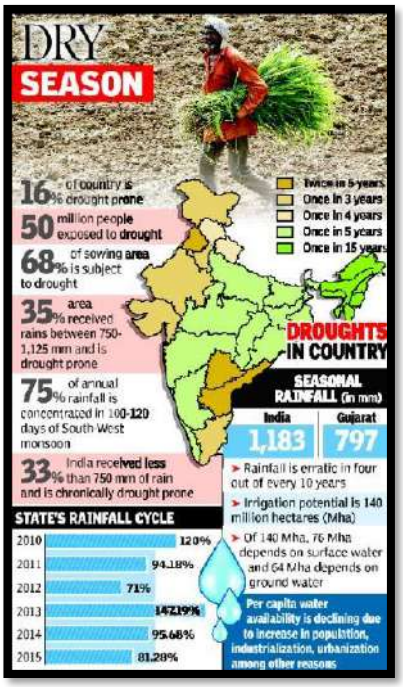
LESS RAINFALL

INDIAN OCEAN

SITUATION MAY WORSEN

Droughts: Of the total agricultural land in India, about 68 % is prone to drought of which 33% is chronically drought prone, receiving rainfall of less than 750mm per year. This is particularly the states of Maharashtra, Gujarat, Rajasthan, Karnataka, Andhra Pradesh and Orissa.
The World Record for Drought was in 2000 in Rajasthan, India.

According to researches, unabated global warming will lead to exacerbation of the droughts, cutting down the water availability in the plains of Pradesh and Bihar. India's initial National Communication to the United Nations Framework Convention (UNFCCC) on Climate Change projects that Luni; the west flowing rivers of Kutchh and Saurashtra are likely to experience acute physical water scarcity. The river basins of Mahi, Pennar, Sabarmati and Tapi are also likely to experience constant water scarcities and shortages.



The Indian economy is considered as one of the fastest growing major economies. However, the country is plagued by climatic disasters that continue to wreak havoc on its economy. As a result, majority of the people of India continue to live in poverty, with malnutrition and diseases corroding the society. In this light, a comprehensive mitigation and adaptation plan needs to be drafted and implemented for better preparation and response to such climate disasters that are generated as a result of global warming.

CYCLONES:

As a result of global warming, the average number of Category 4 and 5 hurricanes per year has increased over the past 30 years. India has an 800 km coastline, and is therefore very susceptible to cyclonic activity. Cyclones have been observed to be more frequent in the Bay of Bengal than the Arabian Sea. Consequently, the states of West Bengal, Orissa, Andhra Pradesh, and Tamil Nadu along the Bay of Bengal are the most affected. The notable cyclones in Indian history include the 1737 Calcutta cyclone, 1970 Bhola cyclone, and Cyclone 05B, which affected more than a million people.

The National Institute of Oceanography (NIO), under the Council of Scientific and Industrial Research (CSIR), Government of India, researched on the impacts of climate change on sea level, to assess the degree to which mean sea level and the occurrence of extreme events may change, and concluded that an increased

occurrence of cyclones in the Bay of Bengal, particularly in the post-monsoon period, along with increased maximum wind speeds associated with cyclones and a greater number of high surges under climate change has been observed. In addition, the strength of tropical cyclones, which represent a threat to the eastern coast of India and to Bangladesh, is also likely to increase.

Disasters ranked according to reported (a) deaths and (b) economic losses (1970–2012). TC indicates disasters caused by tropical cyclones.

(a)	Disaster type	Year	Country	Number of deaths
1	Storm (TC[a])	1970	Bangladesh	300 000
2	Storm (TC[b])	1991	Bangladesh	138 866
3	Storm (*Nargis*)	2008	Myanmar	138 366
4	Flood	1974	Bangladesh	28 700
5	Storm (TC)	1985	Bangladesh	15 000
6	Storm (TC)	1977	India	14 204
7	Storm (TC)	1999	India	9 843
8	Storm (TC)	1971	India	9 658
9	Flood	1980	China	6 200
10	Storm (*Sidr*)	2007	Bangladesh	4 234

CLIMATIC EFFECTS ON THE SEA AND COASTAL AREAS:

India has a long coastline with the Arabian Sea and the Bay of Bengal. The coastal areas of India are highly vulnerable to the effects of global warming, as they are densely populated with people who are totally dependent on the sea for their food supply. Therefore, any damage to the natural cycle of the sea affects the people of India very severely.

Already global warming has resulted in an increased cyclonic activity, sea level rises displacing people, flooding, and the reduction in the sea food due to the acidification of the waters. Thousands of people have been displaced by ongoing sea level rises that have submerged low-lying islands in the Sundarbans. A one-meter sea level rise is projected to displace approximately 7.1 million people in India and about 5,764 Km2 of land area will be lost, along with 4200 Km of road. Around seven million people are projected to be displaced due to submersion of parts of Mumbai and Chennai if global temperatures were to rise by a mere 2 °C. The effects of global warming have also caused damage to coastal infrastructure, aquaculture and coastal tourism. The aquatic ecosystems such as mangroves, coral reefs and grass lands have also been affected by the climatic change.

Thus, the process of global warming has affected India intensely, destroying its economy and depriving its people of their basic needs like food and shelter. The current patterns of destructive floods, increasing intensity of cyclones, recurring droughts and the increasing temperatures are all the results of global warming.

WAYS TO PREVENT GLOBAL WARMING

There is no one-size-fits-all approach to stopping or slowing global warming, and each individual, business, municipal, state, tribal, and federal entity must weigh their options in light of their own unique set of circumstances. Experts say it is likely many strategies working together will be needed. Generally speaking, here are some examples of mitigation strategies we can use to slow or stop the human- caused global warming:

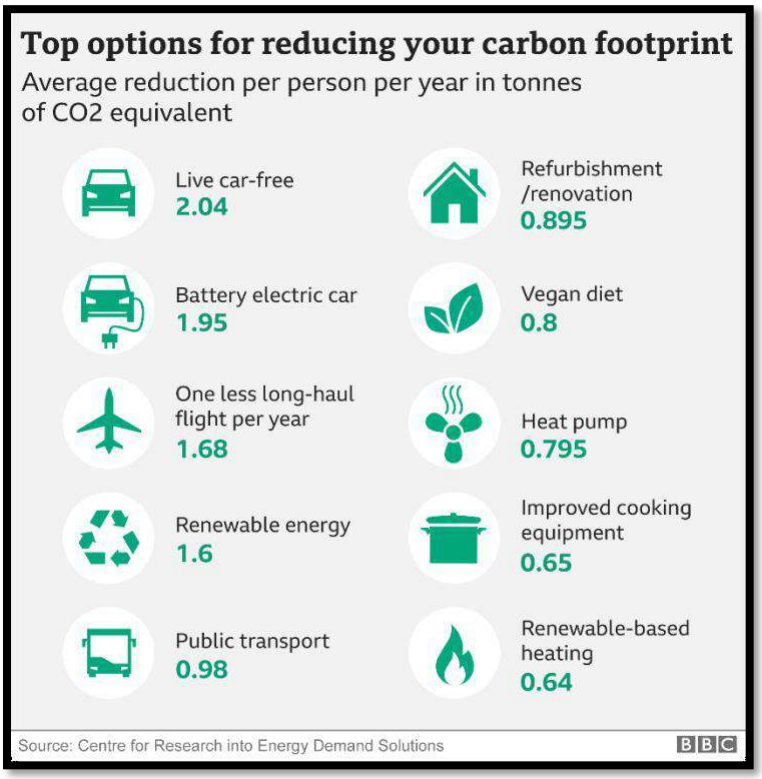
- Reforestation is the most cost-effective way to prevent global warming, according to research presented at the American Association for the Advancement of Science conference. Trees absorb carbon dioxide (reminder: which makes up 82 % of greenhouse gases in our atmosphere), so planting more trees can help reduce the amount of carbon in our atmosphere. In fact, we could remove roughly two-thirds of human- made carbon just by letting all forests regrow, according to a study published in the journal
of Science.
- Do our part to reduce waste by choosing reusable products instead of disposables -- get a reusable water bottle, for example. Buying products with minimal packaging will help to reduce waste. And whenever we can,
recycle paper, plastic, newspaper, glass, and aluminium cans.
- Adopting responsible consumption habits is crucial, be it regarding food (particularly meat), clothing, cosmetics or cleaning products. Last but not least, recycling is an absolute necessity for dealing with waste.
- Encouraging better use of natural resources, stopping massive deforestation as well as making agriculture greener and more efficient should also be a priority
- In order to reduce the CO2 emissions from buildings - caused by heating, air conditioning, hot water or lighting - it is necessary both to build new low energy buildings, and to renovate the existing constructions.

- Where possible, we can switch to renewable sources of energy (such as solar and wind energy) to power our homes and buildings, thus emitting far less heat- trapping gases into the atmosphere.

- Where feasible, we can drive electric vehicles instead of those that burn fossil fuels; or we can use mass transit instead of driving our own cars.

- Where affordable, we can conserve energy by better insulating our homes and buildings, and by replacing old, failing appliances with more energy-efficient models.

- Where practical, we can support more local businesses that use and promote sustainable, climate-smart practices such as those listed above.



- We can consider placing an upper limit on the amount of carbon dioxide we will allow ourselves to emit into the atmosphere within a given timeframe.

STEPS TAKEN BY INDIAN GOVERNEMENT TO MITIGATE FLOODS AND OTHER CLIMATIC DISASTERS:

- In India, National Disaster Management Authority (NDMA) is the apex body for addressing the disaster related policy issues and for laying guidelines. The Ministry of Environment and Forests, the Ministry of Science and Technology, the Ministry of External Affairs as well as the Prime Minister's Office are the offices related to climatic changes. India has always been plagued by the recurrent and devastating floods. The history of mitigating steps taken by the Indian government can be traced back to 1953, when the unprecedented floods of 1953

struck India, at which time the first national policy in this regard was made. After that, every government employed many policies and committees to counteract the dreaded floods and their devastations.

- Community based disaster preparedness (CBDP): The ministry of Home Affairs, government of India has taken an initiative at local level known as the community-based disaster preparedness. It functions with the help of the local people as well as the NGOs to help prepare the people for different climatic disasters by mobilizing them easily, and helping in providing relief to the affected community. Other tasks of this committee include the preparation of seasonal calendars to predict the climatic disasters, mapping the risks faced by the community and taking actions to prevent them.

STEPS REQUIRED BY THE INDIAN GOVERNMENT TO MITIGATE GLOBAL WARMING AND RESULTING CLIMATIC DIASTERS:

- In spite of the steps taken by the Indian government, global warming continues to increase, and the resulting climatic disasters ravage the country in an unabated manner. This can be attributed to the lack of resources, and access to technology. To cope up with the climate change-disasters-security nexus, the country needs to have a better technical understanding, capacity building, networking and expansive consultation processes spanning every section of the society. The committees and organizations working to counteract against the climatic disasters work independently from each other. The ongoing climatic changes, with an increase in a possibility of more disasters impose imperatives for a unity among all these bodies, resulting in an integrated risk management framework, creating a common platform for the committees to work on. India has a distinctive vulnerability profile as the poor are the most affected. Tremendous weather events take place more frequently and are becoming more ruthless. Therefore, the previous attempts of just rescuing the affected will not be enough now, instead, meticulous steps to prevent these disasters are required. This can only be met if the strategies and policies can cope with climate change, requiring the active participation of the government and the people.

CONCLUSION

In spite of the steps taken by different independent bodies, global warming continues to increase, and the resulting climatic disasters ravage the earth in an unabated manner. This can be attributed to the lack of resources, gaps and access to technology. To cope up with the climate change-disasters-security nexus, the world needs to have a better technical understanding, capacity building, networking and expansive consultation processes spanning every section of the society. The committees and organizations working to counteract against the climatic disasters work independently from each other. The ongoing climatic changes, with an increase in a possibility of more disasters impose imperatives for a unity among all these bodies, resulting in an integrated risk management framework, creating a common platform for the committees to work on. Some countries have a distinctive vulnerability profile as the poor are the most affected. Tremendous weather events take place more frequently and are becoming more ruthless. Therefore, the previous attempts of just rescuing the affected will not be enough now, instead, meticulous steps to prevent these disasters are required. This can only be met if the strategies and policies can cope with climate change, requiring the active participation of the different independent governing bodies and scientists all over the world.

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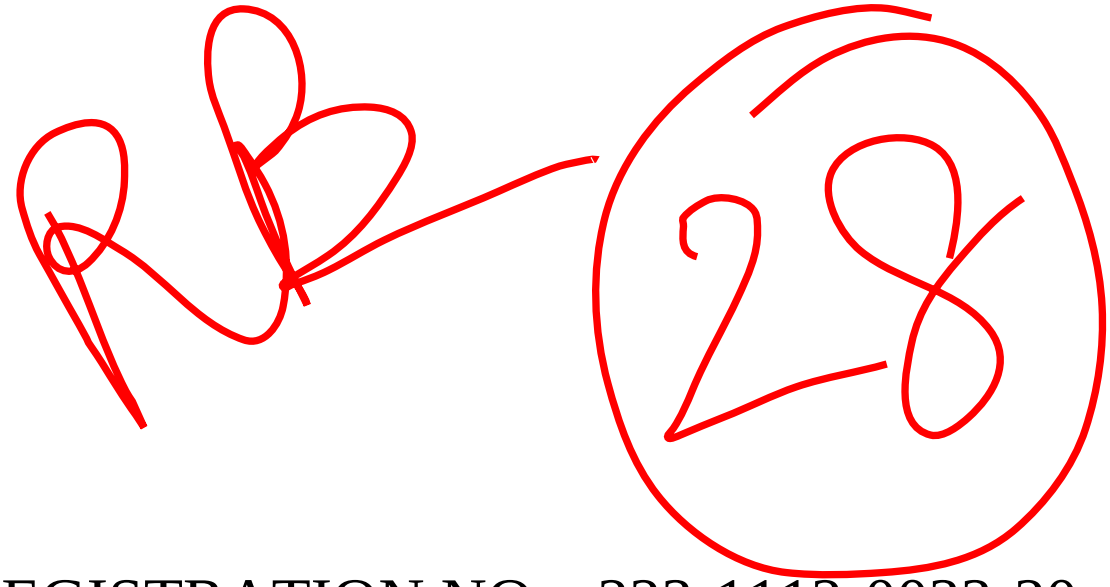
WATER POLLUTION



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INTRODUCTION

Fig 1 - Water Pollution

Water – an essential and natural resource for all life on Earth. It is known as "Universal Solvent". It dissolves maximum substances as compared to any other liquid, which means its most likely to get polluted.

WATER POLLUTION - 'Addition of certain substances to the water such as organic, inorganic, biological, radiological heat, which degrades the quality of water so that it becomes unfit for use. It is not only confined to surface water, but it has also spread to ground water, sea and ocean.

71% of earth's surface is covered with water and only 1 % of total amount of water of the hydrosphere is available to biotic communities from various sources such as ground water, lakes, soils, rivers etc. Despite of the fact water is one of our most poorly managed resources which is wasted and polluted to a large extent. Moreover, little efforts are put in the direction to recharge the water sources to make it available. Additionally, the growth in human population and fast rate of expansion of industries on the name of development has resulted in the degradation of water quality to a larger extent.

SOURCES

POINT SOURCES	NON-POINT SOURCES
i) It comes through discrete pipes and flows into a river.	i)It is more diffuse sources and doesn't come from one single pipe.
ii)Sources are municipal and industrial effluents.	ii)Sources are return flow from irrigated agriculture.
iii) Overflow of sanitary sewers.	iii) Runoff from pasture and range.
iv)Runoff from oilfields, animal feedlots, waste disposal sites.	iv) Runoff from abandoned mines, construction sites.

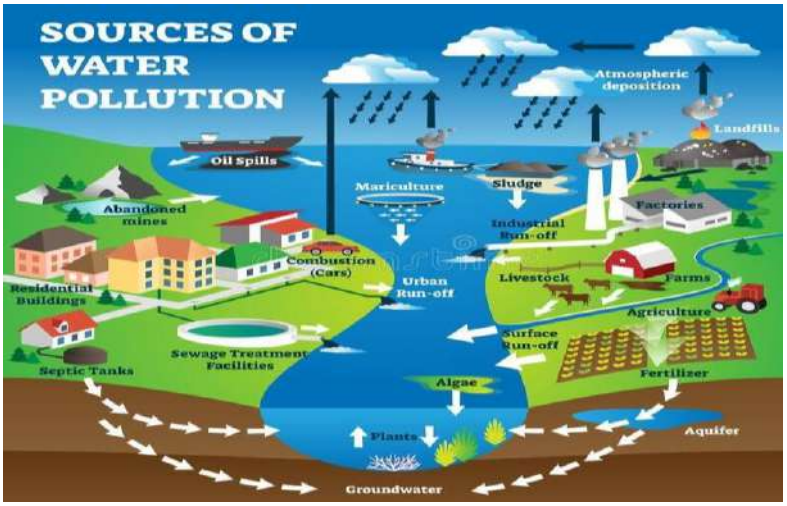

Fig 2 – Sources of Water Pollution

Some of the important sources of water pollution are discussed below:-

Sewage and Wastewater -Water after use becomes Wastewater. The rainwater which washes chemicals, oil, etc. and run into waterways are also referred to as the Wastewater. Without being reused or treated, most of the wastewater comes back to the ecosystem.

Agriculture – One of the main source of Water Pollution is Agriculture. It causes it through rainwater. When all the chemicals, fertilizers, pesticides from the field get washed through rain and runs into the waterways, it contaminates the water, which contains large amounts of Phosphorous and Nitrogen. All these leads to the death of aquatic animals, fish, seabirds, marine mammals as well as harms human beings. The contaminates encourage the algal blooms growth, which when decomposes, use the oxygen present in water. Lack of oxygen causes 'dead zones'- where the fishes cannot survive. Globally, there are almost 245,000 square kilometers of dead zones, as estimated by UNESCO.

Plastics and Garbages –

Fig 3- Plastics

Plastic comprises 10% of the annual wastes. Due to its extensive usage, 4.8 – 12.7 million tons of wastes enters into the seawater through garbages discarded from peoples daily usage, from agricultural fields and debris from ships.

As plastic breaks, microplastics are formed, which are very small and fishes considering them as food consumes these microplastics, which are indirectly consumed by humans ultimately. Over a million of seabird dies each year due to the plastic debris.

Oil - Through the factories, oil enters into the sea, as well as when there is spill in the oil tankers. It is very dangerous among all the other pollutants. In a very short period, oil spreads over a large area. It is lighter than water and thus floats on the water surface, decreasing the level of oxygen in water.

Thermal Pollution - Water quality and aquatic biota are adversely affected by changes in water temperature. Due to human activities, majority of thermal Pollution takes place in water. Nuclear Power plants, coal fire power plant, electric power plants, petroleum refineries are the important sources of thermal Pollution. These sources releases large amount of heat to the water body which changes the Physical and chemical characteristics of the water bodies which receives it. The oxygen contents of water is declined due to high temperature, disturbing the respiratory rates and the reproductive cycles. These causes difficulties for the aquatic life.

Radioactive waste - The presence of radioactive materials in water causes the Radioactive pollution. It is classified into small and large doses . The ones which temporary stimulate the metabolism are the small doses while the ones which gradually damage the organism causing genetic mutation are the large doses. Radioactive sediment , Nuclear Power plants, usage of radioisotopes in medical and research purposes are the sources of Radioactive waste.

Climate change - Through evaporation, soil moisture, geographical changes in precipitation intensity, the frequency of droughts and floods the water resources has been impacted by Global Warming .The monsoon rainfall will increase in India with increased greenhouse gases and sulphate aerosols. This will result into land degradation, limited water supply and will impact on agriculture and drinking water.

EFFECT ON HUMAN HEALTH

Fig 4 – Effect on Human Health

i) We are drinking water which contains chemical waste like heavy metals, fertilizers and pesticides. When ingested they cause severe health problems like Cancer, kidney problems, damages immune system, cardiovascular problems and also sometimes damages the reproductive systems. It can also cause hairloss, rashes, itchy skin and respiratory infections. For weakening of bones and protection against dental

carriers, the presence of fluoride in water is very necessary. Lead is contaminated through the household plumbing system into the drinking water. It may affect the kidney and the central nervous system. Mercury is used as smelters in industries and in the manufacture of pesticides , fungicides , etc.

ii) Contaminated water contains bacteria which are responsible for diarrhea , typhoid, polio and few other diseases like hepatitis A, cholera and dysentery. Around 300,000 children every year below the age of five dies due to unsafe drinking water and unhealthy sanitation and hygiene. Salmonella sp., Shigella sp., Escherichia coli and Vibrio cholera are the microorganisms that plays a major role in the quality of water and are responsible for the water-borne diseases. When faeces enter the water supply, a dangerous form of water pollution occurs.

iii) Microplastics if examined, can be found in the digestive system of most humans. We not only consume it by eating seafood that takes the broken down plastics as their food but also through drinking water. It is also found within salt and other food products causing metabolic disorder and oxidative stress in humans.

EFFECT ON PLANTS

Fig 5 - Effect on Plants

Effects of slit deposition - Due to flood and erosion carrying slit laden water , deposition of slit in water bodies takes place. This reduces light penetration in deep water causing decline in abundance of submerged plants and increases the turbidity of water. The growth of aquatic plants are inhibited by Siltation. Reduction in surface exchange of gases and nutrients affects the abundance of phytoplankton. Polygonum, Sagittaria grows in dominance.

Effects of acid deposition - When fossil fuel combustion takes place from industrial or domestic sources, aerosols and other acidic substances are released into the atmosphere, which falls on ground and runs into waterbodies along with the run-off rainwater from polluted soil surface, then the pH of the water body gets lowered, causing acidification of water bodies. Chemicals like sulphates, chlorides makes the waterbodies much more acidic.

Nutrient deficiency in aquatic ecosystem - The critical pH of the aquatic species is 6.0, the diversity of the aquatic species reduces below this pH and the number of acid tolerant species increases. In acid water, the population of decomposing micro-organisms reduces, which will reduce the decomposition rate of the organic matter thus affecting the nutrient cycling. At the initial stage of acidification of water the filamentous algae gets proliferated, and forms a thick mat. Below the pH of 5.8, diatoms and green algae disappears. Cladophora is found

abundantly in acidic freshwater bodies as they are highly acid tolerant. The roots of Macrophytes gets affected in acidic water which results in poor plant growth, thus are generally absent in acidic water, whereas Potamogeton pectenalis is present in acidic water. Plants which have short roots gets severely affected in acidic water while the ones with deep roots and rhizomes use less affected in acidified water.

Phytotoxicity effects on plants - Plants can absorb the chemicals through their roots, when chemical pollutants build up in aquatic or terrestrial environments. It takes place when toxic chemicals poison plants. Poor growth, dying seedlings and dead spots on leaves are the symptoms of phytotoxicity on plants.

Effects of organic matter deposition - From sewage discharges organic matter from dead and decaying materials of plants and animals is directly deposited and gets washed into the water bodies causing increase in microbes. Nutrient availability increases due to rapid decomposition of organic matter, which favours growth to planktonic green algal bloom. Salvania, Eicchornia reduces penetration of light into deeper layer of water body, growing rapidly. This reduces the dissolved oxygen and increases the biological oxygen demand.

STEPS TAKEN BY GOVERNMENT

The quality of water bodies are monitored by The Central Pollution Control Board (CPCB) along with State Pollution Control Boards (SPCBs) and Pollution Control Committees (PPCs) at 2500 locations across the country under National Water Quality Monitoring Programme (NWQMP). This indicates that organic pollution is the predominant cause for Water Pollution.

Steps taken to address the issue of Water Pollution by the Government are :-

i) To restore the quality of water in aquatic resources and for sewage management, action plan was prepared by the State Government.

ii) To check the discharge of effluent directly into the water bodies Online Effluent Monitoring System is installed.

iii) For assessing the quality of water , monitoring network are being set up.

iv) To improve the water quality of the rivers action is taken by SPCBs / PCCs to comply with effluent standards.

v) Financial assistance is provided to Small Scale Industrial units for installing Common Effluent Treatment Plants.

vi) For implementing Zero Liquid Discharge directions are issued.

WATER POLLUTION IN INDIA

Fig 6 - Water pollution In India

According to a report published by MoEF (Ministry of Environment and Forest) in 2009, water pollution is a serious problem in India as almost 70 per cent of its surface water are contaminated by toxic pollutants as per the report of MOWR(Ministry of Water Resource) in 2000. According to the report degraded water quality can contribute to water scarcity as it limits its availability for both human use and the ecosystem. In the same report groundwater contamination has been identified as a serious major problem affecting 19 states of India. Many districts of Bihar, West Bengal, Delhi, Rajasthan and many other states have been identified as higher level of fluoride concentration in water. Also, water of many districts of Uttar Pradesh, West Bengal has high concentration of arsenic. The water quality monitoring results obtained by the CPCB (Central pollution Control Board) during 1995 to 2009 indicate that organic and bacterial contamination was critical in the water bodies and its cause was discharge of industrial wastewater in an untreated manner into the waterways. It's no wonder that disease rates are high and life expectancy is low in New Delhi. Agricultural practices have been identified as the largest polluter of water bodies in India (MoEF 2009). This is due to the increase in pesticide use, which grew by 750 % over the second half of the

twentieth century, and excessive application of fertilizers for increasing of crop production. . The Central and State Pollution Control Boards have identified 1,532 “grossly polluting” industries across the country (MoEF 2009). The small scale industries contribute considerable amount of pollutant in water. A large number of paper mills are also in small scale sector, making it difficult to manage the effluent. Water in India is governed under three different Acts: the Environmental Protection Act (1986), the River Boards Act (1956) and the Inter State Water Disputes Act (1956). Namami Gange is an ambitious project launched by Government of India in recent years to work in the direction of controlling and monitoring the water pollution level in river Ganga yet there is a lot left to implement and reduce the level of water pollution significantly.

CONCLUSION

There is more than a billion people who doesn't have access to proper drinking water and more than 2 billion people who doesn't have proper sanitation. Very soon most of the world to come to fight over water which the future generations are going to face.

It is a very serious issue as it not only effect the human health but also affect every living life and the industries and agriculture.

It is very important that we take immediate measures and devise methods to reduce the water pollution as we have to save it on time.

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ENVIRONMENTAL POLLUTION

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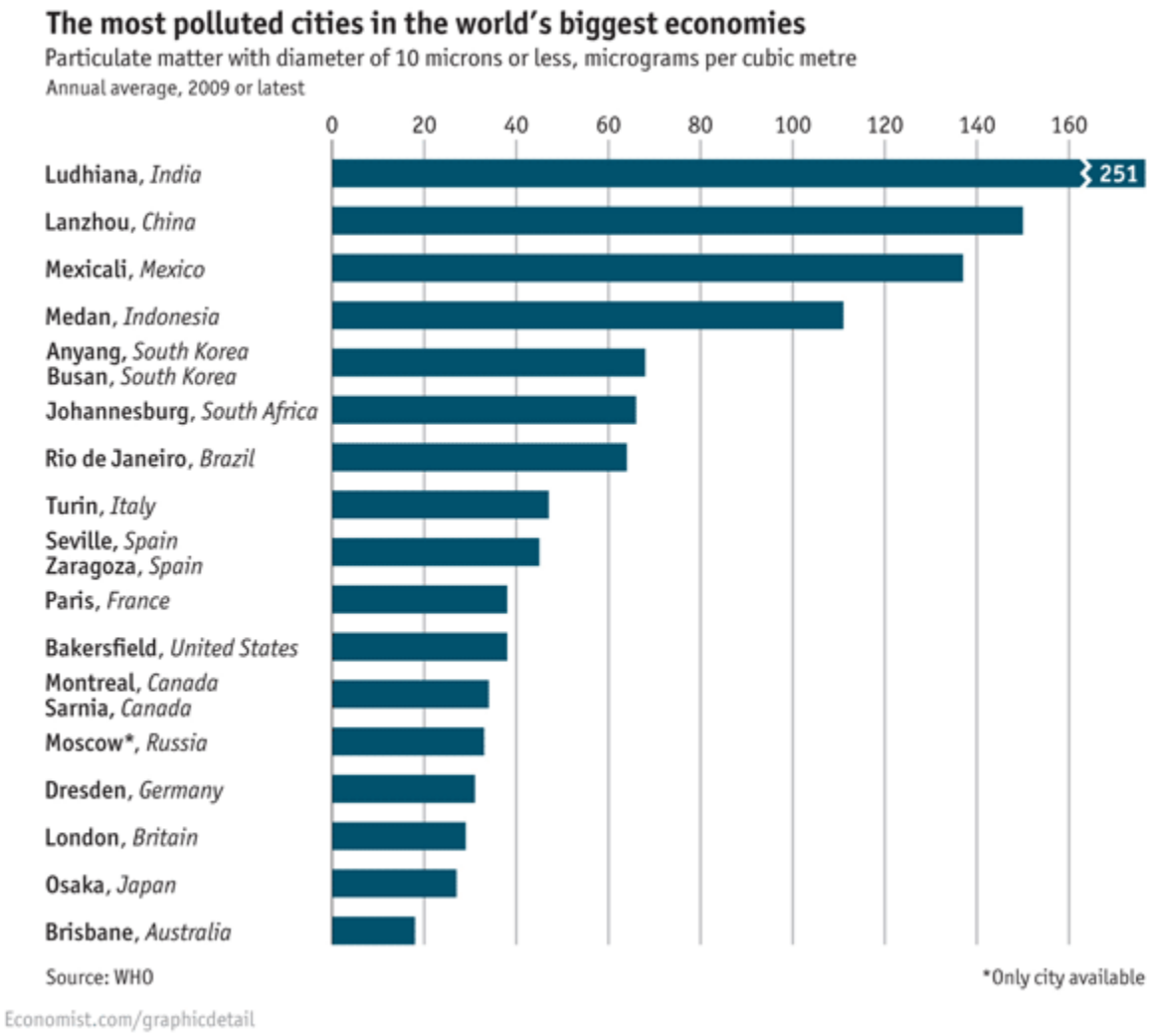
INTRODUCTION

Before addressing the topic on environment pollution, we must first understand what pollution is. So Pollution is the introduction of contaminates into the natural environment that cause adverse change. The contaminates can be any substance (solid, liquid or gas) or any form of energy such as heat, sound or radioactivity. It remains the world's greatest problem facing humanity, and the leading environmental causes of morbidity and mortality. Man's activities through urbanization, industrialization, mining, and exploration are at the forefront of global environmental pollution.

According to a 1983 article in the journal Science, "soot" found on ceilings of prehistoric caves provides ample evidence of the high levels of pollution that was associated with inadequate ventilation of open fires. Metal forging appears to be a key turning point in the creation of significant pollution levels outside the home. Core samples of glaciers in Greenland indicate increases in pollution associated with Greek, Roman, and Chinese metal production.

After understanding what pollution let's move on to why pollution matters so much. It matters first and foremost because it has negative impacts on crucial environmental services such as provision of clean air and clean water without which life on Earth as we know it would not exist. People are the reason we have pollution.

The major kinds of pollution, usually classified by environment, are air pollution, water pollution, and land pollution. Modern society is also concerned about specific types of pollutants, such as noise pollution, light pollution, and plastic pollution.



Graph displaying the most polluted cities in the world

AIR POLLUTION

One of the major cause of environmental pollution is air pollution it is the release of pollutants into the air—pollutants which are detrimental to human health and the planet as a whole. According to the World Health Organization (WHO), each year air pollution is responsible for nearly seven million deaths around the globe. Nine out of ten human beings currently breathe air that exceeds the WHO's guideline limits for pollutants, with those living in low- and middle-income countries suffering the most.

Causes of Air Pollution

Most air pollution comes from energy use and production. Burning fossil fuels releases gases and chemicals into the air which are harmful for the environment. And in an especially destructive feedback loop, air pollution not only contributes to climate change but is also exacerbated by it. Climate change also increases the production of allergenic air pollutants, including mold and pollen. Air pollution in the form of carbon dioxide and methane raises the earth's temperature and the smog, is then worsened by that increased heat, forming when the weather is warmer and there's more ultraviolet radiation.

Effects of Air Pollution

The effects of air pollution on the human body vary depending on the type of pollutant and the length and level of exposure—as well as other factors, including a person's individual health risks and the cumulative impacts of multiple pollutants or stressors.

Smog and soot- These are the two most prevalent types of air pollution. Smog occurs when emissions from combusting fossil fuels react with sunlight. Soot is made up of tiny particles of chemicals, soil, smoke, dust, or allergens in the form of either gas or solids that are carried in the air. The sources of smog and soot are similar.

Harmful gas being released from chimneys

Smog can irritate the eyes and throat and also damage the lungs, especially those of children, senior citizens, and people who work or exercise outdoors. It's even worse for people who have asthma or allergies. The tiniest airborne particles in soot are especially dangerous because they can penetrate the lungs and bloodstream and worsen bronchitis, lead to heart attacks, and even hasten death. In 2020 a report from Harvard's T. H. Chan School of Public Health showed COVID-19 mortality rates in areas with more soot pollution were higher than in areas with even slightly less.

Hazardous Air Pollutants- A number of air pollutants pose severe health risks and can sometimes be fatal even in small amounts. Some of the most common are mercury, lead, dioxins, and benzene. These are also most often emitted during gas or coal combustion, incinerating, or (in the case of benzene) found in gasoline. Benzene can cause eye, skin, and lung irritation in the short term and blood disorders in the long term. Dioxins, more typically found in food but also present in small amounts in the air, can affect the liver in the short term and harm the immune, nervous, and endocrine systems as well as reproductive functions. Mercury attacks the central nervous system. In large amounts, lead can damage children's brains and kidneys, and even minimal exposure can affect children's IQ and ability to learn. Another category of toxic compounds, polycyclic aromatic hydrocarbons (PAHs), are by-products of traffic exhaust and wildfire

smoke. In large amounts they have been linked to eye and lung irritation, blood and liver issues, and even cancer. In one study, the children of mothers exposed to PAHs during pregnancy showed slower brain-processing speeds

Greenhouse Gases- By trapping the earth's heat in the atmosphere, greenhouse gases lead to warmer temperatures, which in turn lead to the hallmarks of climate change: rising sea levels, more extreme weather, heat-related deaths, and the increased transmission of infectious diseases. In 2018 carbon dioxide accounted for 81 percent of the country's total greenhouse gas emissions, and methane made up 10 percent.

Extreme pollution, as seen here in New Delhi, could aggravate the ongoing COVID-19 crisis.

Another class of greenhouse gases, hydrofluorocarbons (HFCs) are thousands of times more powerful than carbon dioxide in their ability to trap heat. In October 2016 more than 140 countries reached an agreement to reduce the use of these chemicals which are found in air conditioners and refrigerators and develop greener alternatives over time.

Pollen and Mold- Mold and allergens from trees, weeds, and grass are also carried in the air, are exacerbated by climate change, and can be hazardous to health. Though they aren't regulated and are less directly connected to human actions, they can be considered a form of air pollution. When homes, schools, or businesses get water damage, mold can grow and can produce allergenic airborne pollutants. Mold exposure can precipitate asthma attack or an allergic response, and some molds can even produce toxins that would be dangerous for anyone to inhale. Pollen allergies are worsening because of climate change. Climate change also extends the pollen production season, and some studies are beginning to suggest that ragweed pollen itself might be becoming a more potent allergen. If so, more people will suffer runny noses, fevers, itchy eyes, and other symptoms.

WATER POLLUTION

Water pollution occurs when harmful substances (often chemicals or microorganisms) contaminate a stream, river, lake, ocean, aquifer, or other body of water, degrading water quality and rendering it toxic to humans or the environment. Unsafe water kills more people each year than war and all other forms of violence combined. Meanwhile, our drinkable water sources are finite; less than one percent of the earth's freshwater is actually accessible to us. Without action, the challenges will only increase by 2050, when global demand for freshwater is expected to be one-third greater than it is now.

Harmful wastes being thrown into the water bodies

Causes of Water Pollution

Water is uniquely vulnerable to pollution. Known as a “universal solvent,” water is able to dissolve more substances than any other liquid on earth. This is the reason why water is so easily polluted. Toxic substances from farms, towns, and factories readily dissolve into and mix with it, causing water pollution. Groundwater gets polluted when contaminants—from pesticides and fertilizers to waste leached from landfills and septic systems—make their way into an aquifer, rendering it unsafe for human use. Eighty percent of ocean pollution originates on land. Contaminants such as chemicals, nutrients, and heavy metals are carried from farms, factories, and cities by streams and rivers into our bays and estuaries; from there they travel out to sea. Meanwhile, marine debris (particularly plastic) is blown in by the wind or washed in via storm drains and sewers. Our seas are also sometimes spoiled by oil spills and leaks and are consistently soaking up carbon pollution from the air. Agriculture is another cause for water pollution. Around the world, agriculture is the leading cause of water degradation. In the United States, agricultural pollution is the top source of contamination in rivers and streams, the second-biggest source in wetlands, and the third main source in lakes. Every time it rains, fertilizers, pesticides, and animal waste from farms and livestock operations wash nutrients and pathogens (such bacteria and viruses) into our waterways. Nutrient pollution, caused by excess

nitrogen and phosphorus in water or air, is the number-one threat to water quality worldwide and can cause algal blooms, a toxic soup of blue-green algae that can be harmful to people and wildlife.

Toxic green algae in water

Effects of Water Pollution

On human health- Waterborne pathogens, in the form of disease-causing bacteria and viruses from human and animal waste, are a major cause of illness from contaminated drinking water. Diseases spread by unsafe water include cholera, giardia, and typhoid. Even in wealthy nations, accidental or illegal releases from sewage treatment facilities, as well as runoff from farms and urban areas, contribute harmful pathogens to

waterways. Every year, unsafe water sickens about 1 billion people. And low-income communities are disproportionately at risk because their homes are often closest to the most polluting industries.

On the environment- When water pollution causes an algal bloom in a lake or marine environment, the proliferation of newly introduced nutrients stimulates plant and algae growth, which in turn reduces oxygen levels in the water. This dearth of oxygen, known as eutrophication, suffocates plants and animals and can create “dead zones,” where waters are essentially devoid of life. In certain cases, these harmful algal blooms can also produce neurotoxins that affect wildlife, from whales to sea turtles. Chemicals and heavy metals from industrial and municipal wastewater contaminate waterways as well. These contaminants are toxic to aquatic life, most often reducing an organism’s life span and ability to reproduce and make their way up the food chain as predator eats prey. Marine ecosystems are also threatened by marine debris, which can strangle, suffocate, and starve animals.

NOISE POLLUTION

Noise pollution is the unwanted or excessive sound that can have deleterious effects on human health, wildlife, and environmental quality. It is commonly generated inside many industrial facilities and some other workplaces, but it also comes from highway, railway, and airplane traffic and from outdoor construction activities.

Causes of Noise Pollution

Most of the industries use big machines which are capable of producing a large amount of noise. Apart from that, various equipment like compressors, generators, exhaust fans, grinding mills also participates in producing big noise.

The world's noisiest cities

Noise pollution in urban settings may also be caused when residential properties and industrial buildings are in proximity. Noise is at its peak in most of the social events. Whether it is marriage, parties, pub, disc or place of worship. A large number of vehicles on roads, airplanes flying over houses, underground trains produce heavy noise, and people find it difficult to get accustomed to that.

Effects of Noise Pollution

Physical- Respiratory agitation, racing pulse, high blood pressure, headaches and, in case of extremely loud, constant noise, gastritis, colitis and even heart attacks.

Psychological- Can cause attacks of stress, fatigue, depression, anxiety and hysteria in both humans and animals.

Memory and concentration- Noise may affect people's ability to focus, which can lead to low performance over time. It is also bad for the memory, making it hard to study.

CONCLUSION

By the middle of the 20th century, an awareness of the need to protect air, water, and land environments from pollution had developed among the general public. In response, major pieces of environmental legislation, such as the Clean Air Act (1970) and the Clean Water Act (1972; United States), were passed in many countries to control and mitigate environmental pollution. Great efforts are made to limit the release of harmful substances into the environment through air pollution control, water waste treatment, solid waste management, hazardous waste management, and recycling. Unfortunately, attempts at pollution control are often surpassed by the scale of the problem, especially in less developed countries. The problem of plastic pollution on land and in the oceans has only grown as the use of single-use plastics has burgeoned worldwide. In addition, greenhouse gas emissions, such as methane and carbon dioxide, continue to drive global warming and pose a great threat to biodiversity and public health.

India also has taken some initiatives to protect the environment like the ‘Swachh Bharat Abhiyan’; launched on Mahatma Gandhi’s birth anniversary on October 2, 2014, the movement had people coming out to clean the roads across India. The ‘Namami Ganga Programme’; recognising the cultural and environmental importance of the river Ganga. The

Centre allocated a total of Rs. 20,000 crore to conserve and rejuvenate the river. Key achievements of this programme include creating sewerage treatment capacity, river front development and surface cleaning.

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ENVIRONMENTAL POLLUTION

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সূচনা :

পরিবেশ বলতে সাধারণভাবে আমরা বুঝি বিভিন্ন সজীব ও জড় উপাদানের সমন্বয় এবং পারস্পরিক নির্ভরশীলতায় গঠিত এক সুষ্ঠু স্বাভাবিক প্রকৃতি, যা জীবনের উন্নয়ন ও বৃদ্ধির সহায়ক। প্রকৃতির নিজস্ব গতিময়তার কারণে পরিবেশ সদা পরিবর্তনশীল। অর্থাৎ পরিবেশের উপাদানগুলির আনুপাতিক হার, অবস্থান, বিশুদ্ধতা বা বিভিন্ন উপাদানের পারস্পরিক সম্পর্ক – কিছুই স্থির নয়। এই পরিবর্তনকে আমরা তখনই দূষণ বলে থাকি, যদি পরিবর্তনটি জীবনের অস্তিত্ব বা বৃদ্ধির পক্ষে কোনও ভাবে ক্ষতিকর হয়ে ওঠে। সাধারণত, জল, বাতাস ও মাটিসহ পরিবেশের কোন উপাদানের যখন এমন কোনো মৌলিক পরিবর্তন ঘটে, যা প্রত্যক্ষ বা পরোক্ষভাবে, জীবজগতের উপর নেতিবাচক ও ক্ষতিকর প্রভাব ফেলে বা ফেলতে পারে তখন তাকে পরিবেশ দূষণ বলা হয়।

পরিবেশ দূষণের কারণসমূহ :-

পরিবেশ দূষণের জন্য যে সমস্ত জিনিস বা পদার্থ দায়ী তাদেরকে দূষক বলা হয়। এদেরকে মূলত তিন শ্রেণীতে ভাগ করা যায়, যথা—

(ক) পদার্থ বিষয়ক দূষণসমূহ (যেমন - শব্দ, তাপ ও তেজস্ক্রিয় বিকিরণ)

(খ) রাসায়নিক পদার্থসমূহ (যেমন - জৈব ও অজৈব, কৃত্রিম বা প্রাকৃতিক রাসায়নিক পদার্থ)।

(গ) জীবসমূহ (যেমন - বিভিন্ন রোগের জীবাণু, ব্যাকটেরিয়া ও পরজীবীসমূহ)।

প্রধানত দুটি কারণে পরিবেশ দূষিত হয়, যথা—

১। প্রাকৃতিক কারণ

২। মানুষের কর্মকান্ডজনিত কারণ

প্রাকৃতিক ও মনুষ্যসৃষ্ট কারণ :-

পরিবেশের দূষণের প্রাকৃতিক কারণ-গুলির মধ্যে আগ্নেয়গিরির অগ্ন্যুৎপাত, ভূমিকম্প, বন্যা, ঘূর্ণিঝড় ইত্যাদি অন্যতম। পরিবেশ দূষণের প্রধানকারণ মানব সৃষ্ট কর্মকাণ্ড। পরিকল্পনাহীন উন্নয়ন, অসংগতিপূর্ণ নগরায়ণ, জমির অবিচক্ষণ, জমিতে অবিচক্ষণ হারে রাসায়নিক ও রাসায়নিক সারের ব্যবহার, শিল্প-কারখানার অপরিশোধিত বর্জ্য, আবাসিক এলাকায় শিল্পকারখানার অবস্থান, শিল্প দুর্ঘটনা, জ্বালানীসহ অন্যান্য প্রয়োজনে অবিচক্ষণ হারে বৃক্ষনিধন, অবিচক্ষণ জনসংখ্যা, দারিদ্র, অশিক্ষা, যানবাহনের কালো ধোঁয়া ও কোলাহল শব্দের হর্ন, উন্নযুক্ত পয়ঃনিষ্কাশন ব্যবস্থার অভাব, অতিমাত্রায় প্রাকৃতিক সম্পদের আহরণ, ইত্যাদি সবকিছু মিলে পরিবেশকে দূষিত করছে এবং সামগ্রিক পরিবেশগত ভারসাম্য নষ্ট হচ্ছে।

পরিবেশ দূষণ কখন রাসায়নিক বিক্রিয়ার মত খুব ধীরে অথবা অত্যন্ত দ্রুতগতিতে ঘটতে পারে।

এর ফলাফল অত্যন্ত ভয়াবহ, যা অনেক সময় স্থায়ী-রূপ ধারণ করে। উদাহরণ হিসেবে উল্লেখ করা যেতে পারে ১৯৮৫ সালে ভোপালের মধ্যপ্রদেশের রাজধানী ভূপালে মার্কিন প্রতিষ্ঠিত ইউনিয়ন কার্বাইডের কীটনাশক কারখানা থেকে বিষাক্ত মিথাইল আইসোসায়ানাইড গ্যাস নির্গমনের ঘটনা এবং ১৯৮৬ সালে সোভিয়েত ইউনিয়নের ইউক্রেনের চেরনোবিল পারমাণবিক চুল্লীর বিস্ফোরণজনিত প্রতিক্রিয়ায় ভোবহ পরিবেশ দূষণ, ভোপালের দুর্ঘটনায় আড়াই হাজার লোক মারা যায় এবং প্রায় দু'লক্ষ লোক বিষক্রিয়ার শিকার হয়। এদের অনেকে স্থায়ীভাবে পঙ্গু হয়ে পড়ে। অন্যদিকে চেরনোবিলের দুর্ঘটনায় ইতিমধ্যে একত্রিশ জন মারা গেছে এবং প্রায় সাড়ে তিন লক্ষ লোক তেজস্ক্রিয়তার শিকার হয়েছে। তেজস্ক্রিয়তা বিভিন্ন ধরনের ক্যান্সারসহ অন্যান্য জটিল রোগ-ব্যাধির সৃষ্টি করে। চেরনোবিল তেজস্ক্রিয়তায় আক্রান্ত সাড়ে তিন লক্ষ লোকের অনেকেই অদূরভবিষ্যতে মারাত্মক ব্যাধি ক্যান্সারে আক্রান্ত হতে চলেছে। দুর্ঘটনার দু-দশকে

অতিক্রম হলেও এখনও চেরনোবিল ও তার আশেপাশের ভূমি আবাদযোগ্য নিরাপত্তা অর্জন করতে পারেনি। প্রকৃত-পক্ষে চেরনোবিল দুর্ঘটনায় ফলে মোটা উত্তর-পশ্চিম ইউরোপের কৃষিজমি ও কৃষিফল দূষিত হয়েছিল এবং এর প্রভাব দীর্ঘমেয়াদী।

বিশ্বের অন্যতম জনবহুল মহানগরী মেক্সিকো সিটিতে প্রায় দু-কোটি লোকের বাস, পরিবেশ দূষণের কারণে এ মহানগরী বর্তমানে বিপর্যয়ের সম্মুখীন। প্রায় ত্রিশ লক্ষ মোটরগাড়ি এবং প্রায় পয়ত্রিশ হাজার শিল্প-কারখানা নির্গত বর্জ্যে নগরীর পরিবেশ ক্যানসার মাত্রায় দূষিত হয়ে পড়ায় নগরবাসীরা প্রায়ই মাথাব্যথা, শ্বাসকষ্ট, চোখ জ্বালাপোড়া, মাথা ঝিম ঝিম করা ইত্যাদি অস্বাস্থ্যকর অবস্থায় দিন কাটাতে বাধ্য হয়। দূষণের কারণে নগরবাসীদের মধ্যে ক্যান্সার ও হৃদরোগের আশঙ্কা বেড়েছে, শিশুদের জ্ঞানার্জনে অক্ষমতা ও অস্বাভাবিক মানসিক বিকাশেও বিঘ্ন সৃষ্টি হচ্ছে।

বাংলাদেশের প্রেক্ষাপটে প্রধান শহরগুলির মধ্যে রাজধানী ঢাকার পরিবেশ দূষণ চরম পর্যায়ে পৌঁছেছে।

গাড়ীর নির্গত সীসা মিশ্রিত কালো ধোঁয়া ঢাকার পরিবেশ দূষণ চরম পর্যায়ে পৌঁছেছে। গাড়ির নির্গত ধোঁয়া, চামড়া প্রক্রিয়াকরণ শিল্প প্রতিষ্ঠান গুলোর থেকে নিঃসৃত বর্জ্য পার্শ্ববর্তী নদী বুড়িগঙ্গার পানি ব্যাপকভাবে দূষিত হচ্ছে, ফলে নদীতে মাছসহ অন্যান্য জলজ জীব বিলুপ্ত হচ্ছে। সাম্প্রতিক সময়ে বহুল প্রসারিত গারমেন্টস ইন্ডাস্ট্রির সহায়ক হলেও ইন্ডাস্ট্রির বর্জ্য পরিবেশের উপর ব্যাপক প্রভাব ফেলছে।

বায়ুদূষণ

প্রকারভেদ :-

সাধারণত বিভিন্ন কারণেই পরিবেশ দূষিত হয়ে থাকে, তার মধ্যে অন্যতম হল বায়ুদূষণ, জলদূষণ, ভূমিদূষণ ও শব্দদূষণ।

● বায়ুদূষণ :- পৃথিবীর বায়ুমন্ডলের কোন স্তরে বিভিন্ন ভৌত, রাসায়নিক ও জৈব পদার্থের অনুপ্রবেশ বা বায়ুর স্বাভাবিক উপাদানগুলির পারস্পরিক অনুপাতের পরিবর্তন যা প্রাণী বা উদ্ভিদের জীবনযাত্রায় কোনো প্রতিকর প্রভাব বিস্তার করে তাকে বায়ুদূষণ বলে থাকি।

বায়ু জীবজগতকে ঘিরে থাকা মিশ্র, চলমান, ও সদা পরিবর্তনশীল গ্যাসীয় পদার্থ। বায়ুদূষণ তাই সর্বদা সামগ্রিক অবস্থার সূচক যা পরিবেশের অন্যসকল উপাদান-গুলিকে সর্বদা প্রভাবিত করে, এবং দ্রুত একস্থান থেকে অন্যস্থানে ছড়িয়ে পড়ে। তাই এটি এক আন্তর্জাতিক পরিবেশ সমস্যারূপে চিহ্নিত হয়েছে।

বায়ুদূষণের প্রকারভেদ :

(i) গ্যাসীয় দূষণ :- বায়ুতে কোনো বিষাক্ত বা ক্ষতিকর গ্যাসের মিশে যাওয়ার ফলে এই প্রকার বায়ুদূষণ ঘটে। কয়েকটি প্রধান দূষক গ্যাস হলো কার্বন মনোক্সাইড (CO), সালফার ডাই-অক্সাইড (SO_2), নাইট্রোজেনের বিভিন্ন অক্সাইড (N_2O, NO, NO_2 ইত্যাদি) এছাড়া বিভিন্ন হাইড্রোকার্বন ইত্যাদি। শিল্পাঞ্চলে অন্যান্য বিষাক্ত গ্যাস যেমন অ্যামোনিয়া (NH_3), হাইড্রোজেন সালফাইড, ক্লোরিন ইত্যাদি কোনও ভাবে বায়ুতে মিশে পরিবেশকে প্রচন্ডভাবে ক্ষতিগ্রস্থ করে। আবার কোনও কারণে বায়ুর গ্যাসীয় উপাদানগুলির স্বাভাবিক অনুপাতে পরিবর্তন ঘটার ফলে বায়ুদূষণ সৃষ্টি হয়ে থাকে। যেমন কার্বন ডাই-অক্সাইড গ্যাসটি বায়ুর একটি গুরুত্বপূর্ণ উপাদান, কারণ এটি প্রাথমিক খাদ্যে অর্থাৎ সবুজ উদ্ভিদের খাদ্য উৎপাদনের জন্যে একটি অন্যতম প্রধান পদার্থ রূপে ব্যবহৃত হয়। তাছাড়া এই CO_2-এর কারণে পৃথিবীর উষ্ণতা বৃদ্ধি পাচ্ছে যার ফল স্বরূপ

হল গ্লোবাল ওয়ার্মিং।

(i) ভাসমান জৈব রাসায়নিক দূষণ : বায়ুতে বিভিন্ন জৈব রেণু যেমন ফুলের পরাগ জীবাণু ইত্যাদি এবং বিভিন্ন সূক্ষ্ম ধূলিকণা মিশে থাকে যা প্রকৃতিজাত এবং স্বাভাবিক। এর উন্নয়নশীল মানুষের দ্বারা বিভিন্ন ভাবে নানা কঠিন পদার্থ বা রাসায়নিক দ্রব্যের সূক্ষ্ম বা ছোলার গুঁড়ো ইত্যাদি বায়ুতে মিশছে বা শ্বাসের সঙ্গে শরীরে ঢুকে মানুষ ও অন্যান্য প্রাণীর দেহে নানা অসুখের সূচনা করে।

(ii) জলদূষণ : জলের মধ্যে কোনো অবাঞ্ছিত পদার্থ মিশে যাবার ফলে যদি জলের ভৌতধর্ম বা রাসায়নিক ধর্ম বা জৈব বৈশিষ্ট্য ও গুনমানের এমন কোন পরিবর্তন হয় যার ফলে জলজ উদ্ভিদ বা প্রাণী বা মানুষের ক্ষতির সম্ভাবনা ঘটে তবে সেই পরিবর্তনকে জলদূষণ বলা হয়।

জলদূষণ :-

জলের মধ্যে কোনো অবাঞ্ছিত পদার্থ মিশে যাবার ফলে যদি জলের ভৌতধর্ম বা রাসায়নিক ধর্ম বা জৈব বৈশিষ্ট্য ও গুণমানের এমন কোন পরিবর্তন হয় যার ফলে জলজ উদ্ভিদ বা প্রাণী বা মানুষের ক্ষতির সম্ভাবনা থাকে তবে সেই পরিবর্তনকে জলদূষণ বলা হয়।

জলদূষণের উৎস :

(i) মানুষের দৈনন্দিন জীবনযাত্রার ফলে তার দ্বারা ব্যবহৃত দু-পাশে সংলগ্ন জলের উৎসগুলি দূষিত হয়, ঘর-বাড়ির দৈনন্দিন আবর্জনা মাটিতে ফেলার ফলে মাটির ভৌম জলস্তর দূষিত হয় এবং জলে নানা রাসায়নিক ও রোগসৃষ্টিকারী জীবাণু মিশে যায়। মাটির ভৌমজল থেকে ঐ দূষণ পার্শ্ববর্তী ছোট ছোট জলাধার যেমন পুকুর, কুয়ো ইত্যাদির জলকে দূষিত করে। ফলে জলে বিভিন্ন রঙ ও দুর্গন্ধ তৈরি হয়। প্রাথমিকভাবে জল ঘোলাটে হয়ে ওঠে, পরে দূষণের পরিমান ও প্রকৃতি অনুসারে লালচে, সবুজ বা কালো

সাধারণভাবে জৈব অ্যামাইনের উপস্থিতিতে জলে আঁশটে গন্ধ, জৈব হিউমাসের উপস্থিতিতে মোঁদা গন্ধ, হাইড্রোজেন সালফাইড বা ফসফরাস যুক্ত জলে পচা ডিমের গন্ধ থাকে।

(ii) শিল্প কারখানাগুলির পরিত্যক্ত আবর্জনা ও উদ্বৃত্ত রাসায়নিক পদার্থ সাধারণত: নর্দমা দিয়ে সংলগ্ন জোনো জলের উৎসে স্থানান্তর করা হয়, যেমন সমুদ্র, নদী, খাল ইত্যাদি। ঐ সব আবর্জনার মধ্যে বিভিন্ন ধাতু যেমন সীসা, তামা, দস্তা, ক্যাডমিয়াম বা বিভিন্ন ধাতব যৌগ, জৈব পদার্থ এবং অজৈব সালফার, ফসফরাস, ক্লোরিন ঘটিত যৌগ থাকে। এগুলি জলকে দূষিত করে। বিভিন্ন শিল্পের ক্ষেত্রে সাধারণ শিল্পজাত বর্জ্য পদার্থগুলির মধ্যে প্রধান কয়েকটি হলো —

(ক) পরমাণু শক্তিকেন্দ্রে ক্লোরাইড যৌগ

(খ) গ্যাস এবং কোক শিল্পজাত অ্যামোনিয়া, ফেনল সায়ানাইড, সালফাইড যৌগ,

(গ) রং ও ব্যাটারী শিল্পজাত সীসা ও সীসার অক্সাইড

(ঘ) মদ ও অন্য রাসায়নিক শিল্পজাত অজৈব অ্যাসিড; যেমন হাইড্রোক্লোরিক এবং জৈব অ্যাসিড।

(ঙ) তৈল শোধনাগার, পেট্রো রসায়ন শিল্প ও ইঞ্জিনিয়ারিং শিল্পে ব্যবহৃত হাইড্রোকার্বন যৌগ, তেল, চর্বি, গ্রিজ ইত্যাদি;

(চ) চর্মশিল্পে ব্যবহৃত ট্যানিক অ্যাসিড, যেমন, অ্যালুমিনিয়াম ও ক্রোমিয়াম যৌগ।

(ছ) সার শিল্পের উপজাত ফসফেট ও ক্লোরাইড যৌগ ইত্যাদি।

(iii) শহর ও গ্রামের সাধারণ নৌচব্যবস্থায় প্রত্যেক নর্দমা উন্মুক্ত হয় যেন বৃহৎ জলাশয় যেমন খাল, নদী, সমুদ্র ইত্যাদিতে এবং তার পূর্বে দূষিত জলের শোধনের কোনও উপযুক্ত ব্যবস্থা নেওয়া হয় না। এছাড়া বৃষ্টির জল আস্তাকুঁড়, খাটাল, শ্মশান, ডাস্টবিনের উপর দিয়ে প্রবাহিত হয়ে জলাধারগুলিতে গিয়ে পড়লে তা দূষণ সৃষ্টি করে।

(iv) গৃহস্থালীর কাজে সাবান ও ডিটারজেন্ট দিয়ে কাপড়জামা ধোয়ার ফলে বাসনমাজা হয়, বর্জ্য জলে দ্রবীভূত কিছু ক্ষতিকর রাসায়নিক পদার্থের অনুপ্রবেশ ঘটে যার পরিশোধন

বেশ কয়েকটি।

(v) জৈব আবর্জনা যেমন গাছের পাতা, মৃত প্রাণীর দেহাবশেষ, মুদ্রা ওলত উদ্ভিদ, জীবনতথ্য পচনের ফলে পচনশীল সুক্ষ্মজৈব কণা, রোগজীবাণু, ভেইরাস, ব্যাকটেরিয়া প্রভৃতির উদ্ভব ঘটে।

(vi) দুর্ঘটনা বা যুদ্ধবিগ্রহের ফলে খনিজ তেল ও তেলের উৎপাত দ্রব্যাদি সমুদ্রে পড়লে তা প্রাণঘাতী দূষণ সৃষ্টি করে।

(vii) অ্যাসিড বৃষ্টির ফলেজলে অম্ল ধর্ম দেখা যায়, ফলে শুধু পানীয় হিসাবেই নয় স্নান এবং কৃষিকার্যে ব্যবহারের জন্যেও ঐ জল দূষিত বলে গণ্য হয়।

প্রধানত: বাতাসে SO_2 ও NO_2 গ্যাসের দূষণ থেকে অ্যাসিড বৃষ্টির সৃষ্টি হয়।

(viii) পারমাণবিক বোমা, অস্ত্র ইত্যাদি সমুদ্রতলে পরীক্ষামূলকভাবে বিস্ফোরণ করার ফলে প্রবল হারে সামুদ্রিক প্রাণীর মৃত্যু ও দীর্ঘস্থায়ী রাসায়নিক দূষণের সৃষ্টি হয়।

মাটিদূষণ :-

মাটির প্রয়োজনীয় উপাদান হ্রাস ও অবাঞ্ছিত পদার্থসমূহের সঞ্চয়, যা বর্তমান প্রাণী ও উদ্ভিদ জগতের জন্য ক্ষতিকর, অবাঞ্ছিত পদার্থ বলতে যেসব উপাদানকে বুঝায়, যা মাটির নৈতিবাচক রূপান্তর ঘটায়,

কারণসমূহ :-

(i) ভূমি ক্ষয় :- ভূমি ক্ষয়ের প্রধান কারণ বৃষ্টি ও বায়ু প্রবাহ, ভূমিক্ষয় ব্যাপকভাবে বেড়ে যায় যখন মানুষ নির্বিচারে গাছ-পালা কেটে বন উজাড় করে, তৃণভূমিতে চাষাবাদ শুরু করে এবং মাটির অনিয়ন্ত্রিত ব্যবহার করে গাছ-পালা কেটে ফেলে মাটি আলগা হয়, তখন বাতাস সহজে মাটি উড়িয়ে দিয়ে ভূমিক্ষয় ঘটায়,

(ii) রাসায়নিক দ্রব্য ও বর্জ্যের দূষণ :- শিল্প কল-কারখানা থেকে বিভিন্ন ধরনের রাসায়নিক পদার্থ বর্জ্য হিসেবে নির্গত হয়, এছাড়া গ্রাম বা শহরের গৃহস্থালীর বর্জ্য ও নানারকম বর্জ্য ভূমিভূক্ত স্থান ও তার পার্শ্ববর্তী স্থানকে

দূষিত করে।

(iii) অনিয়ন্ত্রিত বৃক্ষনিধন : জনসংখ্যা বৃদ্ধির সাথে বৃক্ষকর্তনের একটি নিবিড় সম্পর্ক রয়েছে। অধিক জনসংখ্যার জন্য বাসস্থান রাস্তাঘাট, কল-কারখানা তৈরি করতে বনভূমি ও কৃষিজমি ব্যবহার করা হয়, ফলে বনভূমিতে গাছের সংখ্যা দিন দিন কমে যাচ্ছে এবং মাটি উন্মুক্ত হয়ে পড়েছে। মাটি উন্মুক্ত হওয়ায় মাটিতে ক্ষয়বৃদ্ধি পায় আর পুষ্টি উৎপাদন হ্রাস পাচ্ছে ফলে মাটি দূষণ হচ্ছে।

শব্দদূষণ : শব্দ মাপের একক ডেসিবেল। এটি একক বেল-এর একদশমাংশ। আমরা 20 ডেসিবেল থেকে 120 ডেসিবেল-এর উচ্চমাত্রার শব্দ শুনতে পাই না। তবে মানুষের স্বাভাবিক শ্রবণমাত্রা 60-75 ডেসিবেল মাত্রার শব্দ। শব্দের মাত্রা 75 ডেসিবেল অতিক্রম করলেই সেটা শব্দ দূষণ হয়ে ওঠে।

কারণ :

বিভিন্ন কারণে শব্দ দূষণ হতে পারে, এগুলির মধ্যে যানবাহনের তোরালো হর্ন, কলকারখানার নির্গত শব্দ, বিভিন্ন নির্মাণ কাজের শব্দ, যানবাহন চলাচলের শব্দ, অনিয়ন্ত্রিত লাউডস্পিকার ব্যবহার, উড়োজাহাজের শব্দ, প্রচন্ড জনকোলাহল ইত্যাদি শব্দ দূষণের মূল কারণ। এমনকী ঘরের বাইরে নয়, ঘরের অভ্যন্তরেও ব্যবহৃত আধুনিক যন্ত্রপাতি, যেমন ভ্যাকুয়াম ক্লিনার, ফুড ব্লেন্ডার, বাসন ধোয়ার যন্ত্র, ফুড প্রাইন্ডার ইত্যাদি থেকে শব্দ দূষণ হতে পারে। এছাড়া শব্দোতে বিভিন্ন আতস-বাজি, পটকা, বোম ইত্যাদি শব্দ দূষণের মূল কারণ।

শব্দদূষণ-এর ছবি

প্রতিরোধের উপায়:-

(i) বায়ু দূষণের প্রধান কারণ হল জীবাশ্ম জ্বালানি। অই এই জ্বালানির ব্যবহার সীমিতকরণ।

(ii) কলকারখানার চিমনি থেকে বেরিয়ে আসা ধোঁয়াতে সালফার ও অন্যান্য দূষক থাকে, এ দূষকগুলিকে বাতাসে মিশে যাবার আগে অন্যত্র সরিয়ে ফেলা যেতে পারে।

(iii) গাছ-পালা ধ্বংস বন্ধ করা। গাছ-পালা পরিবেশ থেকে CO_2 শোষন করে পরিবেশ দূষণ রোধ করে।

(iv) জ্বালানীবিহীন যানবাহনের সংখ্যা বৃদ্ধি করে, যেমন- সহরে এলাকায় বাই-সাইকেলের ব্যবহার বৃদ্ধি করে দূষণ রোধ করা।

(v) সৌরশক্তির ব্যবহার: জ্বালানী নির্ভর শক্তির পরিবর্তে সৌরশক্তি ব্যবহার করা।

(vi) সহর ও বন্দরের আবর্জনা ও নর্দমার বর্জ্য নদ-নদী, খাল-বিলে গড়িয়ে পড়ার আগে শোধন করা উচিত।

(vii) নদীর জলের স্বাভাবিক প্রবাহ অব্যাহত রাখা আবশ্যক,

নদীর জলদূষণ যাতে বাড়তে না পারে সেজন্য নিয়মিত ড্রেজিং প্রয়োজন।

(viii) মৃত্তিকা ক্ষয়রোধে জৈব ও অজৈব পরিমিত পরিমাণে রাসায়নিক সার প্রয়োগ করা উচিত। ফলে অতিরিক্ত সার জলাশয়ের জল দূষিত করতে পারবে না।

(ix) শিল্প ও কলকারখানার বর্জ্য পার্শ্ববর্তী জলাশয় ও নদ-নদীতে পড়ার পূর্বে শোধন করা প্রয়োজন।

(x) পারমাণবিক বিস্ফোরণ ঘটানো বন্ধ করা ও তেজস্ক্রিয় পদার্থের ব্যবহার কমানো।

(xi) অবনমন মাটি সহজেই ক্ষয় হয়ে যায়। এজন্য অবনমন মাটিতে যত তাড়াতাড়ি সম্ভব ঘাস বা অন্যান্য উদ্ভিদ লাগানো উচিত।

(xii) কাশ্মীরে বৃক্ষনিধন বন্ধ করা উচিত। নতুন গাছ লাগাবার প্রয়োজন হলে পাশাপাশি নতুন গাছ লাগাবার উদ্যোগ নিতে হবে।

(xiii) নগর বা গ্রামের বর্জ্য ও নির্গমের বর্জ্য স্থানান্তর পূর্বে পরিশোধিত করে নিতে হবে।

(xiv) অপরিকল্পিত নগরায়ণ বন্ধ করা উচিত।

(xv) শব্দ দূষণের নিয়ন্ত্রণের জন্যে বিভিন্ন যানবাহন ও কলকারখানা থেকে সৃষ্ট শব্দের মাত্রা নিয়মিত পরিমাপ করা।

(xvi) উচ্চ শব্দ সৃষ্টিকারী তথা শব্দদূষণকারী যানবাহন ও কলকারখানার বিরুদ্ধে উপযুক্ত শাস্তি প্রদান করা।

(xvii) আতসবাজি, বোমাবাজি, বা বিভিন্ন ধরনের শব্দবাজি ফাটানো বন্ধ করতে হবে অথবা কড়া পদক্ষেপ গ্রহণ করতে হবে।

মাটিদূষণ

কৃষিক্ষেত্রে দূষণ

উপসংহার :-

মানুষ পরিবেশের একটি অংশ এবং জীবজগতের মানুষসহ পরিবেশ। তাই ক্রমে ক্রমে আমাদের আবাসিত ভূমণ্ডলের জন্য পরিবেশ দূষিত হচ্ছে, তাই আমাদের মানসিক ও অন্তর্মুখী চিন্তাভাবনা রদবদল ঘটাতে হবে। আর আরও পরিমানে গাছ লাগাতে হবে। যেখানে যেকোনো কিছু অস্বাভাবিক বা অনিয়ন্ত্রিত দূষণ দেখলেই আমাদের বা সরকারের জোড়া ব্যবস্থা বা পদক্ষেপ নেওয়া উচিত।

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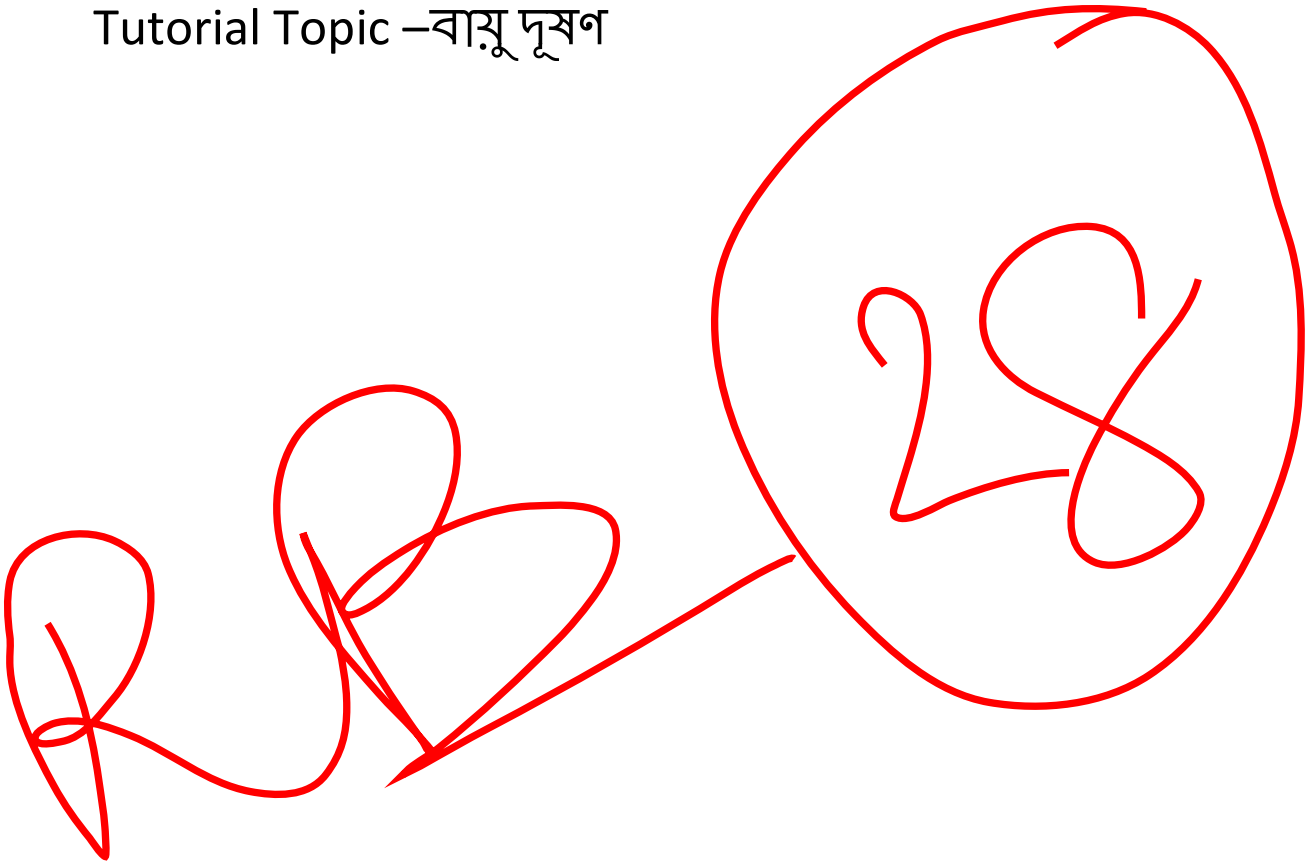
Tutorial Topic –বায়ু দূষণ



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ভূমিকা

বায়ুদূষণ আজ সারা পৃথিবীতে এক গুরুত্বূর্ণ সমস্যা হিসেবে দেখা দিয়েছে। ভারতেও বায়ুদূষণের মাত্রা অনেক বেশি। দিল্লী, কলকাতা, মুম্বাই এই সমস্ত বড়ো বড়ো শহর গুলিতে দূষণের মাত্রা অনেক বেশি। গ্রাম গুলিতে অবশ্য দূষণের মাত্রা শহরের তুলনায় কম। পরিবেশ দূষণের মধ্যে বায়ুদূষণ সবথেকে বেশী মারাত্মক তাই বায়ুদূষণের মাত্রা কে কমানো, নিয়ন্ত্রণে আনা খুবই জরুরি।

বায়ুদূষণের সংজ্ঞা: বিভিন্ন প্রাকৃতিক কারণে বা মনুষ্য সৃষ্ট কারণে উদ্ভূত কঠিন বজ্র পদার্থ অথবা অপ্রয়োজনীয় বস্তুর ঘনত্ব বায়ুতে যদি স্বাভাবিক অনুপাতের থেকে কম বা বেশি হয়ে যায়, তাহলে ওই প্রকার বায়ুকে দূষিত বায়ু এবং এই পদ্ধতি কে বায়ুদূষণ বলে

বায়ুদূষণের বিভিন্ন উৎসগুলি হল –

1)**যানবাহন ও কলকারখানার পরিত্যক্ত ধোঁয়া :**বায়ুদূষণের একটি বিশেষ কারন হলো যানবাহনের পরিত্যক্ত ধোঁয়া। যানবাহনের পরিত্যক্ত ধোঁয়া বায়ুদূষণের জন্য শতকরা 60 ভাগ দায়ী। যানবাহনের পরিত্যক্ত ধোঁয়ার মধ্যে প্রচুর পরিমানে কার্বন ডাই অক্সাইড, কার্বন মনো অক্সাইড, নাইট্রোজেন অক্সাইড থাকে। কলকারখানার কয়লা ও খনিজ তেল দহণের ফলে প্রচুর পরিমানে দূষিত ধোঁয়ার সৃষ্টি হয়, এই ধোঁয়াতে SO_2 থাকায় সহজেই বায়ু দূষিত হয়। আগ্নেয়গিরির অগ্নুৎপাত এর সময় যে ধোঁয়া নির্গত হয় তাতে প্রচুর বায়ু দূষক থাকে।

2)**ধোঁয়াশা :**নানারকমের রাসায়নিক বাষ্প এবং ধোঁয়ার সাহায্যে কুয়াশা কখনো কখনো ভারী ও কালো হয়ে ভুপৃষ্ঠে নেমে আসে তখন তাকে ধোঁয়াশা বলে। সুতরাং, ধোঁয়াশা হলো ধোঁয়া ও কুয়াশার সংমিশ্রণ। বায়ুর সাথে গাড়ির ধোঁয়া, কলকারখানার ধোঁয়া ইত্যাদি বিষাক্ত গ্যাস গুলি মিশে ধোঁয়াশার সৃষ্টি হয়।

3)**তেজস্ক্রিয় পদার্থ :** বর্তমানে বিশ্বের বিভিন্ন স্থানে আনবিক বা পারমাণবিক বোমা বিস্ফোরণ ঘটানোর ফলে বায়ুমন্ডল দূষিত হচ্ছে। নানাবিধ পারমাণবিক পদার্থ ধূলি কণারুপে বায়ুমন্ডলে ভেসে বেড়ায় এবং বৃষ্টির সময় বায়ুমন্ডল থেকে ভু ত্বকে এসে পরে|কুয়াশা ও ধুলো বায়ুমন্ডলকে নানাভাবে দূষিত করে| ধুলোর সাথে মিশে থাকা নানারকমের জীবাণু নানারকম রোগ সৃষ্টি করে এবং শস্যের ক্ষতি করে|

বায়ুদূষকের শ্রেণীবিভাগ

বায়ুদূষক কে প্রধানত দুটি শ্রেণীতে ভাগ করা হয়েছে

A.প্রাকৃতিক উৎস থেকে সৃষ্ট বায়ুদূষক পদার্থ

প্রাকৃতিক উৎস	**বায়ুদূষক পদার্থ**
1. উদ্ভিদ	ছত্রাক, স্পোর, পরাগরেণু
2. দাবানল	CO_2, CO, NO
3. পচনশীল উদ্ভিদ	মিথেন, হাইড্রোজেন সালফাইড
4. সমুদ্র	মিথাইল ব্রোমাইড, মিথাইল আয়োডাইড

B. মনুষ্যসৃষ্ট বায়ুদূষক পদার্থ

মনুষ্যসৃষ্ট উৎস	**বায়ু দূষক পদার্থ**
1. তাপবিদ্যুৎ কেন্দ্র	এরোসল, ধোঁয়া
2. কৃষিক্ষেত্র	মিথেন, হাইড্রোজেন সালফাইড
3. বাতানুকুল যন্ত্র	ফ্রেয়ন গ্যাস, ক্লোরিন
4. আবর্জনা দহন	মিথেন, কার্বন ডাই অক্সাইড

প্রাথমিক বায়ুদূষক :যেসব বায়ুদূষক উৎস থেকে সরাসরি বায়ুতে মিশে যায়, তাদের প্রাথমিক বায়ুদূষক বলে | এগুলি হলো -ছাই, ধোঁয়া, সালফারের গুঁড়ো, হ্যালোজেন যৌগ ইত্যাদি |

গৌণ বায়ুদূষক :যেসব দূষক পদার্থ দুই বা তার অধিক প্রাথমিক বায়ুদূষকের সংমিশ্রনে উৎপন্ন হয়, তাদের গৌণ বায়ুদূষক বলে এগুলি হল :ওজন, সালফিউরিক অ্যাসিড, কিটোন, PAN ইত্যাদি |

নিরাপদ মাত্রা :যে নির্দিষ্ট মাত্রা অতিক্রম করলে কোনো দূষক পদার্থ উদ্ভিদ ও প্রাণী জগতের ক্ষতিসাধন করে বা বিরূপ প্রতিক্রিয়া সৃষ্টি করে, সেই মাত্রটিকে নিরাপদ মাত্রা বলে | একে Dose Limit ও বলে |

TLV -STEL পদ্ধতি : TLV-STEL কথাটির সম্পূর্ণ অর্থ হলো Threshold Limit Value-Short Term Exposure Limit| TLV-STEL দ্বারা কোনো দূষণযুক্ত পরিবেশে মানুষ কতক্ষন সুস্থ থেকে কাজ করতে তার হিসেবকে বোঝায় |

Source -Pathway -Sink পদ্ধতি : Source-Pathway-Sink পদ্ধতি দ্বারা কোনো দূষক পদার্থের উৎস বা Source, বিক্রিয়া প্রণালী বা Pathway, বিনাশ বা Sink সম্মন্ধে ধারণা থাকা দরকার | যেকোনো ধরণের দূষক পদার্থের নিরাপদ মাত্রা নির্ধারণ করতে গেলে Source-Pathway-Sink পদ্ধতি জানা দরকার | দূষক পদার্থ গুলি এই পথ অনুসরণ করে চলে |

অধিবিষ বা টক্সিন : মানুষের শরীরের পক্ষে ক্ষতিকর বিষকে অধিবিষ বা টক্সিন বলে |


STOP

বায়ুদূষণে বিভিন্ন গ্যাসের ভূমিকা

কার্বন মনো অক্সাইড :এটি একটি বর্ণহীন, গন্ধহীন গ্যাস | অতিরিক্ত যানবাহন চলাচল, জীবাশ্ম জ্বালানির দহণের ফলে পরিবেশে কার্বন মনোঅক্সাইড মিশে যায় | এছাড়াও গ্যাস কারখানা, খনি অঞ্চল, তৈল শোধনাগার থেকে কার্বন মনোঅক্সাইড নির্গত হয়ে বাতাসে মেশে |কলকাতা শহর থেকে প্রায় 450 টন কার্বন মনোঅক্সাইড প্রতিদিন বায়ুমন্ডলে মেশে |

1. **কার্বন ডাই অক্সাইড :**কার্বন ডাই অক্সাইড বায়ুদূষক হিসেবে কাজ করে |এটি বর্ণহীন কিন্তু এর হালকা ঝাঁঝ আছে |শিল্প বিপ্লবের পর থেকেই বায়ুমন্ডলে CO_2 এর পরিমান 25% বেড়ে গেছে |1988 খ্রিস্টাব্দে CO_2 এর পরিমান 280 ppm থেকে বেড়ে 360 ppm হয়েছে |বায়ুমন্ডলে CO_2এর পরিমান বাড়লে নিম্নস্তরের তাপমাত্রা ক্রমশ বৃদ্ধি পেতে থাকে |এই কারণে কার্বন ডাই অক্সাইড গ্যাস কে Heat Trapper বলা হয় |
2. **ক্লোরোফ্লুরোকার্বন :**প্রকৃতিতে এই গ্যাস পাওয়া যায় না | বিভিন্ন শিল্পে যেমন রেফ্রিজারেটার, শীততাপ নিয়ন্ত্রক যন্ত্র, প্লাস্টিক ও ফোম ফাঁপিয়ে তুলতে এই গ্যাস ব্যবহৃত হয় |এই গ্যাস বায়ুমন্ডলে একবার মিশলে স্ট্র্যাটোস্ফীয়ার স্তরে 100 বছর থেকে যায় |CFC গ্যাস সূর্যের অতিবেগুনি রশ্মির সাথে বিক্রিয়া করে ক্লোরিন পরমাণু উৎপন্ন করে |ক্লোরিন পরমাণুর সাথে বিক্রিয়া করলে ওজন গ্যাস ধ্বংস হয় |
3. **নাইট্রিক অক্সাইড :**নাইট্রোজেনর অক্সাইড গুলির মধ্যে নাইট্রিক অক্সাইড নির্গমনের পরিমান সবথেকে বেশি প্রায় 95% এর কাছাকাছি |অতিরিক্ত যান চলাচল এর ফলে এবং বিদ্যুৎ কেন্দ্র থেকে নাইট্রিক অক্সাইড নির্গত হয় |এটি একটি গুরুত্বপূর্ণ বায়ুদূষক |

4. **হাইড্রোকার্বন ও অ্যালডিহাইড যৌগ:**হাইড্রোকার্বন ও অ্যাল ডিহাইড এর মধ্যে মিথেন, ইথিলিন, প্রোপেন প্রভিতি গুরুত্বপূর্ণ বায়ুদূষক | কয়লা ও পেট্রোলিয়াম এর দহন ও কলকারখানা থেকে এই সকল পদার্থ নির্গত হয়ে বায়ুমন্ডলে মিশছে |পেট্রোলিয়ামজাত পণ্যের অসম্পূর্ণ দহন হলে অ্যালডিহাইড জাতীয় দ্রব্যের উৎপত্তি হয় |
5. **অ্যারোসল :**বায়ুমন্ডলের একটি গুরুত্বপূর্ণ দূষক উপাদান হলো অ্যারোসল| সমুদ্রতীর অথবা মরুভুমি অঞ্চলের সুক্ষ বালিকণা, কলকারখানার পোড়া ছাই, বিভিন্ন প্রকার অতিসুক্ষ খনিজ লবন, আগ্নেয়গিরি থেকে উৎক্ষিপ্ত ছাই ভষ্ম, উল্কার ধ্বংসবশেষ প্রভৃতি ধুলিকণা রূপে বায়ুমন্ডলে ভাসমান অবস্থায় রয়েছে|বিভিন্ন প্রকার অ্যারসলগুলি হলো :
    A. **ফ্লাই অ্যাশ :**ফ্লাই অ্যাশ মূলত তাপবিদ্যুৎ কেন্দ্র থেকে নির্গত হয় | এটি একপ্রকার উড়ন্ত ছাই, যার মধ্যে কার্বন কণা, ধুলিকণা, ক্যালসিয়াম, নাইট্রোজেন কণা প্রভৃতি ভাসমান অবস্থায় থাকে| ভারতের বায়ুমন্ডলে ফ্লাই অ্যাশ এর পরিমান অত্যন্ত বেশি|
    B. **পেট্রোকক কণা :**এই কণার প্রধান উৎসস্থল হলো খনিজ তেল শোধনাগারে| পেট্রোলিয়ামের অসম্পূর্ণ দহণের ফলে পেট্রোকক কণার উৎপত্তি হয়| এটি অতিসুক্ষ কণা, যা বায়ুমন্ডলে ভেসে বেড়ায়|
    C. **কয়লার গুঁড়ো :**কয়লার গুঁড়ো সাধারণত খুব সুক্ষ কণা|প্রধানত কয়লাখনি, তাপবিদ্যুৎ কেন্দ্র, লৌহ ইস্পাত প্রভৃতি থেকে এই কয়লার গুঁড়ো নির্গত হয় |
6. **সালফার ডাইঅক্সাইড :**সালফার ডাইঅক্সাইড একটি বর্ণহীন গ্যাস, কিন্তু এর গন্ধ আছে| সালফার যুক্ত আকরিক থেকে লোহা, তামা প্রভৃতি ধাতু নিষ্কাশন করার সময় প্রচুর প্রচুর পরিমানে সালফার ডাইঅক্সাইড বাতাসে মেশে| শহরাঞ্চলে যানবাহনএর ধোঁয়া থেকেও সালফার ডাইঅক্সাইড বাতাসে মেশে| পৃথিবীর বায়ুমন্ডলে প্রায় 120 কোটি টনের মত সালফার ডাইঅক্সাইড

এসে মিশেছে| আমাদের ভারতবর্ষের শহর ও নগরগুলির মধ্যে কলকাতা শহরের বায়ুতে SO_2 এর পরিমান সবথেকে বেশি|

বায়ুদূষণ নিয়ন্ত্রণ

বায়ুদূষণ নিয়ন্ত্রণের কয়েকটি পদ্ধতি হল 1)আধুনিক প্রযুক্তির সাহায্যে বায়ুকে শোধন বা ফিল্টার করে বায়ুমন্ডলের অনেক ক্ষতিকারক গ্যাসকে দূর করা যায়|2) কীটনাশক ব্যবহার কমাতে হবে এবং কীটপতঙ্গকে তাদের শত্রু দিয়ে দমন করার চেষ্টা করতে হবে|3)অনেক সময় ক্ষতিকারক রাসায়নিক পদার্থকে অন্য কোনো রাসায়নিক পদার্থ দিয়ে শোধন করা যেতে পারে|4)বসতি অঞ্চল ও শিল্পাঞ্চলের মধ্যে উপযুক্ত দূরত্ব রাখা দরকার|

প্রধান কয়েকটি বায়ুদূষণ প্রতিরোধক যন্ত্র

1)ক্যাটালাইটিক কনভারটার :এগুলি বিভিন্ন গাড়ির ইঞ্জিনের সাথে লাগানো হয়|এর সাহায্যে গাড়ির ধোঁয়া থেকে দূষক পদার্থগুলিকে আলাদা করে অন্যান্য পদার্থ এ পরিণত করা হয়|

2)সাইক্লোন সেপারেটর:এই যন্ত্রের সাহায্যে দূষিত বায়ু থেকে ঘুর্ণনের সাহায্যে কণাজাতীয় দূষক পদার্থগুলিকে অপসারণ করা হয়|

3)স্ক্রাবার :এই যন্ত্রের সাহায্যে বায়ু থেকে অ্যামোনিয়া, সালফার ডাইঅক্সাইড ইত্যাদি গ্যাসকে পৃথক করা হয়

4)ইলেক্ট্রোস্ট্যাটিক প্রেসিপিটেটর:এটির সাহায্যে বায়ু থেকে ধুলো, ধোঁয়া ইত্যাদি অপসারণ করা হয়|এর মধ্যে দূষকপূর্ণ বায়ু প্রবেশ করিয়ে দূষক পদার্থগুলিকে থিতিয়ে জমা করা হয় এবং বিশুদ্ধ বায়ু নির্গত করা হয়|

অম্ল বৃষ্টি :বাতাসে ভাসমান ধুলিকণা ও বিভিন্ন গ্যাসিয় বস্তু তুষার, শিশির ও জলীয় বাষ্পের সাথে মিশ্রিত হয়ে বিক্রিয়ার মাধ্যমে সালফিউরিক অ্যাসিড, নাইট্রিক অ্যাসিড, হাইড্রোজেন ক্লোরাইড প্রভৃতি রাসায়নিক পদার্থগুলি পৃথিবীর বুকে বৃষ্টিরূপে পতিত হওয়ার ঘটনাকে অম্লবৃষ্টি বলে|

অম্ল বৃষ্টির কারণ :বায়ু দূষণকেই অম্লবৃষ্টির প্রধান কারণ হিসেবে চিহ্নিত করা হয়|মূলত কলকারখানা, যানবাহন, ধাতু নিষ্কাসন চুল্লি থেকে নির্গত গ্যাস এবং ধোঁয়ার মাধ্যমে বায়ুমন্ডলে সালফার ও নাইট্রোজেনের অক্সাইডগুলি জমা হয়|এই রাসায়নিক পদার্থ সমূহ ভাসমান জ্বলকণার সাথে বিক্রিয়া করে বৃষ্টি, শিশির বা তুষারের সাথে পৃথিবী পৃষ্ঠে অ্যাসিড বৃষ্টিরূপে নেমে আসে|আসলে বায়ুমন্ডলে অক্সিজেন ও ভাসমান ধুলিকণা গুলি জলের সাথে আলোক -রাসায়নিক বিক্রিয়া ঘটিয়ে সালফার ডাইঅক্সাইড এবং সালফিউরিক অ্যাসিড তৈরী করে |

বায়ুদূষণ রোধে আইনসম্মত উপায় :

1)নতুন কোনো শিল্প স্থাপন করতে হলে রাজ্য দূষণ পর্ষদের অনুমতি নেওয়া বাধ্যতামূলক|2)কোনো কারখানা বা শিল্পদূষণ নিয়ন্ত্রণ পর্ষদের অনুমোদন সীমার বেশি ক্ষতিকারক গ্যাস বায়ুতে মেশাতে পারবেনা|3)শিল্পায়ন ও নগরায়নের স্থান নির্ধারণের জন্য রাজ্য দূষণ পর্ষদের অনুমতি নেওয়া বাধ্যতামূলক|4)অটোমোবাইল ইঞ্জিনের ধোঁয়া নির্ধারিত সীমার মধ্যে রাখা বাধ্যতামূলক|5)শিল্পাঞ্চল কখনোই গ্রামাঞ্চলের বায়ুর উৎকর্ষমানের সীমা অতিক্রম করবে না|

বায়ুদূষণ রোধের ব্যক্তিগত উপায়:

বায়ুদূষণ রোধের জন্য ব্যক্তিগতভাবে যেসব ব্যবস্থা নেওয়া সম্ভব সেগুলি হলো-1)জীবাশ্ম জ্বালানির ব্যবহার কমানো|2)অপ্রয়োজনীয় বস্তুর উৎপাদন হ্রাস করা এবং ব্যবহার কমানো দরকার|3)বসতি অঞ্চল শিল্পাঞ্চল থেকে দূরে রাখতে হবে|4)জনবহুল স্থানে এবং সর্বসাধারণের ব্যবহার্য স্থানগুলিতে ধূমপান করা যাবে না|5)রাসায়নিক কীটনাশক এর ব্যবহার কমিয়ে জৈবিক পদ্ধতিতে কীটপতঙ্গদের দমনের ব্যবস্থা নিতে হবে|

বায়ুদূষণের ফলে সৃষ্ট রোগ:

বায়ুতে কার্বনমনোঅক্সাইডের পরিমান বেশি হলে মানুষের মাথাধরা এবং শ্বাসকষ্ট দেখা যায়| কার্বন মনোঅক্সাইড রক্তের হিমোগ্লোবিনের সাথে মিশে হিমোগ্লোবিনের অক্সিজেন বহন ক্ষমতা কমিয়ে দেয়| হাইড্রোকার্বোনের অসম্পূর্ণ জারণের ফলে নির্গত বেঞ্জপাইরিন ফুসফুসের ক্যান্সার সৃষ্টি করে|

বায়ুদূষক পদার্থ কিভাবে মানুষ ও উদ্ভিদের ক্ষতি করে তা নিচে দেখানো হল

1)কার্বন মনোঅক্সাইড গ্যাস:হিমোগ্লোবিনের অক্সিজেন পরিবহন ক্ষমতা কমিয়ে দেয়, ফলে মাথা ধরা, বমি বমি ভাব, শ্বাসকষ্ট, ঘুম ঘুম ভাব ইত্যাদি লক্ষণ প্রকাশ পায়|

2)সালফার ডাইঅক্সাইড গ্যাস :চোখে জ্বালা, শ্বাসনালির প্রদাহ, হাঁপানি, ফুসফুসের ক্যান্সার ইত্যাদি|

3)নাইট্রোজেন অক্সাইড :নিউমোনিয়া, ফুসফুসের প্রদাহ ইত্যাদি

4)হাইড্রোজেন সালফাইড :মাথাধরা, দৃষ্টি কমে যাওয়া, স্নায়ুকোশের ইত্যাদি

5)হাইড্রোজেন সায়ানাইড:মাথাধরা, দৃষ্টি কমে যাওয়া, স্নায়ুকোশের মৃত্যু ইত্যাদি

6)ক্লোরিন :সম্পূর্ণ শ্বাসযন্ত্র আক্রান্ত হয়

7)ইথিলিন :উদ্ভিদের বৃদ্ধি ব্যাহত হয়, টোম্যাটো ও বেগুনের মিউটেশন ব্যাহত হয়

8)ফটোকেমিক্যাল ধোঁয়াশা :শস্যের ক্ষতি হয়|

বায়ুদূষণঘটিত রোগ ও তার কারণ

রোগ	কারণ
1. সিলিকোসিস	1. সিলিকন
2. ব্ল্যাক লাং	2.কার্বন কণা
3. বিজিনোসিস	3.সুতো, শন, তিসি
4. ট্যালকোসিস	4.পাউডারের গুঁড়ো
5. নিউমোকোনিওসিস্	5.ধুলিকণা, জীবাণু
6. অ্যাজমা	6.ধুলিকণা, রেনু
7.অ্যানথ্রোকোসিস	7. কয়লার গুঁড়ো

পরিবেশ ও মানব স্বাস্থ্যের ওপর বায়ুদূষণের প্রভাব

মানুষ ও পরিবেশের ওপর বায়ুদূষণের প্রভাব অত্যন্ত ক্ষতিকর|এই প্রভাবগুলিকে চারটি প্রধান ভাগে ভাগ করা যায়-

1)**আবহাওয়া ও জলবায়ুর উপর প্রভাব:** বায়ুদূষণের ফলে বিভিন্ন প্রকারের গ্রিনহাউস গ্যাসগুলির প্রভাব বৃদ্ধি পেয়েছে|একদিকে ওজন স্তরে গহ্বর সৃষ্টি হয়েছে, অন্যদিকে বায়ুমন্ডলে তাপমাত্রা বৃদ্ধি পেয়েছে|ফলে বর্তমানে জলবায়ুর পরিবর্তন ঘটেছে|এর ফলে শহরে ও শিল্পাঞ্চলে ধোঁয়াশা এবং অম্লবৃষ্টির সৃষ্টি হচ্ছে|

2)**মানুষের স্বাস্থ্যের ওপর প্রভাব:**বায়ুদূষণের ফলে শ্বাসকষ্ট, নিউমোনিয়া, ব্রঙ্কাইটিস, ফুসফুসের রোগ, চামড়ার রোগ, চোখ-মুখ ও গলার রোগ, পেটের রোগ ল, দাঁতের মাড়ির রোগ, ক্যান্সার, সিলিকোসিস প্রভৃতি রোগ ঘটে|কোনো শিল্পকারখানা থেকে হটাৎ করে বিষাক্ত গ্যাস প্রচুর পরিমানে বের হলে অন্ধত্ব থেকে শুরু করে মানুষের মৃত্যু পর্যন্ত ঘটে|1984-তে ভোপাল শহরে ইউনিয়ন কার্বাইড

কীটনাশক তৈরির কারখানা থেকে MIC বের হয়ে প্রায় 2500 জন মানুষের প্রানহানি ঘটে| এটি পৃথিবীর বৃহত্তম বায়ুদূষণঘটিত দুর্ঘটনা|

3)**প্রাণী ও উদ্ভিদ জগতের ওপর প্রভাব:**অতিবেগুনি রশ্মি আগের চেয়ে বেশি পরিমানে বায়ুমন্ডলে প্রবেশের ফলে প্রাণী ও উদ্ভিদজগৎ বায়ুদূষণের দ্বারা ক্ষতিগ্রস্ত হচ্ছে| সালোকসংশ্লেষ ব্যাহত হচ্ছে, মাটিতে জলের পরিমান কমে গিয়ে কৃষিজ উৎপাদন কমে যাচ্ছে|

4)**বস্তুজগতের উপর প্রভাব:**বায়ুদূষণের ফলে মানুষের বসবাসের স্থান, বিষয়সম্পত্তি, এমনকি মন্দির, মসজিদ, স্মৃতিসৌধও ক্ষতিগ্রস্ত হচ্ছে| ধোঁয়া, ময়লা, ধুলো ও সালফার ডাইঅক্সাইডের কুপ্রভাবে বায়ুদূষিত হয়ে ইট, সিমেন্ট, চুনাপাথর, মার্বেল প্রভৃতির ক্ষয়সাধন করছে|

উপসংহার

বায়ুদূষণ আজকের দিনে এক বড় সমস্যা হয়ে দাঁড়িয়েছে আমাদের সমাজে|অনেক জায়গায় এই সমস্যা অনেক গুরুতর|তাই আমাদের একত্রিত হয়ে বায়ুদূষণকে রুখতে হবে|বায়ুকে দূষিত করে এমন জিনিসপত্র কম ব্যবহার করতে হবে,সরকারকে এর জন্য করা পদক্ষেপ নিতে হবে, সরকার ও জনগণের যৌথ প্রচেষ্টায় বায়ুদূষণকে রক্ষা সম্ভব|ব্যাটারী চালিত গাড়ির production বাড়াতে হবে এবং ডিজেল ও পেট্রল চালিত গাড়ির সংখ্যা কমাতে হবে|প্রাকৃতিক কারণে যে বায়ুদূষণ হয় তাকে আমরা রুখতে পারবো না তবে আমরা অবশ্যই মনুষ্য সৃষ্ট কারণ গুলিকে রুখতে পারি|

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কৃতজ্ঞতা স্বীকার

আমার envs এর উপরে এই প্রজেক্ট টা করতে সম্মানীয় envs এর শিক্ষিকারা আমাকে পর্যাপ্ত পরিমানে উপকরণ, তথ্য দিয়ে আমাকে সাহায্য করেছে, তাই আমি তাদের কাছে কৃতজ্ঞ থাকবো |তারা সাহায্য না করলে হয়তো আমার প্রজেক্ট টা সম্পূর্ণ হতো না|

Topic - Environmental pollution

AECC

SEMESTER 2

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Contents

- Introduction
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Introduction

The concept of environment is as old as the concept of the nature itself. It is a composite term referring to conditions in which organisms consisting of air, water, food, sunlight etc.P thrive and become living sources of life for- all the living and non-living beings including plant life. The term also includes atmospheric temperature, wind and its velocity. Developmental activities such as construction, transportation and manufacturing not only deplete the natural resources but also produce large amount of wastes that leads to pollution of air, water, soil, and oceans; global warming and acid rains. Untreated or improperly treated waste is a major cause of pollution of rivers and environmental degradation causing ill health and loss of crop productivity. In this lesson you will study about the major causes of pollution, their effects on our environment and the various measures that can be taken to control pollution.

Environmental pollution

Before understanding what "Environmental Pollution" is it is equally necessary to-know what "pollution is.
Definition of pollution: The introduction by man into the environment of substances or energy liable to cause hazards to human health, harm to living resources and ecological systems, damage to structure or amenity or interference with legitimate uses of the environment". The release (into any environmental medium) from any process of substances which are capable of causing harm to man or any other living organisms supported by the environment.
Pollution occurs when there is the potential for harm. Harm of man is not confined to physical injury but encompasses offence caused to any of his senses or harm to his property, therefore smells and noise which I may not cause injury can constitute pollution. Harm to living organisms can include harm to their health or interference with the ecological systems of which they form a part".
KINDS OF POLLUTION
Environmental pollution may broadly be classified into: (1) Natural pollution; (2) Man-made pollution.
1. Natural Pollution: Environment is polluted often by natural phenomenon, such as earthquakes, floods, drought, cyclones, etc.
2. Man-made Pollution: Human activities.
The environmental pollution can also be classified further as, Air pollution, water pollution, land pollution, food pollution, noise pollution and radio-active pollution, etc.

POLLUTION AND POLLUTANTS
Human activities directly or indirectly affect the environment adversely. A stone crusher adds a lot of suspended particulate matter and noise into the atmosphere. Automobiles emit from tail pipes oxides of nitrogen, sulphur dioxide, carbon dioxide, carbon monoxide and a complex mixture of unburnt hydrocarbons and black soot which pollute the atmosphere. Domestic sewage and run off from agricultural fields, laden with pesticides and fertilizers, pollute water bodies. Effluents from tanneries contain many harmful chemicals and emit foul smell. These are only a few examples which show how human activities pollute the environment. Pollution may be defined as addition of undesirable material into the environment as a result of human activities. The agents which cause environmental pollution are called pollutants. A pollutants may

be defined as a physical, chemical or biological substance unintentionally released into the environment which is directly or indirectly harmful to humans and other living organisms.

TYPES OF POLLUTION

Pollution may be of the following types:

- Air pollution
- Noise pollution
- Water pollution
- Soil pollution
- Thermal pollution
- Radiation pollution

AIR POLLUTION

DEFINITION OF POLLUTION

Air pollution is a result of industrial and certain domestic activity. An ever increasing use of fossil fuels in power plants, industries, transportation, mining, construction of buildings, stone quarries had led to air pollution. Air pollution may be defined as the presence of any solid, liquid or gaseous substance including noise and radioactive radiation in the atmosphere in such concentration that may be directly and indirectly injurious to humans or other living organisms, plants, property or interferes with the normal environmental processes. Air pollutants are of two types (1) suspended particulate matter, and (2) gaseous pollutants like carbon dioxide (CO_2), NOx etc. Some of the major air pollutants, their sources and effects are given in table

Pollutant	**Sources**	**Effects**
Suspended particulate matter/dust	Smoke from domestic, industrial and vehicular soot	Depends on specific composition Reduces sunlight and visibility, increases corrosion, Pneumoconiosis, asthma, cancer, and other lung diseases.
Fly ash	Part of smoke released from chimneys of factories and power plants	Settles down on vegetation, houses. Adds to the suspended participate matter (SPM) in the air. Leachates contain harmful Material.

Particulate pollutants

Particulate matter suspended in air are dust and soot released from the industrial chimneys. Their size ranges from 0.001 to 500 μm in diameter. Particles less than 10μm float and move freely with the air current. Particles which are more than 10μm in diameter settle down. Particles less than 0.02 μm form persisent aerosols. Major source of SPM (suspended particulate matter) are vehicles, power plants, construction activities, oil refinery, railway yard, market place, industries, etc.

- **Fly ash**

Fly ash is ejected mostly by thermal power plants as by products of coal burning operations. Fly ash pollutes air and water and may cause heavy metal pollution in water bodies. Fly ash affects vegetation as a result of

its direct deposition on leaf surfaces or indirectly through its deposition on soil. Fly ash is now being used for making bricks and as a land fill material.

• **Lead and other metals particles**

Tetraethyl lead (TEL) is used as an anti-knock agent in petrol for smooth and easy running of vehicles. The lead particles coming out from the exhaust pipes of vehicles is mixed with air. If inhaled it produces injurious effects on kidney and liver and interferes with development of red blood cells. Lead mixed with water and food can create cumulative poisoning. It has long term effects on children as it lowers intelligence.

Oxides of iron, aluminum, manganese, magnesium, zinc and other metals have adverse effect due to deposition of dust on plants during mining operations and metallurgical processes. They create physiological, biochemical and developmental disorders in plants and also contribute towards reproductive failure in plants.

Annual average concentration of pollutants in ambient air in residential and industrial areas (year 2000) mg/m3 in 24 hours

SPM permissible- residential 140 – 200 mg/m3, industrial 360 – 500 mg/m3.

City	Residential area	Industrial area
Agra	349	388
Bhopal	185	160
Delhi	368	372
Kanpur	348	444
Nagpur	140	157
Kolkata	218	405

Gaseous pollutants

Power plants, industries, different types of vehicles – both private and commercial use petrol, diesel as fuel and release gaseous pollutants such as carbon dioxide, oxides of nitrogen and sulphur dioxide along with particulate matter in the form of smoke. All of these have harmful effects on plants and humans. lists some of these pollutants, their sources and harmful effects.

Pollutant	Source	Harmful effect
Carbon compound (CO and CO2)	Automobile exhaust burning of wood and coal.	• Respiratory problems • Green house effect

Sulphur compounds (SO_2 and H_2S) Nitrogen Compound (NO and N_2O)	Power plants and refineries volcanic eruptions. Motor vehicle exhaust atmospheric reaction.	• Respiratory problems in humans • Loss of chlorophyll in plants (chlorosis) • Acid rain • Irritation in eyes and lungs • Low productivity in plants • Acid rain damages material (metals and stone)
Hydrocarbons (benzene, ethylene)	Automobiles and petroleum industries.	• Respiratory problem • Cancer causing properties
SPM (Suspended Particulate Matter) (Any soild and liquid) particles suspended in the air, (flush, dust, lead)	Thermal power plants, Construction activities, metalurgical processes and automobiles	• Poor visibility, breathing problems • Lead interfers with the development of red blood diseases and cancer. • Smoge (skoke & fog) formation leads to poor visibility and aggravates asthma in patients
Fibres (Cotton, wool)	Textiles and carpet weaving industries.	• Lung disorders

Prevention and control of air pollution

(i) **Indoor air pollution**

Poor ventilation due to faulty design of buildings leads to pollution of the confined space. Paints, carpets, furniture, etc. in rooms may give out volatile organic compounds (VOCs). Use of disinfectants, fumigants, etc. may release hazardous gases. In hospitals, pathogens present in waste remain in the air in the form of spores. This can result in hospital acquired infections and is an occupational health hazard. In congested areas, slums and rural areas burning of firewood and biomass results in lot of smoke. Children and ladies exposed to smoke may suffer from acute respiratory problems which include running nose, cough, sore throat, lung infection, asthama, difficulty in breathing, noisy respiration and wheezing.

(ii) **Prevention and control of indoor air pollution**

Use of wood and dung cakes should be replaced by cleaner fuels such as biogas, kerosene or electricity. But supply of electricity is limited. Similarly kerosene is also limited. Improved stoves for looking like smokeless chullahs have high thermal efficiency and reduced emission of pollutants including smoke. The house designs should incorporate a well ventilated kitchen. Use of biogas and CNG (Compressed Natural Gas) need to be encouraged. Those species of trees such as baval (Acacia nilotica) which are least smoky should be planted and used. Charcoal is a comparatively cleaner fuel. Indoor pollution due to decay of

exposed kitchen waste can be reduced by covering the waste properly. Segregation of waste, pretreatment at source, sterilization of rooms will help in checking indoor air pollution.

(iii) **Prevention and control of industrial pollution**

Industrial pollution can be greatly reduced by:

(a) useofcleanerfuelssuchasliquefiednaturalgas(LNG)inpowerplants,fertilizer plants etc. which is cheaper in addition to being environmentally friendly.

(b) employingenvironmentfriendlyindustrialprocessessothatemissionofpollutantsand hazardous waste is minimized.

(c) installingdeviceswhichreducereleaseofpollutants.Deviceslikefilters,electrostatic precipitators, inertial collectors, scrubbers, gravel bed filters or dry scrubbers are described below:

I. **Filters** – Filters remove particulate matter from the gas stream. The medium of a filter may be made of fibrous materials like cloth, granular material like sand, a rigid material like screen, or any mat like felt pad. Baghouse filtration system is the most common one and is made of cotton or synthetic fibres (for low temperatures) or glass cloth fabrics (for higher temperature up to 290oC).

II. **Electrostaticprecipitators(ESP**)-Theemanatingdustischargedwithionsandthe ionized particulate matter is collected on an oppositely charged surface. The particles are removed from the collection surface by occasional shaking or by rapping the surface. ESPs are used in boilers, furnaces, and many other units of thermal power plants, cement factories, steel plants, etc.

III. Inertial collectors – It works on the principle that inertia of SPM in a gas is higher than its solvent and as inertia is a function of the mass of the particulate matter this device collects heavier particles more efficiently. 'Cyclone'is a common inertial collector used in gas cleaning plants.

IV. Scrubbers – Scrubbers are wet collectors. They remove aerosols from a stream of gas either by collecting wet particles on a surface followed by their removal, or else the particles are wetted by a scrubbing liquid. The particles get trapped as they travel from supporting gaseous medium across the interface to the liquid scrubbing medium.

Gaseous pollutants can be removed by absorption in a liquid using a wet scrubber and depends on the type of the gas to be removed e.g. for removal of sulphur dioxide alkaline solution is needed as it dissolves sulphur dioxide. Gas episode pollutants may be absorbed on an activated solid surface like silica gel, alumina, carbon, etc. Silica gel can remove water vapour. Condensation allows the recovery of many by products in coal and petroleum processing industries from their liquid effluents.

Apart from the use of above mentioned devices, other control measures are-

• increasing the height of chimneys.
• closing industries which pollute the environment.
• shifting of polluting industries away from cities and heavily populated areas.
• development and maintenance of green belt of adequate width.

(iv) Control of vehicular pollution

• The emission standards for automobiles have been set which if followed will reduce the pollution.

Standards have been set for the durability of catalytic converters which reduce vehicular emission.

- In cities like Delhi, motor vehicles need to obtain Pollution Under Control (PUC) certificate at regular intervals. This ensures that levels of pollutants emitted from vehicle exhaust are not beyond the prescribed legal limits.
- The price of diesel is much cheaper than petrol which promotes use of diesel. To reduce emission of sulphurdioxide, sulphur content in diesel has been reduced to 0.05%.
- Earlier lead in the form of tetraethyl lead was added in the petrol to raise octane level for smooth running of engines. Addition of lead in petrol has been banned to prevent emission of lead particles with the vehicular emission.

Ozone holecause and harm due to ozone depletion

The stratosphere has an ozone layer which protects the earth's surface from excessive ultraviolet (UV) radiation from the Sun. Chlorine from chemicals such as chlorofluorocarbons (CFCs) used for refrigeration, air conditioning, fire extinguishers, cleaning solvents, aerosols (spray cans of perfumes, medicine, insecticide) cause damage to ozone layer chlorine contained in the CFCs on reaching the ozone (O3) layer split the ozone molecules to form oxygen (O2). Amount of ozone, thus gets reduced and cannot prevent the entry of UV radiation. There has been a reduction of ozone umbrella or shield over the Arctic and Antarctic regions. This is known as ozone hole. This permits passage of UV radiation on earth's atmosphere which causes sunburn, cataract in eyes leading to blindness, skin cancer, reduced productivity of forests, etc. Under the "Montreal Protocol" amended in 1990 it was decided to completely phase out CFCs to prevent damage of ozone layer.

GLOBAL WARMING AND GREEN HOUSE EFFECTS

Atmospheric gases like carbondioxide, methane, nitrous oxide, water vapour, and chlorofluorocarbons are capable of trapping the out-going infrared radiation from the earth. Infra-red radiations trapped by the earth's surface cannot pass through these gases and to increase thermal energy or heat in the atmosphere. Thus, the temperature of the global atmosphere is increased. As this phenomenon of increase in temperature is observed in green houses, in the botanical gardens these gases are known as green house gases and the heating effect is known as green house effect. If greenhouse gases are not checked, by the turn of the century the temperature may rise by 50C. This will melt the polar ice caps and increase the sea level leading to coastal flooding, loss of coastal areas and ecosystems like swamps and marshes, etc.

NOISE POLLUTION

Noise is one of the most pervasive pollutant. A musical clock may be nice to listen during the day, but may be an irritant during sleep at night. Noise by definition is "sound without value" or "any noise that is unwanted by the recipient". Noise in industries such as stone cutting and crushing, steel forgings , loudspeakers, shouting by hawkers selling their wares, movement of heavy transport vehicles, railways and airports leads to irritation and an increased blood pressure, loss of temper, decrease in work efficiency, loss of hearing which may be first temporary but can become permanent in the noise stress continues. It is therefore of utmost importance that excessive noise is controlled. Noise level is measured in terms of decibels (dB). W.H.O. (World Health Organization) has prescribed optimum noise level as 45 dB by day and 35 dB by night. Anything above 80 dB is hazardous. The table10.4 gives the noise intensity in some of the common activities.

Sources of some noises and their intensity

Source	Intensity	
Quiet Conversation	20-30dB	
Loud Conversation	60dB	
Lawn Mower	60-80 dB	
Aircraft Noise	90-120 dB	
Beat Music	120 dB	

Motor Cycle	105 dB	
Radio Music	50-60 dB	
Traffic Noise	60-90 dB	
Heavy Truck	90-100 dB	
Space Vehicle Launch	140-179 dB	
Jet Engine	140 dB	

Sources of noise pollution

Noise pollution is a growing problem. All human activities contribute to noise pollution to varying extent. Sources of noise pollution are many and may be located indoors or outdoors.

Indoor sources include noise produced by radio, television, generators, electric fans, air coolers, air conditioners, different home appliances, and family conflict. Noise pollution is more in cities due to a higher concentration of population and industries and activities such as transportation. Noise like other pollutants is a by product of industrialization, urbanization and modern civilization.

Outdoor sources of noise pollution include indiscriminate use of loudspeakers, industrial activities, automobiles, rail traffic, aeroplanes and activities such as those at market place, religious, social, and cultural functions, sports and political rallies. In rural areas farm machines, pump sets are main sources of noise pollution. During festivals, marriage and many other occasions, use of fire crackers contribute to noise pollution.

Effects of noise pollution

Noise pollution is highly annoying and irritating. Noise disturbs sleep, causes hypertension (high blood pressure), emotional problems such as aggression, mental depression and annoyance. Noise pollution adversely affects efficiency and performance of individuals.

Prevention and control of noise pollution

Following steps can be taken to control or minimize noise pollution-

• Road traffic noise can be reduced by better designing and proper maintenance of vehicles.

• Noise abatement measures include creating noise mounds, noise attenuation walls and well maintained roads and smooth surfacing of roads.

• Retrofitting of locomotives, continuously welded rail track, use of electric locomotives or deployment of quieter rolling stock will reduce noises emanating from trains.

• Air traffic noise can be reduced by appropriate insulation and introduction of noise regulations for take off and landing of aircrafts at the airport.

• Industrial noises can be reduced by sound proofing equipment like generators and areas producing lot of noise.

• Power tools, very loud music and land movers, public functions using loudspeakers, etc should not be permitted at night. Use of horns, alarms, refrigeration units, etc. is to be restricted. Use of fire crackers which are noisy and cause air pollution should be restricted.

• A green belt of trees is an efficient noise absorber.

WATER POLLUTION

Addition or presence of undesirable substances in water is called water pollution.

Water pollution is one of the most serious environmental problems. Water pollution is caused by a variety of human activities such as industrial, agricultural and domestic. Agricultural run off laden with excess fertilizers and pesticides, industrial effluents with toxic substances and sewage water with human and animal wastes pollute our water thoroughly. Natural sources of pollution of water are soil erosion, leaching of minerals from rocks and decaying of organic matter. Rivers, lakes, seas, oceans, estuaries and ground water sources may be polluted by point or non-point sources. When pollutants are discharged from a specific location such as a drain pipe carrying industrial effluents discharged directly into a water body it represents point source pollution. In contrast non-point sources include discharge of pollutants from diffused sources or from a larger area such as run off from agricultural fields, grazing lands, construction sites, abandoned mines and pits, roads and streets.

Sources of water pollution

Water pollution is the major source of water born diseases and other health problems. Sediments brought by runoff water from agricultural fields and discharge of untreated or partially treated sewage and industrial effluents, disposal of fly ash or solid waste into or close to a water body cause severe problems of water pollution. Increased turbidity of water because of sediments reduces penetration of light in water that reduces photosynthesis by aquatic plants.

(i) **Pollution** due to pesticides and inorganic chemicals

• Pesticides like DDT and others used in agriculture may contaminate water bodies. Aquatic organisms take up pesticides from water get into the food chain (aquatic in this case) and move up the food chain. At higher trophic level they get concentrated and may reach the upper end of the food chain.

• Metals like lead, zinc, arsenic, copper, mercury and cadmium in industrial waste waters adversely affect humans and other animals. Arsenic pollution of ground water has been reported from West Bengal, Orissa, Bihar, Western U.P. Consumption of such arsenic polluted water leads to accumulation of arsenic in the body parts like blood, nails and hairs causing skin lesions, rough skin, dry and thickening of skin and ultimately skin cancer.

• Pollution of water bodies by mercury causes Minamata disease in humans and dropsy in fishes. Lead causes displexia, cadmium poisoning causes Itai – Itai disease etc.

• Oil pollution of sea occurs from leakage from ships, oil tankers, rigs and pipelines. Accidents of oil tankers spill large quantity of oil in seas which kills marine birds and adversely affects other marine life and beaches.

(ii) **Thermal pollution**

Power plants- thermal and nuclear, chemical and other industries use lot of water (about 30 % of all abstracted water) for cooling purposes and the used hot water is discharged into rivers, streams or oceans. The waste heat from the boilers and heating processes increases the temperature of the cooling water. Discharge of hot water may increase the temperature of the receiving water by 10 to 15 °C above the ambient water temperature. This is thermal pollution. Increase in water temperature decreases dissolved oxygen in water which adversely affects aquatic life. Unlike terrestrial ecosystems, the temperature of water bodies remain steady and does not change very much. Accordingly, aquatic organisms are adopted to a uniform steady temperature of environment and any fluctuation in water temperature severely affects aquatic plants and animals. Hence discharge of hot water from power plants adversely affects aquatic organisms. Aquatic plants and animals in the warm tropical water live dangerously close to their upper limit of temperature, particularly during the warm summer months. It requires only a slight deviation from this limit to cause a thermal stress to these organisms.

Discharge of hot water in water body affects feeding in fishes, increases their metabolism and affects their growth. Their swimming efficiency declines. Running away from predators or chasing prey becomes

difficult. Their resistance to diseases and parasites decreases. Due to thermal pollution biological diversity is reduced. One of the best methods of reducing thermal pollution is to store the hot water in cooling ponds, allow the water to cool before releasing into any receiving water body

Ground water pollution

Lot of people around the world depend on ground water for drinking, domestic, industrial and agricultural uses. Generally groundwater is a clean source of water. However, human activities such as improper sewage disposal, dumping of farm yard manures and agricultural chemicals, industrial effluents are causing pollution of ground water.

Eutrophication

• 'Eu' maens well or healthy and 'trophy' means nutrition. The enrichment of water bodies with nutrients causes entrophication of the water body.

Discharge of domestic waste, agricultural surface runoff, land drainage and industrial effluents in a water body leads to rapid nutrients enrichment in a water body. The excessive nutrient enrichment in a water body encourages the growth of algae duckweed, water hyacinth, phytoplankton and other aquatic plants.The biological demand for oxygen (BOD) increases with the increase in aquatic organisms. As more plants grow and die, the dead and decaying plants and organic matter acted upon by heterotrophic prtozoans and bacteria, deplete the water of dissolved oxygen (DO). Decrease in DO result in sudden death of large population of fish and other aquatic organisms including plants, releasing offensive smell and makes the water unfit for human use. The sudden and explosive growth of phytoplankton and algae impart green colour to the water is known as water bloom, or "algal blooms". These phytoplankton release toxic substances in water that causes sudden death of large population of fishes. This phenomenon of nutrient enrichment of a water body is called eutrophication. Human activities are mainly responsible for the eutrophication of a growing number of lakes and water bodies in the country

Methodsforcontrolofwaterpollutionandwaterrecycling

Control water pollution

Waste water from domestic or industrial sources or from garbage dumps is generally known as sewage. It may also contain rain water and surface runoff. The sewage water can be treated to make it safe for disposal into water bodies like rivers, lakes etc. The treatment involves three stages: primary, secondary and tertiary. This includes 1. sedimentation, 2. coagulation/flocculation, 3.filtration, 4.disinfection, 5.softening and 6.aeration. The first four steps are of primary treatment. The first three steps are involved in primary treatment remove suspended particulate matter. Secondary treatment removes organic solids, left out after primary treatment, through their microbial decomposition. Effluents after secondary treatment may be clean but contain large amounts of nitrogen, in form of ammonia, nitrates and phosphorous which can cause problem of eutrophication upon their discharge into a receiving water body such as river, lake or pond. The tertiary treatment is meant to remove nutrients, disinfect for removing pathogenic bacteria, and aeration removes hydrogen sulphide and reduce the amount of carbon dioxide and make water healthy and fit for aquatic organisms. This treatment of waste water or sewage is carried out in effluent treatment plants especially built for this purpose. The residue obtained from primary treatment one known as sludge.

Water recycling

With increasing population the requirement for water is increasing rapidly. However, the availability of water is limited but an ever increasing water withdrawal from different sources
such as rivers, lakes and ground water is depleting these sources and deteriorating their water quality. Therefore, it is essential to utilize the available water with maximum economy. This involves recycling of waste water for certain uses with or without treatment. Recycling refers to the use of waste-water by the original user prior to the discharge either to a treatment system or to a receiving water body. Thus the waste water is recovered and repetitively recycled with or without treatment by the same user.

Control of water pollution

The following measures can be adopted to control water pollution:

i. The water requirement should be minimize by altering the technique involved.
ii. Water should be reuse with or without treatment
iii. Recycling of water treatment should be practiced to the maximum extent possible.
iv. The quantity of waste water discharged should be minimize.

SOIL POLLUTION

Addition of substances which adversely affect the quality of soil or its fertility is known as soil pollution. Generally polluted water also pollute soil. Solid waste is a mixture of plastics, cloth, glass, metal and organic matter, sewage, sewage sludge, building debris, generated from households, commercial and industries establishments add to soil pollution. Fly ash, iron and steel slag, medical and industrial wastes disposed on land are important sources of soil pollution. In addition, fertilizers and pesticides from agricultural use which reach soil as run-off and land filling by municipal waste are growing cause of soil pollution.

Acid rain and dry deposition of pollutants on land surface also contribute to soil pollution.

Sources of soil pollution

Plastic bags – Plastic bags made from low density polyethylene (LDPE), is virtually indestructible, create colossal environmental hazard. The discarded bags block drains and sewage systems. Leftover food, vegetable waste etc. on which cows and dogs feed may die due to the choking by plastic bags. Plastic is non biodegradable and burning of plastic in garbage dumps release highly toxic and poisonous gases like carbon monoxide, carbon dioxide, phosgene, dioxine and other poisonous chlorinated compounds.

Industrial sources – It includes fly ash, chemical residues, metallic and nuclear wastes. Large number of industrial chemicals, dyes, acids, etc. find their way into the soil and are known to create many health hazards including cancer.

Agricultural sources – Agricultural chemicals especially fertilizers and pesticides pollute the soil. Fertilizers in the run off water from these fields can cause eutrophication in water bodies. Pesticides are highly toxic chemicals which affect humans and other animals adversely causing respiratory problems, cancer and death.

Control of soil pollution

Indiscriminate disposal of solid waste should be avoided. To control soil pollution, it is essential to stop the use of plastic bags and instead use bags of degradable materials like paper and cloth. Sewage should be treated properly before using as fertilizer and as landfills. The organic matter from domestic, agricultural and other waste should be segregated and subjected to vermicomposting which generates useful manure as a by product. The industrial wastes prior to disposal should be properly treated for removing hazardous materials. Biomedical waste should be separately collected and incinerated in proper incinerators.

RADIATION POLLUTION: SOURCES AND HAZARDS

Radiation pollution is the increase in over the natural background radiation. There are many sources of radiation pollution such as nuclear wastes from nuclear power plants, mining and processing of nuclear material etc. The worse case of nuclear pollution was the cherndoyl disaster in Russia occured in 1986 but the effects still longer today.

Radiation

Radiation is a form of energy travelling through space. The radiation emanating from the decay of radioactive nuclides are a major sources of radiation pollution. Radiations can be categorized into two groups namely the non-ionizing radiations and the ionizing radiations.

Non-ionizing radiations are constituted by the electromagnetic waves at the longer wavelength of the spectrum ranging from near infra-red rays to radio waves. These waves have energies enough to excite the atoms and molecules of the medium through which they pass, causing them to vibrate faster but not strong enough to ionize them. In a microwave oven the radiation causes water molecules in the cooking medium to vibrate faster and thus raising its temperature.

Ionizing radiations cause ionization of atoms and molecules of the medium through which they pass. Electromagnetic radiations such as short wavelength ultra violet radiations (UV),

X-rays and gamma rays and energetic particles produced in nuclear processes, electrically charged particles like alpha and beta particles produced in radioactive decay and neutrons produced in nuclear fission, are highly damaging to living organisms. Electrically charged particles produced in the nuclear processes can have sufficient energy to knock electrons out of the atoms or molecules of the medium, thereby producing ions. The ions produced in water molecules, for example, can induce reactions that can break bonds in proteins and other important molecules. An example of this would be when a gamma ray passes through a cell, the water molecules near the DNA might be ionized and the ions might react with the DNA causing it to break. They can also cause chemical changes by breaking the chemical bonds, which can damage living tissues. The ionizing radiations cause damage to biological systems and are, therefore, pollutants.

Radiation damage

The biological damage resulting from ionizing radiations is generally termed as radiation damage. Large amounts of radiation can kill cells that can dramatically affect the exposed organism as well as possibly its offspring. Affected cells can mutate and result in cancer. A large enough dose of radiation can kill the organism.

Radiation damage can be divided into two types: (a) somatic damage (also called radiation sickness) and (b) genetic damage. Somatic damage refers to damage to cells that are not associated with reproduction. Effects of somatic radiation damage include reddening of the skin, loss of hair, ulceration, fibrosis of the lungs, the formation of holes in tissue, a reduction of white blood cells, and the induction of cataract in the eyes. This damage can also result in cancer and death. Genetic damage refers to damage to cells associated with reproduction. This damage can subsequently cause genetic damage from gene mutation resulting in abnormalities. Genetic damages are passed on to next generation.

Radiation dose

The biological damage caused by the radiation is determined by the intensity of radiation and duration of the exposure. It depends on the amount of energy deposited by the radiation in the biological system. In studying the effects of radiation exposure in humans, it is important to realize that the biological damage caused by a particle depends not only on the total energy deposited but also on the rate of energy loss per unit distance traversed by the particle (or “linear energy transfer”). For example, alpha particles do much more damage per unit energy deposited than do electrons.

Radiation effects and radiation doses

A traditional unit of human-equivalent dose is the rem, which stands for radiation equivalent in man.

At low doses, such as what we receive every day from background radiation (< 1 m rem), the cells repair the damage rapidly. At higher doses (up to 100 rem), the cells might

not be able to repair the damage, and the cells may either be changed permanently or die. Cells changed permanently may go on to produce abnormal cells when they divide and may become cancerous.

At even higher doses, the cells cannot be replaced fast enough and tissues fail to function. An example of this would be “radiation sickness.” This is a condition that results after high doses is given to the whole body (>100 rem).

Nuclear explosions and accidents in nuclear reactors are a serious source of radiation hazard. The effects of atomic explosions in Nagasaki and Hiroshima are still not forgotten. The nuclear reactor accident at

Chernobyl in 1986 led to deaths of many reactor personnel and a very large release of radionuclide to the environment causing a long term radiation damage to the people living in the neighboring regions.

Accidents at nuclear power plants

Nuclear fission in the reactor core produces lot of heat which if not controlled can lead to a meltdown of fuel rods in the reactor core. If a meltdown happens by accident, it will release large quantities of highly dangerous radioactive materials in the environment with disastrous consequences to the humans, animals and plants. To prevent this type of accidents and reactor blow up, the reactors are designed to have a number of safety features.

Inspite of these safety measures two disasters in the nuclear power plants are noteworthy- namely at 'Three Mile Island' in Middletown (U.S.A.) in 1979, at Chernobyl (U.S.S.R.) in 1986. In both these cases a series of mishaps and errors resulted in over heating of the reactor core and lot of radiation was released into the environment. The leakage from Three Mile Island reactor was apparently low and no one was injured immediately. However, in case of Chernobyl the leakage was very heavy causing death of some workers and radiation spread over large areas scattered all over Europe. People of the city had to be evacuated to safer places and the plant had to be closed down. These two disasters are a reminder that nuclear power reactors require a constant up gradation of safety measures. Accidents with nuclear submarines also points to the same.

Radiation Prevention

Radiation Pollution can be controlled and prevented at various levels, including the handling and treatment of radiation waste, the control and mitigation of nuclear accidents, as well as the control and minimization of personal exposure to radiation at an individual level.

The treatment of radiation waste cannot be done through degradation by chemical or biological processes. Additionally, many radioactive materials have very long half-times (time necessary for half of the material to degrade or transform into non-radioactive materials) and thus radiation waste may pose a risk for many years after it was produced. Basically, there are only a few options for radiation waste treatment involving:

- **Containment of the waste in radiation-shielded containers usually buried underground**
- **Isolation** of radiation waste in remote locations such as remote caves or abandoned mines - which may also involve the use of some kind of barriers (shields),
- When the first two alternatives are not possible, the waste may be **diluted until background** values are achieved.

Heat and Radiation Pollution

Basically, radiation is a method of heat transfer. While radiation may be generated in any conditions, the heat increases the amount of radiation and thus may increase the health risk. For example, radiation is concentrated in the ash due to burning processes. Also, the higher the heat, the higher the energy of radiation produced (e.g., UV rays are produced by hot bodies such as the sun). This is why radiation waste should be stored in cold places, away from any heating source.

Law Enforcement

In the U.S., environmental standards designed to protect human health from radiation are issued by EPA (the Environmental Protection Agency), along with guidance for federal agencies related to radiation exposure standards/limits. The Nuclear Regulatory Commission (NRC) is the federal agency responsible for

implementing some of the EPA's regulation and standards. The Department of Energy (DOE) implements the standards at their facilities.

Individual Prevention Measures

At individual levels, there are measures you may take to prevent and/or reduce radiation pollution that may affect you and your family:

- First, testing of your home for radon may be done by each person using inexpensive testing kits or by specialized consulting services. If radiation seems to be an issue (a higher than background value of radon in the home is found), a preferred radon reduction technique is the installation of a special system called active soil depressurization (ASD). This system contains a vent pipe with an inline centrifugal fan that operates continuously to vent radon and other intruding gases from beneath the house. Thus, the system may be efficient to block the intrusion into homes not only of radon, but also of other toxic chemicals (non-radioactive) that may get from the subsurface into indoor breathing air.
- Also, a good way of avoiding radiation exposure is to choose an appropriate location for your home, away from the main sources of radiation pollution sources.

CONCLUSION

The causes for environmental problems are many. The multiplicity of causes makes it difficult to clearly delineate the causes and consequences of environmental degradation in terms of simple one to one relationship. The causes and effects are often interwoven in complex webs of social, technological, environmental and political factors. However, some of the very common causes of environmental degradation which can be clearly pointed out are the population growth, the economic growth associated with the affluence factor and change of technology. Population is an important resource for development, yet it is a major cause of environmental degradation when it exceeds the threshold limits of the support systems. The overriding impact of adverse demographic pressure ultimately falls on our resources and ecosystems. Combined with it the conditions of poverty and underdevelopment themselves create a situation where the people are forced to live in squalor and further degrade their environment. The process of development itself also leads to damage of the environment, if not properly managed. Associated with the rapid economic growth, the extravagant affluence consume far more resources and put far greater pressure on natural resources. The change of technology causes planned obsolescence causing the generation of more and more wastes which in turn prove ecologically harmful. Short- term interests of private profit maximization, further, hamper the process of replacement of obsolete technologies by the ecologically benign technologies.

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টিউটোরিয়ালের বিষয় -
জলদূষণের পরিনাম ও প্রতিকার

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SEMESTER – II

PAPER – AECC ENVS

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ভূমিকা

Bbkjসাধারণত মানুষের কার্যকলাপের ফলে জলাশয় দূষিত হয়ে পড়লে, তাকে পানি দূষণ বা জল দূষণ বলে। উদাহরণস্বরূপ, জলাশয় বলতে হ্রদ, নদী, সমুদ্র, ভূগর্ভস্থ সিক্ত শিলাস্তর এবং ভৌমজলকেই বোঝায়। স্বাভাবিক পরিবেশে দূষণকারী পদার্থ উপস্থিত হলে জলদূষণ হয়। উদাহরণস্বরূপ, অপর্যাপ্তভাবে পরিশোধিত বর্জ্যজল যদি স্বাভাবিক জলাশয়ে জমা হয়, তবে তা জলজ বাস্তুতন্ত্রের পরিবেশগত অবনতি ঘটাতে পারে। এর ফলে, ভাটির দিকে বসবাসকারী মানুষের মধ্যে জনস্বাস্থ্যের সমস্যা দেখা দিতে পারে। তারা এই দূষিত জল পান করার কাজে, স্নানের কাজে অথবা সেচের কাজে ব্যবহার করতে পারে। জলবাহিত রোগের প্রকোপে সারা বিশ্বে যত মানুষ আক্রান্ত হয় বা মারা যায়, তাদের সিংহভাগই ঘটে জল দূষণের কারণে।

জলদূষণের কারণসমূহ

জলদূষণকে ভূ-পৃষ্ঠতলীয় জল বা ভৌমজল দূষণ - এই দুইভাগে বিভক্ত করা যায়। সামুদ্রিক দূষণ এবং পুষ্টি দূষণ - জল দূষণের এই দুটি উপসেট। জল দূষণের উৎস দুটি হতে পারে – হয় বিন্দু উৎস নতুবা অ-বিন্দু উৎস। বিন্দু উৎসে দূষণের একটিমাত্র চিহ্নিতযোগ্য কারণ থাকে, যেমন বেনো জল বা বর্জ্যজল পরিশোধক কারখানা। অ-বিন্দু উৎস হল আরো বেশি বিস্তৃত, যেমন কৃষিজ জল।[৩] বহু সময় ধরে ক্রমবর্দ্ধিত কাজের ফলেই দূষণ সৃষ্টি হয়। দূষিত জলাশয়ে থাকা অথবা এর সংস্পর্শে আসা সমস্ত গাছ এবং জীবই এর দ্বারা ক্ষতিগ্রস্ত হতে পারে। দূষণের ফলে একক প্রজাতিগুলো ধ্বংস হতে পারে এবং এরা যে স্বাভাবিক জৈব সংগঠনের অন্তর্গত তারও ক্ষতি হতে পারে।

জল দূষণের কারণ হিসেবে প্রচুর রাসায়নিক এবং রোগ-জীবাণুর কথা বলা যেতে পারে; তাছাড়া অনেক ভৌত স্থিতিমাপও রয়েছে। দূষকগুলো জৈব অথবা অজৈব পদার্থের হতে পারে। উষ্ণ তাপমাত্রাও দূষিত জলের কারণ

হতে পারে। তাপীয় দূষণের একটি সাধারণ কারণ হল তাপবিদ্যুৎ কেন্দ্র এবং শিল্পোৎপাদন কেন্দ্রে কুল্যান্ট হিসেবে জলের ব্যবহার। উষ্ণ জলীয় তাপমাত্রা অক্সিজেনের মাত্রা কমিয়ে দেয় যার ফলে মাছ মারা যায় এবং খাদ্যশৃঙ্খলের উপাদানও পরিবর্তিত হয়, প্রজাতির বাস্তুতন্ত্র কমে আসে, এবং এর ফলে তাপের ফলে সৃষ্ট ব্যাকটিরিয়ার নতুন প্রজাতির উদ্ভব হয়।[৪][৫]

জলের নমুনা বিশ্লেষণ করে জল দূষণ পরিমাপ করা হয়। ভৌত, রাসায়নিক এবং জৈব পরীক্ষা করা হতে পারে। সঠিক পরিকাঠামো এবং পরিচালনা পরিকল্পনার দ্বারাই জল দূষণকে নিয়ন্ত্রণ করা যেতে পারে। পরিকাঠামোর মধ্যে থাকতে পারে বর্জ্যজল পরিশোধক কারখানা। বর্জ্যনিকাশী পরিশোধক কারখানা এবং শিল্পজাত বর্জ্যজলের পরিশোধক কারখানা অশোধিত বর্জ্যজলের হাত থেকে জলাশয়গুলোকে রক্ষা করতে পারে। কৃষিখামারের ক্ষেত্রে কৃষিজ বর্জ্যজল পরিশোধন এবং নির্মাণ স্থানে ভূমিক্ষয় রোধের ব্যবস্থাও জলদূষণ প্রতিরোধ করতে পারে। জল দূষণ রোধের আরেকটি উপায় হল প্রকৃতি-কেন্দ্রিক সমাধান।[৬] স্রোতের গতি এবং এর পরিমাণ কমিয়ে শহরের নিকাশী ব্যবস্থার কার্যকরী

নিয়ন্ত্রণ করা যায়। মার্কিন যুক্তরাষ্ট্রে, জল দূষণের জন্য সেরা পরিচালনা ব্যবস্থা হিসেবে জলের পরিমাণ কমানো

এবং জলের মান উন্নত করার চেষ্টা করা হচ্ছে।

জল যদি মানুষবাহিত দূষক দ্বারা ক্ষতিগ্রস্ত হয়, তবে সেই জলকে দূষিত বলা হয়। এইসকল দূষকের ফলে এই জল হয় মানুষের ব্যবহারের যোগ্য হতে পারে না, যেমন জলপানের অযোগ্য হয়ে যায়, অথবা এই জলের জীবগোষ্ঠী ধারণের ক্ষমতাই নষ্ট হয়ে যায়, যেমন মাছ। আগ্নেয়গিরি, শৈবাল পুষ্প, ঝড়, ভূমিকম্প ইত্যাদি প্রাকৃতিক ঘটনার ফলেও জলের গুণাগুণে এবং এর বাস্তুতান্ত্রিক অবস্থায় প্রভূত পরিবর্তন দেখা দেয়।

জল দূষণ একটি বিশ্বব্যাপী গুরুতর সমস্যা। এর জন্য সর্বস্তরে (আন্তর্জাতিক স্তর থেকে ব্যক্তিগত ভূগর্ভস্থ সিক্ত শিলাস্তর এবং কুয়ো) জলসম্পদ নীতির মূল্যায়ন এবং পুনর্মূল্যায়ন জরুরী। মনে করা হয়, বিশ্বে যত রোগ ও মৃত্যু হয়, তার মুখ্য কারণ হল জল দূষণ।[২][১] ২০১৫ সালে ১৮ লক্ষ মানুষের মৃত্যুর জন্য দায়ী ছিল জল দূষণ।[৮]

বৈশ্বিক সামুদ্রিক পরিবেশগত সমীক্ষা নামক সংস্থার মতে জল দূষণ হল অন্যতম প্রধান একটি পরিবেশগত সমস্যা যেটা পরবর্তী দশকগুলোতে পৃথিবীতে প্রাণের অস্তিত্বকে সংকটে ফেলে দিতে পারে। ফাইটোপ্ল্যাঙ্কটন যেগুলো ৭০% অক্সিজেন উৎপন্ন করে এবং পৃথিবীর কার্বন-ডাই-অক্সাইডের একটি বড়ো অংশ শোষণ করে, জল দূষণ তাদের জন্য একটি অন্যতম সমস্যা। এই পরিস্থিতির মোকাবিলার জন্য সংস্থা থেকে বেশ কয়েকটি পদক্ষেপ গ্রহণ করা হয়েছে, কিন্তু সেগুলো কার্যকরী হতে দশ বছর সময় লাগবে।[৯][১০][১১]

ভারত এবং চীন এই দুই দেশে জল দূষণের মাত্রা অত্যন্ত বেশি। ভারতে প্রতিদিন আনুমানিক ৫৮০জন মানুষ জল দূষণজনিত রোগে (জলবাহিত রোগসমেত) মারা যায়।[১২] চীনের শহরের জলের প্রায় ৯০ শতাংশই দূষিত।[১৩] ২০০৭ সালের হিসেবানুযায়ী, চীনের পাঁচ লক্ষ মানুষ নিরাপদ পানীয় জলের থেকে বঞ্চিত।[১৪]

উন্নয়নশীল দেশের এই চূড়ান্ত জল দূষণের পাশাপাশি, উন্নত দেশগুলোও কিন্তু দূষণজনিত সমস্যা নিয়ে লড়াই করে চলেছে। উদাহরণস্বরূপ, ২০০৯ সালের মার্কিন যুক্তরাষ্ট্রের জলের মান রিপোর্টে বলা হয়েছে যে যত মাইল প্রবাহের মূল্যায়ন করা হয়েছে তার ৪৪ শতাংশ, মূল্যায়িত হ্রদের একরের ৬৪ শতাংশ এবং উপসাগর ও মোহনার স্কোয়্যার মাইলের ৩০ শতাংশকে দূষিত বলে জানানো হয়েছে।

জলদূষণের প্রকারভেদ

সামুদ্রিক দূষণ:

সমুদ্রে দূষিত পদার্থের আগমনের একটি সাধারণ পথ হল নদীর জল। এর একটি উদাহরণ হল, নর্দমার জল এবং কারখানার বর্জ্য সরাসরি সমুদ্রে গিয়ে ফেলা। উন্নয়নশীল

দেশগুলোতেই বিশেষ করে এই ধরনের দূষণ দেখা যায়। বাস্তবিক, সারা বিশ্বের ১০টি সর্ববৃহৎ সমুদ্রে প্লাস্টিক দূষণকারী দেশকে বেশি থেকে কম এই ক্রমে সাজালে হয় - চীন, ইন্দোনেশিয়া, ফিলিপাইনস্, ভিয়েতনাম, শ্রীলঙ্কা, থাইল্যান্ড, মিশর, মালয়েশিয়া, নাইজেরিয়া এবং বাংলাদেশ;[১৭] যেসকল নদীগুলোর মাধ্যমে সমুদ্র দূষিত হয় তারা হল ইয়াঙ্গটজে, সিন্ধু, পীতনদী, হাই, নীল, গঙ্গা, পার্ল, আমুর, নাইজের ও মেকং এবং "পৃথিবীতে সমুদ্রে যত প্লাস্টিক জমা হয়, তার ৯০শতাংশ এইসকল নদীগুলো দ্বারা বাহিত হয়"।[১৮][১৯]

প্লাস্টিক আবর্জনা সমুদ্রের বড় বড় বলয়ের (ঘুর্ণি) মধ্যে আটকে পড়ে। প্লাস্টিক আবর্জনাগুলো সামুদ্রিক দূষণে সৃষ্ট বিষাক্ত পদার্থগুলোকে শোষণ করে নেয় যার ফলে সামুদ্রিক জীব এগুলো খেয়ে ফেললে তাদের শরীরেও বিষ প্রবেশ করতে পারে।[২০] এইসকল দীর্ঘজীবী পদার্থগুলো অনেক সময়েই শেষমেশ সামুদ্রিক পাখি এবং প্রাণীদের পেটে চলে যায়। এর ফলে তাদের হজমের পথ আটকে যায়, যার ফলে তাদের খিদে কমে যায় অথবা এর থেকে তারা অনাহারেও ভুগতে পারে।

মূল দূষক ছাড়াও, তার লব্ধ পরিস্থিতিরও অনেক ধরনের অপ্রত্যক্ষ প্রভাব থাকে। যেমন ভূপৃষ্ঠে জলের স্রোতে পলি ভেসে থাকলে জলস্তম্ভের মধ্যে দিয়ে সূর্যরশ্মি প্রবেশ করতে পারে না এবং এর ফলে জলজ উদ্ভিদের সালোকসংশ্লেষ প্রক্রিয়া ব্যাহত হয়।

ভৌমোজল দূষণ:

ভৌমজল এবং ভূপৃষ্ঠতলীয় জলের মধ্যেকার যোগাযোগটা কিছুটা জটিল। যার ফলে, ভৌমজল দূষণকে ভূপৃষ্ঠতলীয় জল দূষণ বলা যায় না।[২১] প্রকৃতিগত কারণেই, ভূগর্ভস্থ

সিক্ত শিলাস্তরের দূষিত হওয়ার প্রবণতা রয়েছে, কিন্তু এই দূষণের উৎস ভূপৃষ্ঠতলীয় জলাশয়ের প্রত্যক্ষ ক্ষতি নাও করতে পারে। বিন্দু বনাম অ-বিন্দু উৎসের পার্থক্য কিছু ক্ষেত্রে অপ্রাসঙ্গিক হতে পারে।

ভৌমজলের দূষণের বিশ্লেষণের ক্ষেত্রে মাটির বৈশিষ্ট্য এবং স্থানের ভূতত্ত্ব, জল ভূতত্ত্ব, জলবিদ্যা এবং দূষকের প্রকৃতির ওপর নজর দেওয়া হয়। ভৌমজলের দূষণের কারণের মধ্যে যেগুলো থাকে তা হল: সাধারণভাবে ঘটা (জিওজেনিক), স্থানটার শৌচব্যবস্থা, নিকাশি ব্যবস্থা, সার এবং কীটনাশকের ব্যবহার, বাণিজ্যিক এবং কলকারখানার অবাঞ্ছিত বহির্গমন, হাইড্রলিক ফাটল, ল্যান্ডফিল লিচেট

দূষণ উৎসের বিভাগ

ভূপৃষ্ঠতলীয় জল এবং ভৌমজল দুটি পৃথক সম্পদ হিসেবে প্রায়শই চর্চিত এবং আলোচিত হয়, যদিও এদের মধ্যে আন্তর্যোগ রয়েছে।[২১] ভূপৃষ্ঠতলীয় জল মাটির মধ্যে দিয়ে চুঁইয়ে যায় এবং ভৌমজলে রূপান্তরিত হয়। বিপরীতক্রমে, ভৌমজলও ভূপৃষ্ঠতলীয় জলের যোগান দিতে পারে। ভূপৃষ্ঠতলীয় জল দূষণের উৎসকে সাধারণত দুই ভাগে বিভক্ত করা হয়।

বিন্দু উৎস

দূষণকারী পদার্থ যদি একটি নির্দিষ্ট চিহ্নিতযোগ্য উৎস থেকে জলপ্রবাহে যুক্ত হয় (যেমন নলের মাধ্যমে, অথবা খানার মধ্যে দিয়ে), তবে তাকে বিন্দু উৎস জল দূষণ বলা হয়। এই ধরনের উৎসের উদাহরণ হিসেবে বলা যায় কোন

নিকাশী জলের পরিশোধনকারী কারখানা, কোন শিল্পকারখানা, অথবা শহরের কোন বেনোজলের নর্দমা।

ইউ.এস ক্লিন ওয়াটার অ্যাক্ট (সিডব্লুএ) বিন্দু উৎসের কেবলমাত্র নিয়ন্ত্রণমূলক ব্যবস্থা গ্রহণের জন্য তৈরি হয়েছিল।[২২] সিডব্লুএর এই সংজ্ঞা ১৯৮৭ সালে সংশোধিত হয় এবং এর ফলে এতে পৌরসভার বেনোজল নিকাশী ব্যবস্থা, শিল্পকারখানার অতিরিক্ত জলও (যেমন নির্মাণ স্থানে) স্থান পায়।

অবিন্দু উৎস:

অ-বিন্দু উৎস দূষণ বলতে যেখানে একটি নির্দিষ্ট উৎস থেকে দূষণ ছড়ায় না, তাকে বোঝায়। এইধরনের দূষণ প্রায়শই একটি বৃহৎ অঞ্চলে অল্প পরিমাণ দূষণকারী পদার্থ জমা হতে হতে তার ক্রমবর্ধিত রূপের ফলে তৈরি হয়। এর একটি সাধারণ উদাহরণ হল সারযুক্ত কৃষিজমিতে নাইট্রোজেন যৌগের লিচিংয়ের ফলে বেরিয়ে যাওয়া।[৩] কৃষিক্ষেত্রে অথবা বনাঞ্চলে বেনোজলের সাথে মাটির উপাদান বেরিয়ে যাওয়াকেও অ-বিন্দু উৎস দূষণের উদাহরণ বলা যেতে পারে।

ভূপৃষ্ঠতলীয় নিকাশী দূষণের বাস্তুতান্ত্রিক প্রভাবের সচেতনতা বৃদ্ধির জন্যে ইউকে এনভায়রনমেন্ট এজেন্সির নীল নর্দমা এবং হলুদ মাছ প্রতীকের ব্যবহার

পার্কিং স্থান, রাস্তাঘাট এবং বড়ো সড়ক থেকে দূষিত বেনোজলের নিকাশ, যাকে শহরের রানঅফ বলা হয়, তাও কিন্তু অ-বিন্দু উৎসের শ্রেণীতেই গণ্য হয়। এই রানঅফ একটি বিন্দু উৎসও হয়ে যেতে পারে কারণ এটাকে বিশেষভাবে বেনোজলের নিকাশী ব্যবস্থার মাধ্যমে প্রবাহিত করা হয় এবং নলের মাধ্যমে তা স্থানীয় পৃষ্ঠতলীয় জলের মধ্যে গিয়ে মেশে।

দূষণকরি পদার্থ এবং তাদের উৎস:

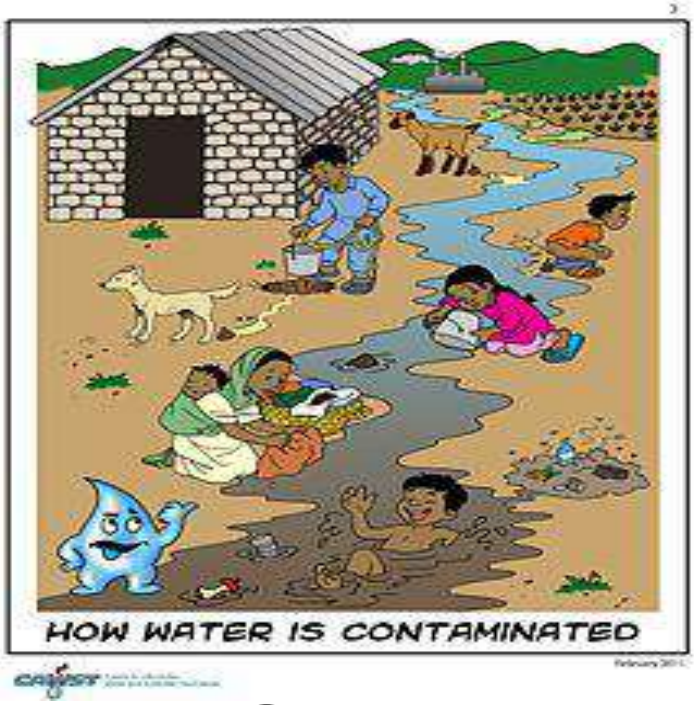
জল দূষণকারী নির্দিষ্ট পদার্থগুলো রাসায়নিক, রোগ সংক্রামক জীবাণু, এবং ভৌত পরিবর্তন যেমন উষ্ণ তাপমাত্রা এবং বিবর্ণতার মত বিভিন্ন ধরনের হতে পারে। রাসায়নিক এবং অন্যান্য পদার্থ যাদের নিয়ন্ত্রণ করা হয়, সেসব পদার্থ প্রাকৃতিক হতে পারে (যেমন ক্যালসিয়াম, সোডিয়াম, লোহা, ম্যাঙ্গানিজ প্রভৃতি), কিন্তু প্রকৃতিতে তাদের ঘনত্ব দ্বারা বোঝা যায়, তারা জলের স্বাভাবিক

উপাদান না কি দূষক। প্রাকৃতিক উপাদানের উচ্চ ঘনত্ব জলজ উদ্ভিদ ও প্রাণীর ওপরে ক্ষতিকর প্রভাব ফেলতে পারে।

অক্সিজেনের মাত্রা কমিয়ে দেওয়া পদার্থের মধ্যে প্রাকৃতিক বস্তু থাকতে পারে, যেমন উদ্ভিদের অংশ (উদাঃ পাতা এবং ঘাস), আবার মনুষ্যসৃষ্ট রাসায়নিক পদার্থও থাকতে পারে। অন্যান্য প্রাকৃতিক এবং অ্যানথ্রোপোজেনিক পদার্থ জলে টার্বিডিটি (মেঘাচ্ছন্নতা) সৃষ্টি করতে পারে যা আলো প্রবেশে বাধা দেয়, উদ্ভিদের বৃদ্ধি ব্যাহত করে এবং মাছের কিছু প্রজাতির ক্ষেত্রে ফুলকাকে আটকে দেয়।[২৪]

জলের ভৌত রাসায়নিক অবস্থার পরিবর্তনের জন্য দায়ী যেসকল বিষয় তা হল অম্লত্ব (পিএইচ মাত্রার পরিবর্তন), বৈদ্যুতিক পরিবাহীতা, তাপমাত্রা এবং ইউট্রোফিকেশন। ইউট্রোফিকেশনের মাধ্যমে একটি বাস্তুতন্ত্রে রাসায়নিক উপাদানগুলোকে বাড়িয়ে দেওয়া হয় যাতে বাস্তুতন্ত্রটির প্রাথমিক উৎপাদন ক্ষমতার বৃদ্ধি হয়। ইউট্রোফিকেশনের মাত্রার ওপর পরিবেশের নেতিবাচক প্রভাব নির্ভর করে যেমন এর ফলে অ্যানোক্সিয়া (অক্সিজেনের পরিমাণ কমে

যাওয়া) হতে এবং জলের মান গুরুতরভাবে হ্রাস পেতে পারে যার ফলে মাছ এবং অন্যান্য প্রাণীকুলের ক্ষতি হয়।



রোগ সংক্রামক জীবাণু

রোগসৃষ্টিকারী অণুজীবগুলোকে রোগ সংক্রামক জীবাণু বা প্যাথোজেন বলা হয়। এইসকল জীবাণুগুলো মানবদেহে বা প্রাণীদেহে জলবাহিত রোগ সৃষ্টি করতে পারে।[২৫] কলিফর্ম ব্যাকটিরিয়া জলবাহিত রোগের প্রকৃত কারণ না হলেও এদেরকেই জল দূষণের একটি ব্যাকটিরিয় মানদণ্ড হিসেবে সাধারণভাবে ব্যবহার করা হয়। অন্যান্য

যেসকল অণুজীব দূষিত ভূপৃষ্ঠতলীয় জলে পাওয়া যায় এবং যেগুলো মানব শরীরের ক্ষতিসাধন করে সেগুলো হল:

- বুরখোলডেরিয়া সিউডোমাল্লেই
- ক্রিপ্টোস্পোরিডিয়াম পারভাম
- গিয়ার্ডিয়া আয়ামব্লিয়া
- সালমোনেল্লা
- নোরোভাইরাস এবং অন্যান্য ভাইরাস

পরজীবী কৃমি, সিস্টোসোমা প্রকৃতিসহ[২৬][২৭]

রোগ সংক্রামক জীবাণু সেই নির্দিষ্ট স্থানটির শৌচব্যবস্থা (মলশোধন প্রকোষ্ঠ বা সেপটিক ট্যাঙ্ক, খাটা পায়খানা) অথবা অপর্যাপ্তরূপে শোধিত নিকাশী জলের থেকে অধিক মাত্রায় ছড়িয়ে পড়ে।[২৮] পুরোনো শহরের পুরোনো পরিকাঠামোর নিকাশী ব্যবস্থায় অবাঞ্ছিত বহির্গমনের (নল, পাম্প, ভালভের ফাটল) ফলে নর্দমার দূষিত জল বাইরে চলে আসতে পারে। কিছু শহরে সংযুক্ত নিকাশী ব্যবস্থা আছে যেগুলোর দূষিত জল ঝড় বৃষ্টির সময়ে অপরিশোধিত অবস্থাতেই বাইরে বেরিয়ে আসতে পারে।[২৯] নর্দমার দূষিত জলের পাঁকও (অধঃক্ষিপ্ত) জলাশয়কে দূষিত হয়।

গৃহপালিত পশু সংক্রান্ত কাজকর্ম যেখানে চলে সেসব জায়গা খারাপভাবে পরিচালিত হলেও রোগজীবাণুর সংক্রমণ হতে পারে।

জৈব, অজৈব এবং ম্যাক্রোস্কোপিক দূষণকারী পপদার্থ

__এইসকল দূষণকারী পদার্থগুলো জৈব এবং অজৈব পদার্থ হতে পারে। অনেক রাসায়নিক পদার্থও বিষাক্ত হয়।

নিউজিল্যান্ডের অকল্যান্ডের একটি শহরের ছোট নদীতে দূষণ কমানোর জন্য একটি আবর্জনা সংগ্রহের বৃদ্ধি।

জৈব জল দূষকের মধ্যে যেগুলো পড়ে, তা হল:

ডিটারজেন্টস্

রাসায়নিকভাবে জীবাণুমুক্ত পানীয় জলের মধ্যে থাকা জীবাণুধ্বংসকারী উপজাত পদার্থ, যেমন ক্লোরোফর্ম

খাদ্য প্রক্রিয়াকরণজাত বর্জ্য, যেগুলোর মধ্যে রয়েছে অক্সিজেনের চাহিদাযুক্ত পদার্থ, চর্বি, গ্রিজ

কীটনাশক এবং ভেষজনাশক, বিভিন্ন ধরনের অর্গ্যানোহ্যালাইডস এবং অন্যান্য রাসায়নিক যৌগ

পেট্রোলিয়াম হাইড্রোকার্বন, যেমন জ্বালানি (পেট্রোল, ডিজেল জ্বালানি, জেট জ্বালানি, এবং জ্বালানি তেল) এবং পিচ্ছিলকারক তেল (মোটর তেল), এবং বেনোজলের মধ্যে দিয়ে বয়ে আসা জ্বালানির দহন-পরবর্তী উপজাত পদার্থ[৩০]

উদ্বায়ী জৈব যৌগ, যেমন অনুপযুক্ত সঞ্চয়স্থান থেকে ছড়িয়ে পড়া কারখানার দ্রাবক।

ক্লোরিনযুক্ত দ্রাবক, এগুলো ঘন অ-জলীয় দশার তরল যা জলে ভালোভাবে দ্রবীভূত না হতে পারার জন্য এবং ঘনত্ব বাড়িয়ে তোলার কারণে জলাধারের তলায় গিয়ে সঞ্চিত হয়।

পলিক্লোরিনেটেড বাইফিনাইল (পিসিবি)

ট্রাইক্লোরোইথিলিন

পার্চক্লোরেট

ব্যক্তিগত স্বাস্থ্যবিধি দ্রব্য এবং প্রসাধনী দ্রব্যে উপস্থিত বিভিন্ন রাসায়নিক যৌগ

ড্রাগ দূষণ যার মধ্যে রয়েছে ওষুধ ড্রাগ এবং তাদের বিপাকজাত দ্রব্য। এসবের মধ্যে রয়েছে অ্যান্টিডিপ্রেস্যান্ট ড্রাগ অথবা গর্ভনিরোধক বড়ির মত হর্মোন ওষুধ। এসকল অণুগুলো এতই ক্ষুদ্র যে দামী ও উন্নত শোধক কারখানা ছাড়া এদেরকে মুক্ত করা বেশ জটিল।[৩১]

অজৈব জল দূষণকারী পদার্থগুলোর মধ্যে রয়েছে:

শিল্পকারখানার বর্জ্য নিষ্কাশনের দ্বারা সৃষ্ট অম্লত্ব (বিশেষ করে তাপবিদ্যুৎ কেন্দ্রের সালফার ডাই-অক্সাইড)

খাদ্য প্রক্রিয়াকরণের বর্জ্য থেকে প্রাপ্ত অ্যামোনিয়া

শিল্পকারখানার উপজাত হিসেবে প্রাপ্ত রাসায়নিক বর্জ্য

নাইট্রেট এবং ফসফেট জাতীয় উপাদানযুক্ত সার যা কৃষিজমি থেকে এবং বাণিজ্যিক ও গৃহস্থ ব্যবহারের ফলেও বৃষ্টির জলের সাথে যুক্ত হয়[৩০]

মোটর গাড়ির ভারী ধাতু (শহরের বর্ষার জলের প্রবাহের মাধ্যমে)[৩০][৩২] এবং অম্ল খনির নর্দমা

কেওসোট সংরক্ষণকারী থেকে নিঃসৃত পদার্থের জলজ বাস্তুতন্ত্রে গিয়ে মেশা

নির্মায়মান অঞ্চল, বৃক্ষচ্ছেদন, ঝুম চাষ অথবা ভূমি নিষ্কাশন অঞ্চল থেকে প্রবাহিত জলের পলি (অধঃক্ষিপ্ত)

ম্যাক্রোস্কোপিক দূষণ - জল দূষণকারী দৃশ্যমান বড়ো বড়ো পদার্থ - যেগুলোকে শহরের ঝোড়ো জলের প্রেক্ষিতে ভাসমান বলা চলে, অথবা সামুদ্রিক জঞ্জাল যখন উন্মুক্ত সাগরে পাওয়া যায় এবং এইধরনের পদার্থগুলোকে নিম্নলিখিতভাবে অন্তর্ভুক্ত করা যায়:

মাটিতে মানুষের দ্বারা পরিত্যক্ত আবর্জনা (যেমন, কাগজ, প্লাস্টিক, অথবা নষ্ট খাবার), এর সাথে রয়েছে দুর্ঘটনাপ্রযুক্ত অথবা ইচ্ছাকৃতভাবে আবর্জনার স্তুপ তৈরি, যা বৃষ্টির জলের সাথে ধুয়ে যায় এবং ভূপৃষ্ঠতলীয় জলে উন্মুক্ত হয়।

নার্ডল, ছোট ছোট সর্বব্যাপী ছড়িয়ে থাকা জলের প্লাস্টিকের টুকরো।

পরিত্যক্ত ভাঙা জাহাজ।

জলদূষণ প্রতিকারের উপায়:

পৌরসভার বর্জ্যজলের শোধন:

_____উন্নত দেশের শহরে, পৌরসভার বর্জ্যজল (অথবা নিকাশী জল) কেন্দ্রীভূত নিকাশী জলের শোধনকারী কারখানা দ্বারা বিশেষভাবে পরিশোধিত হয়। ভালোভাবে পরিকল্পিত এবং পরিচালিত ব্যবস্থার মাধ্যমে (যেমন, মাধ্যমিক শোধনকারী পদক্ষেপ অথবা আরো উন্নত শোধন) ৯০ শতাংশ বা তার বেশি দূষণকারী পদার্থ নিকাশী জল থেকে দূর করা যায়।[৩৮] কোন কোন কারখানায় অতিরিক্ত ব্যবস্থা থাকে যাতে পুষ্টিকর উপাদান এবং রোগ সংক্রামক জীবাণু দূর করা যেতে পারে, কিন্তু এইসকল আরো উন্নত শোধনমূলক পদক্ষেপ ক্রমশই আরো বেশি ব্যয়বহুল হয়ে পড়ছে।

কেন্দ্রীভূত শোধনকারী কারখানার পরিবর্তে (অথবা পাশাপাশি) পরিবেশভিত্তিক সমাধানও ব্যবহার করা হচ্ছে।[৬]

যেসব শহরে শৌচালয়ের নর্দমার জল উপচে পড়ে অথবা সংযুক্ত নর্দমার জল উপচে পড়ে তারা সেইসব অশোধিত নির্গমন রোধ করতে এক বা একাধিক প্রকৌশলী ব্যবস্থা নেয়, যার মধ্যে রয়েছে:

একটি সবুজ পরিকাঠামোমূলক ব্যবস্থা গ্রহণ করা হয় যাতে সমগ্র ব্যবস্থাটির ঝড়ো জলের পরিচালন ক্ষমতা উন্নত হতে পারে এবং শোধনকারী কারখানার হাইড্রলিকের ওপর অতিরিক্ত চাপ কমাতে পারে।[৩৯]

অবাঞ্ছিত নির্গমন এবং বিকল যন্ত্রের মেরামত ও বদল।[২৯]

নিকাশী সংগ্রহ ব্যবস্থাটির সামগ্রিক হাইড্রলিক ক্ষমতাবৃদ্ধি

(এটা অধিকাংশ ক্ষেত্রেই একটি ব্যয়বহুল বিকল্প)।

নির্দিষ্ট স্থানের পয়ঃনিষ্কাশন ব্যবস্থা এবং নিরাপদরূপে পরিচালিত পয়ঃনিষ্কাশন ব্যবস্থা:

_যেসকল অঞ্চলে পৌরসভার শোধনকারী কারখানা নেই সেসকল জায়গায় অবস্থিত বাড়ির এবং ব্যবসায়ী অঞ্চলে ব্যক্তিগত সেপ্টিক ট্যাঙ্ক বা মলশোধনকারী প্রকোষ্ঠ থাকে যা সেই নির্দিষ্ট স্থানের বর্জ্যজলকে পূর্বেই শোধন করে দেয় এবং তা মাটিতে গিয়ে চুঁইয়ে জমা হয়। ভুল পরিকল্পিত অথবা স্থাপিত সেপ্টিক ব্যবস্থা ভৌমজলের দূষণ ঘটাতে পারে। জয়েন্ট মনিটরিং প্রোগ্রাম ফর ওয়াটার সাপ্লাই অ্যান্ড স্যানিটেশনের একটি হিসেব অনুযায়ী, ২০১৭ সালে সমগ্র বিশ্বে প্রায় ৪৫ কোটি মানুষের কাছে নিরাপদভাবে পরিচালিত কোন স্যানিটেশন নেই।[৪০] স্যানিটেশনের অভাবে প্রায়শই জল দূষণ হয়, যেমন উন্মুক্ত মলত্যাগের অভ্যাসের মাধ্যমে: বৃষ্টি অথবা বন্যায় মানুষের মল মাটির তলায় চলে যায় যেখান থেকে সেগুলো ভূপৃষ্ঠতলীয়

জলে জমা হতে থাকে। সাধারণ খাটা পায়খানাও বৃষ্টির জলে প্লাবিত হতে পারে। নিরাপদভাবে পরিচালিত স্যানিটেশন ব্যবস্থার ফলে এই ধরনের জল দূষণ রোধ করা যেতে পারে।[৪০]

কলকারখানার বর্জ্যজলের শোধন:

কিছু শিল্পকারখানা থেকে বর্জ্যজল নিষ্কাশিত হয় যেগুলো গৃহস্থ বর্জ্যজলের মতই এবং নিকাশী জলের শোধনকারী কারখানা কর্তৃক পরিশোধিত করা যেতে পারে। যেসকল কলকারখানা থেকে বর্জ্যজলের সাথে উচ্চ ঘনত্বের জৈব পদার্থ (যেমন, তেল ও গ্রীজ), বিষাক্ত দূষণকারী পদার্থ (যেমন, ভারী ধাতু, উদ্বায়ী জৈব যৌগ) অথবা জৈব উপাদান যেমন অ্যামোনিয়া নির্গত হয়, তাদের বিশেষ রকম শোধনকারী ব্যবস্থা প্রয়োজন হয়।[৪১] ছোটখাটো কলকারখানাগুলো একটি প্রাক-শোধনকারী ব্যবস্থা স্থাপন করে যার দ্বারা কিছু দূষণকারী পদার্থ বেরিয়ে যায় (যেমন, বিষাক্ত যৌগ), এবং তারপর এরা সেই অর্ধপরিশোধিত বর্জ্যজল পৌরসভার নিকাশী ব্যবস্থায় মুক্ত করে।[৪২][৪৩] যেসকল কলকারখানার বর্জ্যজলের পরিমাণ অত্যন্ত অধিক হয়, তারা নিজস্ব

শোধনকারী ব্যবস্থা পরিচালনা করে। কিছু কলকারখানা তাদের নির্মাণ পদ্ধতির পুনর্পরিকল্পনা করে দূষণকারী পদার্থের দূরীকরণ অথবা হ্রাস করতে সফল হয়েছে; এই পদ্ধতিকে বলা হয় দূষণ রোধ।

তাপবিদ্যুৎ কেন্দ্র অথবা নির্মাণ কারখানা থেকে উৎপন্ন বর্জ্যজলের তাপ দূর করতে নিম্নলিখিত প্রযুক্তি ব্যবহার করা হয়:

শীতলকারী পুকুর, বাষ্পীভবন, পরিবহন ও বিকিরণের মাধ্যমে শীতল করার উদ্দেশ্যে কৃত্রিম জলাশয়ের নির্মাণ।

শীতলকারী টাওয়ার, যেগুলো বাষ্পীভবন অথবা তাপ স্থানান্তরের মাধ্যমে বর্জ্য তাপকে পরিবেশে স্থানান্তরিত করে

কোজেনারেশন, এমন একটি পদ্ধতি যেখানে বর্জ্য তাপ গৃহস্থ বাড়িতে অথবা কলকারখানায় তাপ ব্যবহারের জন্য পুনর্ব্যবহারযোগ্য করে তোলা হয়।[৪৪]

কৃষিজমির বর্জ্যজলের পরিশোধন:

_____মার্কিন যুক্তরাষ্ট্রে সবথেকে বেশি পরিমাণ কৃষি দূষণ অধঃক্ষিপ্ত পলি (মাটির গুঁড়ো) জমি থেকে ধুয়ে যাবার ফলে ঘটে থাকে।[২৪] কৃষকরা ভূমিক্ষয় রোধ করার মাধ্যমে এইধরনের ধুয়ে যাওয়া রোধ করতে পারেন এবং মাটিকে তাঁদের কৃষিক্ষেত্রে ধরে রাখতে পারেন। কনট্যুর প্লাওয়িং, ক্রপ মালচিং, ক্রপ রোটেশান, বহুবর্ষজীবী শস্যের চাষ এবং রিপারিয়ান বাফার স্থাপন করা প্রভৃতি হল ভূমিক্ষয় রোধের সাধারণ কিছু উপায়।[৪৫][৪৬] কৃষিক্ষেত্রে যেসকল সার উপাদান (নাইট্রোজেন ও ফসফরাস) প্রয়োগ করা হয় তা হল, বাণিজ্যিক সার, পশুর বর্জ্য, অথবা পৌরসভার বা কলকারখানার বর্জ্যজল (প্রবাহ) বা কাদামাটি ছড়িয়ে দেওয়া। এইসকল সার উপাদানগুলো শস্যের শেষাংশ, সেচ জল, বন্য প্রাণী এবং পরিবেশগত সঞ্চয়ের মাধ্যমেও প্রবাহে মিশতে পারে।[৪৬] কৃষকরা সার উপাদান ব্যবস্থাপনা পরিকল্পনা করে সারের অতিরিক্ত প্রয়োগ কমাতে পারেন এবং সার উপাদান দূষণের সম্ভাবনাকে কমাতে পারেন।[৪৫][৪৬] কীটনাশকের প্রভাব কমাতে, কৃষকরা সম্মিলিত কীট ব্যবস্থাপনা প্রযুক্তি ব্যবহার করতে পারেন (যার মধ্যে থাকতে পারে জৈব কীট দমন) যার ফলে কীটের ওপর নিয়ন্ত্রণও রাখা যাবে আর অন্যদিকে

রাসায়নিক কীটনাশকের ওপর নির্ভরশীলতাও কমবে; এতে জলের গুণমান বজায় রাখা সম্ভব হবে।[৪৭]

যেসকল খামারে অত্যন্ত বেশি পরিমাণে পশুর অথবা মুরগী সংক্রান্ত কাজকর্ম করা হয়, যেমন খামার কারখানা সেগুলোকে মার্কিন যুক্তরাষ্ট্রে কনসেন্ট্রেটেড় অ্যানিমাল ফিডিং অপারেশনস্ অথবা ফিডলটস্ বলা হয় এবং এগুলোকে বেশি পরিমাণে সরকারী নিয়ন্ত্রণের আওতায় আনা হয়েছে।[৪৮][৪৯] পশুর বর্জ্যের অধঃক্ষিপ্ত অংশকে অবায়বীয় হ্রদের মধ্যে রেখে শোধন করা হয় এবং তারপর স্প্রে করে বা চুঁইয়ে ফেলার মাধ্যমে ঘাসজমিতে উন্মুক্ত করা হয়। পশুর বর্জ্যের শোধনের জন্য অনেকসময় নির্মিত জলাভূমিও ব্যবহৃত হয়। কিছু পশুর বর্জ্যকে আবার খড়ের সাথে মিশিয়ে শোধন করা হয় এবং উচ্চ তাপমাত্রায় মিশ্রসারে রূপান্তরিত করে তাকে ব্যাকটিরিয়াগতভাবে নির্বীজ করে তোলা হয় এবং এভাবে খাঁটি সারে পরিণত করে মাটির উন্নতি করা হয়। এইসকল প্রযুক্তিকে “বিন্দু উৎস নিয়ন্ত্রণ” বলা হয়।

উপসংহার:

জলের ওপর নাম জীবন এই কথাটি খুবই প্রাসঙ্গিক সংগ্র জিবকুলকে বাঁচিয়ে রাখার জন্য জলের অবদান অনস্বীকার্য যে ছাড়া পৃথিবীর বুকে জিবকুলের অস্তিত্ব বজায় থাকতো না। কিন্তু মানবসভ্যতার অগ্রগতির সঙ্গে সঙ্গে সমগ্র পরিবেশের পাশাপাশি জল ব্যাপকভাবে দূষিত হচ্ছে যার জন্য দাই মানুষের বিবেচনাহিন ক্রিয়াকলাপ যা আগামী দিনে সমগ্র বিশ্বকে বিপদের সম্মুখীন করবে। কিন্তু এই জলদুষণের পরিস্থিতিকে সামাল দেওয়ার উপায় একমাত্র মানবজাতির সচেতনতা।

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Scottish Church College

AIR POLLUTION

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INTRODUCTION

Air Pollution is the presence of substances in the atmosphere that are harmful to the health of humans and other living beings, or cause damage to the climate or to the materials. There are many different types of air pollutants such as gases,(such as ammonia, carbon monoxide, sulfur dioxide, nitrous oxide, methane and chlorofluorocarbons), particulates (both organic and inorganic), and biological molecules. Air Pollution may cause diseases, allergies, and even death to human; it may also cause harm to other living organisms such as animal and food crops, and may damage the natural environment (for example, climatic change, ozone depletion, or habitat degradation) or built environment (for example, acid rain). Both human activity and natural processes can generate air pollution.

What is Air Pollution?

Air Pollution refers to the release of pollutants into the air that are detrimental to human health and the planet as a whole. The clean air act authorizes the U.D Environmental Protection Agency (EPA) to protect public health by regulating the emissions of these harmful air pollutants.

The NRDC has been a leading authority on this law since it was established in 1970.

What causes Air Pollution?

“ Most air pollution comes from energy use and production”, says John Walke, director of the clean air project, part of the Climate and clean energy program at NRDC.” Burning fossil fuels releases gases

Air Pollution from a cooking oven

and chemicals into the air.” And in especially destructive feedback loop, air pollution not only contributes to climate change but is also exacerbated by it. “Air Pollution in the form of carbon dioxide and methane raises the earth temperature,” Walke says. “Another type of air pollution is then worsened by that increased heat: Smog forms when the weather is warmer and there is more ultraviolet radiation”. Climate change also

increases the production of allergenic air pollutants including mold and pollen.

Effects of Air Pollution

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

Smog and soot

These two are the most prevalent types of air pollution. Smog or “ ground level zone”, as it is more wonkily called, occurs when emissions from combusting fossil fuels react with sunlight. Soot, or “ particulate matter”, is made up of tiny particles of chemicals, soil, smoke, dust or allergens, in the form of gas or solids, that are carried in the air . The EPA’S “ English guide to the clean air act” states, In many part of the United States, pollution has reduced the distance and clarity of what we see by 70 percent. The sources of smog and soot are similar. “Both

come from cars, trucks, factories, power plants, incinerator, engines- anything that combusts fossil fuels such as coal, gas or natural gas", Walke says, the tiniest airborne particles in soot whether they're in the form of gas or solids are especially dangerous because they can penetrate the lungs and bloodstream and worsen bronchitis, leads to heart attacks, and even hasten death.

Reducing Smog and soot from Air Pollution

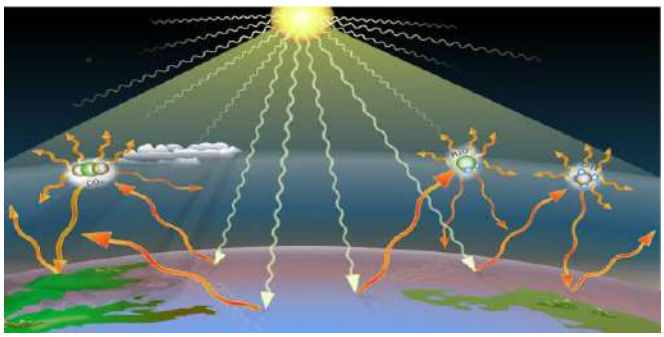
Hazardous Air Pollutants

These are either deadly or have severe health risks even in small amounts. Almost 200 are regulated by law ; some of the most common are mercury, lead, dioxin, and benzene. "These are also most often emitted during gas or coal combustion, incinerating, or in the case of benzene, found in gasoline," Walke says Benzene, classified as a carcinogen by the EPA, can cause eye, skin, and lung irritation in the short term and blood disorders in the long term. Dioxins

more typically found in food but also present in small amounts in the air, can affect the liver in the short term and harm the immune, nervous, and endocrine system, as well as reproductive functions. Lead in large amounts can damage children's brain and kidneys, and even in small amounts it can affect children's IQ and ability to learn. Mercury affects the central nervous system.

Greenhouse Gases

By trapping the earth's heat in the atmosphere, greenhouse gases leads to warmer temperatures and all the hallmarks of climate change: rising sea levels, more extreme weather, heat related deaths, and increasing transmission of infectious diseases like Lyme. According to a 2014 EPA study, Carbon dioxide was responsible for 81 percent of the country's total greenhouse gas emissions, and methane made up 11 percent. Carbon dioxide comes from combusting fossil fuels, and methane comes



from natural and industrial sources, including the large amounts that are released during oil and gas drilling, “Walke says. We emit far larger amounts of carbon dioxide, but methane is significantly more potent, so it’s also very destructive”. Another class of greenhouse gases hydrofluorocarbon (HFCs), are thousands of times more powerful than carbon dioxide in their ability to trap heat. In October 2016, more than 140 countries reached an agreement to reduce the use of these chemicals- which are used in air conditioners and refrigerators and find greener alternative over time. David Doniger, senior strategic director of NRDC’S Climate and Clean Energy program, writes,” NRDC estimates that the agreed HFC phase down will avoid the equivalent of more than 80 billion tons of CO^2 over the next 35 years.”

Pollen and mold

Mold and allergens from trees, weeds, and grass are also carried in the air, are exacerbated by climate change, and can be hazardous to health. Though they are not regulated and are less directly connected to human actions, they can be considered a form of air pollution. “When homes, schools, or

businesses get water damage, mold can grow and can produce allergenic airborne pollutants," Knowlton says. "Mold exposure can precipitate asthma attacks or an allergic response, and some mold can even produce toxins that would be dangerous for anyone to inhale".

Pollen allergies are worsening because of climate change. "Lab and field studies are showing that pollen producing plants especially ragweed grow larger and produce more pollen when you increase the amount of carbon dioxide that they grow in," Knowlton says. Climate change also extends the pollen production session, and some studies are beginning to suggest the ragweed pollen itself might be becoming a more potent allergen". If, so more people will suffer runny noses, fevers, itchy eyes, and other symptoms.

Air Pollution and Environmental Justice

Historically, racist zoning policies and the discriminatory lending practices known as redlining have combined to keep polluting industries and car-choked highways away from white neighborhood and have turned communities of color- especially

poor and working class communities of color-into sacrifice zones where residents are forced to breathe dirty air and suffer the many health problems associated with it. In addition to the increased health risk that come from living in such places, members of these communities experience economic harm in the form of missed workdays, higher medical costs, and local underinvestment.

Environmental racism isn't limited to cities and industrial areas. Outdoor labourers, including the estimated three million migrant and seasonal farmworkers in the United States, are among the most vulnerable to air pollution- and also among the least equipped, politically, to pressure employers and lawmakers to affirm the right to breathe clean air.

Controlling Air Pollution

In the United States, the Clean Air Act has been a crucial tool for reducing air pollution since it's passage in 1970, although fossil fuel interests aided by industry- friendly lawmakers have frequently attempted to weaken it's many protection. Ensuring that this bedrock environmental law remain intact

and properly enforced will always be key to maintaining and improving our air quality.

But the best, most effective way to control air pollution is to speed up our transition to cleaner fuels and industrial processes. By switching over to renewable energy sources (such as wind and solar power), maximizing fuel efficiency in our vehicles, and replacing more and more of our gasoline powered cars and trucks with electric versions, we'll be limiting air pollution at it's source while also curbing the global warming that heightens so many of it's worst health impacts.

How to help reduce air pollution?

"The less gasoline we burn, the better we're doing to reduce air pollution and harmful effects of climate change," Walke says. " Make good choices about transportation. When you can, walk, ride a bike, or take public transportation. For driving, choose a car that gets better miles per gallon of gas, or choose an electric car." You can also investigate your power provider options- you maybe able to request that your electricity be supplied by wind or solar. Buying your food locally cuts down on the fossil fuels burned

in trucking or flying food in from across the country. And most important," Support leaders who push for clean air and water and responsible steps on climate change, "Walke says .

How to protect your health?

- "When you see in the news or hear in the weather report that pollution levels are high, it maybe useful to limit the time when children go outside or you go for a jog, "Walke says. Generally, ozone levels tend to be lower in the morning.
- If you exercise outside, stay far as you can from heavily trafficked roads. Then shower and wash your clothes to remove fine particles.
- The air may look clear, but that doesn't mean it's pollution free. Utilize tools like the EPA's air pollution monitor, Airnow to get the latest conditions. If the air quality is bad, stay inside with windows closed.
- If you live or work in an area prone to wildfire's, stay away from the harmful smoke as much as you're able. Consider keeping a small stock of masks to wear when conditions are poor.

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

Conclusion

The health of the public, especially those who are the most vulnerable, such as children, the elderly and the sick, is at risk from air pollution, but it is difficult to say how large the risk is. It is possible that the problem has been over – stressed in relation to other challenges in the field of public health.

As we have seen, there are considerable uncertainties in estimating both exposures and effect and their relationship. It maybe,for example, that the effect of long term exposure to lower concentrations of air pollutants could be more damaging to public health than short term exposure to higher concentrations. For this reason alone, local authorities could take action to assess and improve local air quality. It is not sufficient to wait for an episode of severe air pollution and then try to deal with it's effects.

Another reason for action on air pollution is that we do not know the contribution which exposure to air pollutants may make to deaths from, for example, heart diseases. In many countries heart diseases is a leading cause of death and even a small contribution from air pollution could mean a significant and important effect on public health.

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ভূমিকা

বাঘের সংখ্যা হঠাৎ করে যাওয়ায় 1969 সালে দিল্লীতে IUCN-এর সাধারণ বৈঠকের পরে 1970 সালে ভারত বর্ষে বাঘ হত্যা নিষিদ্ধ করা হয়। 1972 সালে বন্যপ্রাণী সংরক্ষণ আইন চালু হয়। 1973 সালের 1 এপ্রিল কেন্দ্রীয় সরকার পরিবেশমন্ত্রক, IUCN এবং WWF (ওয়ার্ল্ড ওয়াইল্ড লাইফ ফান্ড) -এর সহযোগিতায় ভারত সরকারের অধীনস্থ সংস্থা ন্যাশনাল টাইগার কনজারভেশন অথোরিটি (NTCA)-এর ব্যাঘ্র প্রকল্প চালু করার মাধ্যমে ভারতবর্ষে বাঘ সংরক্ষণের প্রচেষ্টার সূত্রপাত ঘটে। 1973 সালে প্রাথমিকভাবে NCTA -এর অধীনে 9টি অভয়ারণ্যের মাধ্যমে ব্যাঘ্র সংরক্ষণ প্রকল্প শুরু হয়।

2007 সালের হিসেব অনুযায়ী, দেশের 3,76। বর্গকিলোমিটার এলাকা জুড়ে 40 টি ব্যাঘ্র প্রকল্প বন্যপ্রাণী সংরক্ষণাগার রয়েছে। 1970 এর দশকে যেখানে বাঘের সংখ্যা ছিল 1,200 টি সেখানে ব্যাঘ্র প্রকল্পের ফলে 1990-এর দশকে এই সংখ্যা বেড়ে দাঁড়ায় 3,500 টিতে। এই প্রকল্পের ফলে বাঘের সংখ্যা বৃদ্ধিতে একটি ইতিবাচক প্রভাব পড়ে।

ব্যাঘ্র প্রকল্প

◎ বাঘের সংখ্যা কমার কারণ :-

1. আনন্দের জন্য নির্বিচ্ছিন্ন শিকার :- মধ্যযুগীয় সময়ে জমিদার ও ইংরেজদের লোকেরা যেকোনো প্রকার প্রাণী হিসাবে বিবেচনা করত না তারা বাঘকে শিকারের একটি অংশ ভাবত। কারণ তাদের পছন্দের তালিকায় ছিল বাঘ শিকার করা। ব্রিটিশ এবং জমিদারেরা তখন বলে যেতেন বাঘ শিকার করতে এবং বাঘের চামড়া, মাথা তার বাড়িতে আকর্ষণের বাড়াতেন যৌতুকের সামগ্রী হিসাবে। তখন বাঘ শিকারকে সাহসিকতার পরিচয় হিসাবে দেখা হত। বন জমিদার এবং ব্রিটিশদের শিকারের অংশ হিসাবে পরিণত হয়েছিল। এই আনন্দের জন্য বাঘ শিকার বাঘের সংখ্যা কমে যাওয়ার পিছনে প্রধান হাত রয়েছিল।

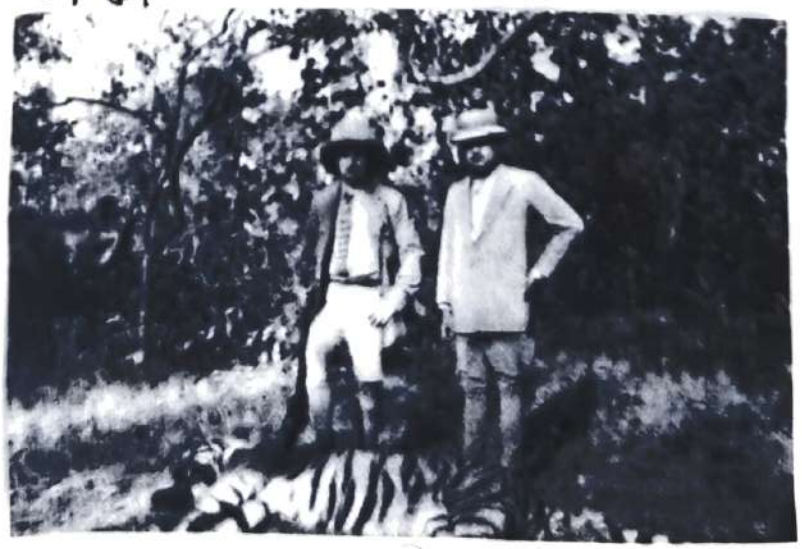
ব্যাঘ্র প্রকল্প

ⓗ বাঘ শিকারের পদ্ধতি :-

ⓘ ফাঁদ - সাধারণরা এই পদ্ধতি শিকারের জন্য ব্যবহার করত। এই ফাঁদগুলি এখন বাঘ শিকারের জন্য ব্যবহার করা হচ্ছে। 1907 সালে রায়পুরের কাছে বাঘ শিকারের ফাঁদ পাতে একজন পুরুষ আহত হন। তদন্তকারীরা বলতে পারে যে এইগুলি ইস্পাত ফাঁদ হিসাবে করা হয়েছিল যে গ্রামবাসীরা বনে যেতে ভয় পেয়েছিল। মানুষ এমনকি ভয়ংকর হয়েছিল এই ফাঁদ থেকে।

ⓘⓘ আগ্নেয়াস্ত্র :- আগ্নেয়াস্ত্র দিয়ে বাঘ শিকার একটি আধুনিক পদ্ধতি। এই আগ্নেয়াস্ত্রের সাহায্যে খুব নির্মম ভাবে বাঘ-হত্যা করা হচ্ছে।

ⓘⓘⓘ বৈদ্যুতিন দমন :- হাত বোমা এর বৈদ্যুতিক তার গুলি আলতো ভাবে ফেলে রাখা হচ্ছে এবং এতে পা দিয়ে অনেক বাঘ মারা যাচ্ছে। এটিও বাঘ শিকারের নির্মম একটি পদ্ধতি।



বাঘ শিকার

৩। ইকোসিস্টেমে মানুষের হস্তক্ষেপ :- দিন দিন মানুষের জনসংখ্যা বৃদ্ধি পাওয়ায় বন কেটে আবাসস্থল স্থাপন, যুদ্ধক্ষেত্র বানানো ইত্যাদির জন্য গত বছরের দিকে বাঘের বসবাসের জায়গা কমে যাওয়ায় বাঘ মানুষের বসবাসের জায়গায় চলে আসছে ফলে বাঘ ও মানুষের সংঘর্ষে বাঘ মারা যাচ্ছে ফলে বর্তমানে বাঘের সংখ্যা কমে যাচ্ছে। বর্তমানে 7% বাঘ রয়েছে আছে।

4] মানব ও বাঘের সংঘাত :- মানুষের সংখ্যা ক্রমাগত বেড়ে যাওয়ায় মানুষ বসবাসের জন্য বন কেটে বাড়ী তৈরি করে, যুদ্ধক্ষেত্র বানায় ফলে বাঘ তার বাসস্থান সংকুচিত হয় এবং খাবার ও কমে যায় ফলে বাঘ মানুষের বসতি অঞ্চলে আসতে শুরু করে ফলে বাঘ ও মানুষের সংঘাতে বাঘ মারা যেতে থাকে। 1993 সাল থেকে মানুষের মূল সংখ্যা 50% বৃদ্ধি পেয়েছে এবং 1993 সালে যেখানে জনসংখ্যা ছিল 3331 মিলিয়ন ছিল। প্রতিবছর 1980 থেকে 1990 এর মধ্যে প্রায় 470,000 বর্গ কিলোমিটার বনভূমি হারিয়ে যায়। ফলে বাঘ প্রজননের জন্য স্বাভাবিক পরিবেশ হারিয়ে যাচ্ছে।

5 নমুনা রচনা :- বাঘ সংরক্ষণ

বাঘ বিশ্বের অন্যতম সুন্দর প্রাণী। বাঘের শরীরের গঠন, রং, ডোরা দাগ, লেজ, মুখমণ্ডল, চোখ, দাঁত, নখ সবকিছুই অত্যন্ত সুন্দর। বাঘের গায়ের রং হলুদ, তার উপর কালো ডোরা দাগ থাকে। বাঘের লেজ লম্বা ও শক্তিশালী। বাঘের মুখমণ্ডল গোলাকার। বাঘের চোখ তীক্ষ্ণ ও উজ্জ্বল। বাঘের দাঁত ও নখ খুব ধারালো। বাঘ মাংসাশী প্রাণী। বাঘ তার শিকারকে ধরে খায়। বাঘ খুব শক্তিশালী প্রাণী। বাঘ একা একা থাকতে পছন্দ করে। বাঘ খুব ভালো সাঁতার কাটতে পারে। বাঘ গাছে উঠতে পারে। বাঘ খুব দ্রুত দৌড়াতে পারে। বাঘ ঘণ্টায় ৬০ কিলোমিটার বেগে দৌড়াতে পারে। বাঘ লাফ দিয়ে ১০ মিটার দূরত্ব অতিক্রম করতে পারে। বাঘ ১৫ থেকে ২০ বছর বাঁচে। বাঘ বংশবৃদ্ধি করে। বাঘিনী ২ থেকে ৪ টি বাচ্চা প্রসব করে। বাঘের বাচ্চাকে শাবক বলা হয়। বাঘের বাচ্চা ২ বছর পর্যন্ত মায়ের সাথে থাকে। বাঘ বনের খুব গুরুত্বপূর্ণ প্রাণী। বাঘ বনের খাদ্যশৃঙ্খল রক্ষা করে। বাঘ বনের ভারসাম্য রক্ষা করে। বাঘ বনের সৌন্দর্য বৃদ্ধি করে। বাঘ বনের শোভা বৃদ্ধি করে। বাঘ বনের গুরুত্বপূর্ণ প্রাণী। বাঘ বনের রাজা। বাঘ বনের রাজা হিসেবে পরিচিত। বাঘ বনের রাজা হিসেবে সম্মানিত। বাঘ বনের রাজা হিসেবে সম্মানিত হয়। বাঘ বনের রাজা হিসেবে সম্মানিত হয়ে থাকে।

বাংলা প্রবেশিকা পরীক্ষা

- বাংলা ভাষার ইতিহাস ও বাংলা ভাষার উপাদান।
- বাংলা ধ্বনি, বর্ণ ও যুক্তবর্ণ।
- বাংলা বানান ও বানানের নিয়ম।
- বাংলা শব্দ ও শব্দগঠন।
- বাংলা বাক্য ও বাক্যগঠন।
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- বাংলা বাক্যের অর্থ ও বাক্যের শুদ্ধি।
- বাংলা বাক্যের বিশ্লেষণ ও বাক্যের সংকোচন।
- বাংলা বাক্যের সম্প্রসারণ ও বাক্যের পরিবর্তন।
- বাংলা বাক্যের সংযোজন ও বাক্যের বিয়োজন।
- বাংলা বাক্যের সমন্বয় ও বাক্যের বিশ্লেষণ।
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- বাংলা শব্দ ও শব্দগঠন।
- বাংলা বাক্য ও বাক্যগঠন।
- বাংলা বাক্যাংশ ও বাক্যের রূপান্তর।
- বাংলা বাক্যের অর্থ ও বাক্যের শুদ্ধি।
- বাংলা বাক্যের বিশ্লেষণ ও বাক্যের সংকোচন।
- বাংলা বাক্যের সম্প্রসারণ ও বাক্যের পরিবর্তন।
- বাংলা বাক্যের সংযোজন ও বাক্যের বিয়োজন।
- বাংলা বাক্যের সমন্বয় ও বাক্যের বিশ্লেষণ।
- বাংলা বাক্যের সংশ্লেষণ ও বাক্যের বিশ্লেষণ।
- বাংলা বাক্যের সংযোজন ও বাক্যের বিয়োজন।
- বাংলা বাক্যের সমন্বয় ও বাক্যের বিশ্লেষণ।
- বাংলা বাক্যের সংশ্লেষণ ও বাক্যের বিশ্লেষণ।

২. বাঘের আবাসস্থল গুলি যে ক্ষতিগ্রস্থ না হয় তার জন্য স্থানীয়দের প্রাকৃতিক কার্যকলাপের মধ্যে পরিচালনা করতে হবে

3. উদ্ভিদ এবং প্রাণী ভূগোলের পরিবর্তন, আবাস এবং বন্য প্রাণী সম্পর্কে তথ্য গবেষণা এবং আববর্তন পর্যবেক্ষণ করা।

ব্যাঘ্রপ্রকল্পের প্রথমের নয়টি টাইগার রিজার্ভ

1. বান্ধিপুর জাতীয় উদ্যান (1973-74)- কর্ণাটক
২. জিম কর্বেট জাতীয় উদ্যান (1973-74) - উত্তর প্রদেশ
3. কানহা জাতীয় উদ্যান (1973-74) - মধ্যপ্রদেশ
4. মানস জাতীয় উদ্যান (1973-74)- আসাম
5. মেলঘাট বন্যজীবন অভয়ারণ্য (1973-74) - মহারাষ্ট্র
6. পালামাউ জাতীয় উদ্যান (1973-74) - বিহার
7. রণথম্বোর জাতীয় উদ্যান (1973-74) - রাজস্থান
8. সিমলিপাল জাতীয় উদ্যান (1973-74) - ওড়িশা
9. সুন্দরবন জাতীয় উদ্যান (1973-74) - পশ্চিমবঙ্গ

বর্তমান ভারতের "Project Tiger" এর আওতায় কিছু বিখ্যাত এর উদাহরণ :-

1. পেরিয়ার জাতীয় উদ্যান (1978-79) - কেরালা।
2. অরিত্রাম জাতীয় উদ্যান (1978-79) - রাজস্থান।
3. ইন্দ্রবতী জাতীয় উদ্যান (1982-83) - ছত্তিশগড়।
4. বক্সা জাতীয় উদ্যান (1982-83) পশ্চিমবঙ্গ।

ব্যাঘ্র প্রকল্প অনুরক্ষণ প্রক্রিয়া

◎ বাঘ অনুরক্ষণের জন্য নিম্নলিখিত ব্যবস্থা প্রয়োজন:-

1. বাঘের প্রাকৃতিক আবাস এবং খাবারের অভ্যাস।
2. অন্যান্য প্রাণীর সাথে এর সম্পর্ক
3. যে কোনও নির্দিষ্ট সময়ে উপস্থিত প্রাণীর সংখ্যা; তাদের হ্রাস বা বৃদ্ধির কারণ।
4. বাঘের প্রজনন অভ্যাস এবং প্রজনন মরসুমের সম্পর্ক।
5. পানীয় জলের স্থান এবং খাদ্য ব্যবস্থা।
6. তাদের সুরক্ষার জন্য আইন কার্যকর করা।

[5] বাঘের গবেষণা ও পর্যবেক্ষণের সমন্বয় আনা করা।

[6] বন্যপ্রাণ বাঘ সুরক্ষা আইনের যথাযথ বাস্তবায়নকে সমর্থন ও সহায়তা করা।

[7] অধিকারের সংরক্ষণের জন্য বৈজ্ঞানিক, তথ্যভিত্তিক এবং আইনী সহায়তার সমালোচনামূলক সহায়তা নিশ্চিত করুন

[8] কর্মচারী ও কর্মচারীদের জন্য সচেতনতা বৃদ্ধির কর্মসূচি প্রদান করা।

ব্যাঘ্র প্রকল্পের অবস্থান

⊙ 1970 সাল থেকে ভারতে বাঘ সংরক্ষণ কর্মসূচির সফল বাস্তবায়ন হয়। আমরা—বলেন জাতীয় বাঘ সংরক্ষণ কর্তৃপক্ষ (NTCA)-র সদস্য সচিব রাজেশ গোপাল। ভারতে বাঘের সংখ্যা 1706 যা বিশ্বে সর্বোচ্চ। ভারতে বাঘের গতিবিধি ইলেকট্রনিক পদ্ধতিতে নজর রাখা হয়। বনরক্ষীদের বিশেষ প্রশিক্ষণ দেওয়া হয় এবং চোরাশিকারের প্রতিরোধে বিজ্ঞান কৌশল প্রয়োগ করা হয়। এই প্রকল্পের সুরক্ষিত এলাকায় 2006 সালে গঠিত হয় জাতীয় বাঘ সংরক্ষণ কর্তৃপক্ষ নামে পৃথক একটি বিধিবদ্ধ সংস্থা। একে পৃথক পৃথক অর্থ বরাদ্দের সংস্থান রাখা হয়। একক্ষেত্রে ভারতের সাফল্যে আন্তর্জাতিক সংস্থা গ্লোবাল টাইগার ফোরামের শীর্ষে আছে ভারতের নাম। বাঘের সংখ্যা খুব তাড়াতাড়ি পরিবর্তন হয়ে যায় 2006 সালের গণনায় দেখা যায় 1411। আবার 2010 সালে 1,706, 2226 টি 2014 সালে এবং 2967 টি 2018 সালে।

ক্ষুদ্র পুষ্টকণা দিবস

- প্রতি বছর ১৬ অক্টোবর ক্ষুদ্র পুষ্টকণা দিবস পালিত হয়।
- ক্ষুদ্র পুষ্টকণা বলতে ভিটামিন, খনিজ লবণ এবং ফাইটোকেমিক্যাল-কে বোঝায়।
- এই পুষ্টিগুলো আমাদের শরীরের জন্য খুবই গুরুত্বপূর্ণ।
- ক্ষুদ্র পুষ্টকণা দিবস পালনের উদ্দেশ্য হলো মানুষকে সচেতন করা যে, সুস্বাস্থ্যের জন্য শুধু ক্যালরি নয়, বরং পুষ্টিকর খাবার খাওয়া জরুরি।
- এই দিবসটি পালনের মাধ্যমে অপুষ্টি দূরীকরণে সচেতনতা বৃদ্ধি করা হয়।
- বাংলাদেশে প্রতি বছর ক্ষুদ্র পুষ্টকণা দিবস পালন করা হয়।

উপসংহার

মানুষ প্রকৃতির সন্তান। প্রকৃতির সঙ্গে তার নিবিড় সম্পর্ক। প্রকৃতির সঙ্গে মানুষের সম্পর্ক যতদিন থাকবে ততদিন মানুষ সুস্থ থাকবে। প্রকৃতি থেকে মানুষ যতই দূরে সরে যাবে ততই মানুষ অসুস্থ হয়ে পড়বে। তাই প্রকৃতির সঙ্গে মানুষের সম্পর্ক রক্ষা করা একান্ত প্রয়োজন। প্রকৃতি রক্ষা করা মানে মানুষকে রক্ষা করা। প্রকৃতি ধ্বংস হলে মানুষও ধ্বংস হয়ে যাবে। তাই প্রকৃতি রক্ষা করা আমাদের সকলের কর্তব্য।

রচনা-৩ : ভ্রমণ

ভ্রমণ বেড়াতে যাওয়া, দেশভ্রমণে বেরোনো, পর্যটন ইত্যাদি বিভিন্ন নামে ভ্রমণ পরিচিত। ভ্রমণ শব্দটির অর্থ ঘোরা। ভ্রমণ করা মানে ঘুরে বেড়ানো। ভ্রমণ করা মানুষের একটি সহজাত প্রবৃত্তি। ভ্রমণ করতে ভালোবাসে না এমন মানুষ খুব কমই আছে। ভ্রমণ করতে ভালোবাসে না এমন মানুষ খুব কমই আছে।

ভ্রমণের উদ্দেশ্য বিভিন্ন হতে পারে। কেউ ভ্রমণ করে আনন্দের জন্য, কেউ ভ্রমণ করে জ্ঞান অর্জনের জন্য, কেউ ভ্রমণ করে ব্যবসা-বাণিজ্যের জন্য, কেউ ভ্রমণ করে তীর্থস্থান দর্শনের জন্য। ভ্রমণের উদ্দেশ্য যাই হোক না কেন, ভ্রমণ করলে মানুষের মন ভালো হয়ে যায়। ভ্রমণ করলে মানুষের জ্ঞান বাড়ে। ভ্রমণ করলে মানুষের অভিজ্ঞতা বাড়ে। ভ্রমণ করলে মানুষের শরীর ভালো থাকে।

গ্রন্থপঞ্জি

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- https://www.notesonzoology.com
- https://www.indiacode.nic.in
- https://www.dw.com

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INTRODUCTION

At the turn of the 20th century, the population of tigers stood at 40,000, while by early 1970s, their number dwindled to 1827 according to First Tiger Census in 1972. This was a worrying sign for the Indian Government, environmentalists in general and for the nature in particular. The decrease in number tiger meant that the biodiversity in the Indian Forest regions were in jeopardy. As a r result, there was a threat to the food web in nature – the decrease in number of this secondary consumer meant that there will be a stagnation in the primary level- with no secondary consumer like tiger in the web, the web cuts down and it affects the next level consumers and nature in a negative way. Being the national animal of India and international concern for them, Indian Government under the then Prime Minister, Mrs. Indira Gandhi, decided to take necessary steps to stop the depletion of Tiger number sooner than later. On April 1973, the Indian Government launched the Project Tiger with the mission to increase the number of tigers and take adequate measures to prevent the decreasing number of tigers.

PROJECT TIGER

- **REASONS HOW TIGER POPULATION WAS DEPLETING**

1. **Uninterrupted hunting for pleasure-** Before the consciousness regarding tiger population took birth, it can be said that tigers were not considered to be an animal at all because earlier in the medieval times by kings and Zamindars and high class people in the British era, it was their favorite item to hunt. This was indeed the case. At that time, it was irony that these high class believed tiger as a symbol of bravery while at the same time they used to hunt them to show ordinary citizen that they were brave enough to hunt them. As a result, it was not surprising that their houses were crammed with tiger products(maybe mat made up of tiger skin, tiger head as a memento, etc.) This can be sited as the earliest reason of dwindling number of tigers across India- uninterrupted hunting for pleasure.

A British Couple Posing in front of a Hunted Tiger in 1920.

2. **Poaching** - Poachers use one of the following methods to kill a wild tiger:

I. Poison - which is usually placed in the carcasses of domestic buffaloes and cows. During the dry, hot summer months small forest pools are also poisoned by poachers, or depressions dug and filled with water for this purpose. There is a sophisticated and well

organized supply route operated by the major traders, to distribute poison and collect tiger bones from the remotest villages. .

ii. Traps - which are made by nomadic blacksmiths. These traps are immensely strong. In a tiger poaching case near Raipur in 1994, it took six adult men to seta a trap. As a result people have received dreadful injuries from these traps.

iii. Firearms - are used where hunting can be carried out with little hindrance.

iv. Electrocution - by tapping 230 volts -11KV overhead electrical wires and laying a live wire on animal tracts.

Tiger poaching occurs in all areas where large number of tigers have been recorded. Poaching is particularly prevalent in the States of Madhya Pradesh, Uttar Pradesh, West Bengal, Bihar, Maharashtra, Andhra Pradesh, Karnataka, Kerala. Even after post-independence and during 80s and 90s(means after launching Project Tiger), poaching continued. Notorious Poachers like Sansar Chand(also known as Veerappan of North India)used to hunt these animals to meet the high demand for tiger bones(used in medicines for arthritis,headache,etc.),tiger skin(for decorative items), meat(for luxurious meal),etc.

Police in Uttarakhand Raided a Poacher's house to find tiger items.

3.Human Interference in Ecosystem- An increase in human populations throughout tiger ranges in India has resulted in tiger habitats being reduced . Over the past 100 years, tiger habitats have dwindled as they've been overtaken by agriculture, plantations, timber logging, human settlements and access routes. Only 7% of the tiger's historical range is intact today and

tiger habitats are left in isolated areas. This results in small pockets of tiger habitat surrounded by human populations. Not only can this result in human/tiger conflicts as tigers roam to find new habitats, but it can also result in inbreeding in small populations which can reduce genetic diversity.

4. Human- Tiger Conflict- Wherever wild tiger populations survive and come into contact with landscapes dominated by humans, they pose a threat by preying on livestock, and, less commonly, on people. In most parts of India, people are remarkably tolerant of wildlife damage compared with elsewhere in the world, but sometimes, in conflict situations, local antagonism against tigers often erupts into a serious problem. Killing of 'problem' tigers – through shooting, poisoning of livestock kills and, less commonly, using techniques such as electrocution, snaring and trapping – has been widely accepted and practiced by local people to solve such "serious problem". But although extremely rare, it has been historically documented in parts of India that individual tigers begin to view human beings as a 'prey species' and persistently stalk them. The ecological and social factors that lead to man-eating are not scientifically proven, but appear to be influenced by distinct factors. Man-eating behaviour is exhibited in an unusually persistent form among the tigers of the Sundarban delta. Such behaviour resulted in killing the tigers.

People surrounding an unconscious tiger who entered in their fields to hunt their cattle, but was poisoned by villagers to make the tiger unconscious

- **OBJECTIVES OF PROJECT TIGER**

1. To ensure maintenance of a viable population of tigers in India for scientific, economic, aesthetic, cultural and ecological values.

2. To preserve, for all times, areas of biological importance as a national heritage for the benefit, education and enjoyment of the people.

- **PRINCIPLES OF TIGER RESERVES**

  In 1973-74 nine tiger reserves were established — located in 9 different states and covering a total area of 13,017 sq. kms.

  It was based on the following principles:

- Elimination of all forms of human exploitation and disturbance from the core and rationalization of such activities in the buffer.

- Limitation of habitat management to repair damage done by man with the aim of restoring the ecosystem as close to its natural functioning as possible.

- Researching facts about habitat and wild animals and carefully monitoring changes in flora and fauna.

  Initially, nine tiger reserves under the early days of Project Tiger were:

  Bandipur National Park (1973-74) – Karnataka

  Jim Corbett National Park (1973-74) – Uttar Pradesh

  Kanha National Park (1973-74) – Madhya Pradesh

  Manas National Park (1973-74) – Assam

  Melghat Wildlife Sanctuary (1973-74) – Maharashtra

  Palamau National Park (1973-74) – Bihar

  Ranthambore National Park (1973-74) – Rajasthan

  Simlipal National Park (1973-74) – West Bengal

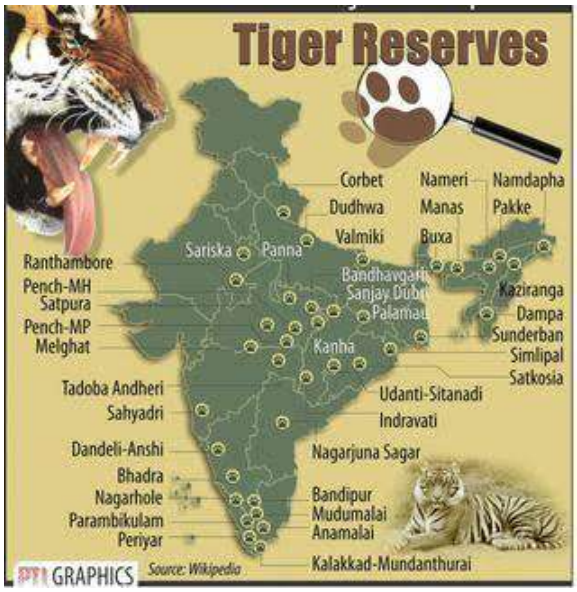
  Sunderbans National Park (1973-74) – Orissa

Today the number of tiger reserves, which come under the 'Project tiger' of India, has increased to 27. For example:

Periyar National Park (1978-79) – Kerala

Sariska National Park (1978-79) – Rajasthan

Buxa National Park (1982-83) – West Bengal



This is the map showing the number and location of Tiger Reserves in India till date.

- **CONSERVATION PROCESS IN PROJECT TIGER**

Conservation of tiger (or any other wildlife) requires the following knowledge:

1. The natural habitat of tiger and its food habit.
2. About the breeding habit and bree-ding season of tigers.
3. Its relation with other animals.
4. The number of animals present at any given time; reasons for their diminishing or increasing.

Levels of Conservation:

Conservation of tiger is done at the following levels:

Level I:

The population of the tigers in any reserve is to be determined from time to time. The reasons for either their increase or decrease are to be noted. In case of decrease, the reasons are to be located and appropriate measures are to be undertaken.

If they encounter severe diseases then it should be diagnosed and immediate treatments are to be made. If the decrease in number is due to poaching then constant vigilance is to be maintained to keep poachers away.

Level II:

The food of tiger comprises of deer, sambar, wild boar etc. as it is a carni-vore. Care should be taken to keep the food animals in sufficient numbers, so that the tiger need not come out of the forest for food and get killed by the hunters.

Level III:

It is essential to have know-ledge about the breeding season of the tigers and the number of litters born. The litters should be protected from all sorts of danger including diseases. The diseased litters or tigers should be imprisoned and treated and later released into their natural habitat.

- **NATIONAL TIGER CONSERVATION AUTHORITY (NTCA)**

  The National Tiger Conservation Authority (NTCA) is a statutory body under the Ministry of Environment, Forests and Climate Change for strengthening tiger conservation in India. NCTA was created in 2005 following the recommendation of the tiger task force and was given the status of statutory authority under Section 38L of the Wild Life (Protection) Amendment Act, 2006.

Within the ambit of the Wildlife Protection Act, 1972 (hereinafter referred to as the Act) NTCA maintains a regulatory oversight over guidelines, ongoing conservation initiatives around India and recommendations of specially constituted Committees.

Emblem of National Tiger Conservation Authority

Powers and functions of Tiger Conservation Authority

Tiger Conservation Authority has been created for better conservation of tigers in India. As an authority, all their functions should be aimed at conserving tigers. Their functions are enumerated in Sec 38O (1) of the Act. These functions are:

1. Tiger conservation plan prepared by the State Government.

2.Maintaining sustainable ecology and disallow any such use of land within the tiger reserves which is detrimental to the ecology.

3.Making rules and guidelines for tourism activity for project Tiger in the tiger reserves and also ensure their due compliances.

4.Measures for addressing conflicts between men and animals and emphasize on co-existence between the 2 outside the national parks, tiger reserve or sanctuaries.

5.Providing information to the public on the conservation plans, estimation of population of tigers, the status of natural habitat and report on any untoward incident. TCA releases the status of tigers in India. The report of 2018 is available here.

6.Approving coordinates research and monitoring of tigers.

7.Facilitating and supporting tiger reserve management in the State.

8.Ensuring critical support in scientific, IT and legal support for better conservation of tigers.

9.Facilitating capacity building programmes for the officers and staff.

- **WILDLIFE PROTECTION ACT(WPA),1972 – PRECURSOROF PROJECT TIGER.**

  The WPA – 1972 is an Act of the Parliament of India enacted for the protection of plants and animal species. Prior to this legislation, India had only five designated national parks. Among other reforms, the Act established schedules of protected plant and animal species; hunting or harvesting these species was largely outlawed.

  The Act provides for the protection of wild animals, birds and plants; and for matters connected therewith or ancillary or incidental thereto. It extends to all territory under the Indian government.

  All the animals in Schedule I of the Wildlife Protection Act are granted protection from poaching, killing, trade etc. Those committing crimes under this Act are liable to be punished with the severest punishment under Indian Law for such crimes. Section of the Wild Life Act prohibits the hunting of any animal in India. Under this law, the protection of tiger has been declared important.

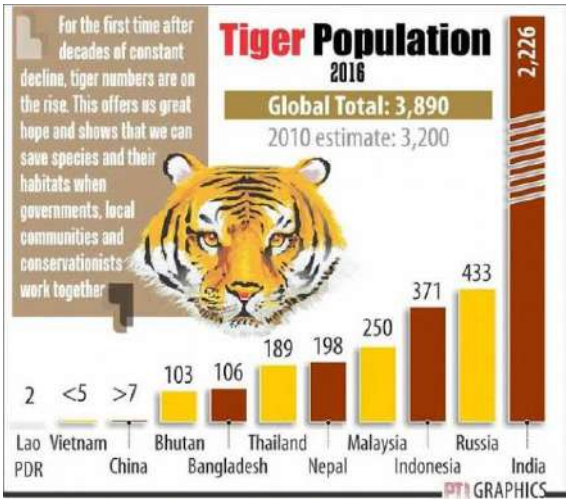
ACHIEVEMENTS OF PROJECT TIGER

More than 45 years have passed, and it will be able unjust to say that Project Tiger is a campaign without success. A significant amount of success has been achieved in this campaign:

1. Protection of Entire Ecosystem – With Project Tiger in action, there has been a stringent protection of Entire Ecosystem. With division of tiger reserves into Transition zone(most human activities done here, located in the periphery of the reserve),Buffer Zone(least human activity) and Core Zone(no human activity zone),the forest officials were successful in maintaining least disturbance in the last two zones. As a result, tigers, plants and other animals survived in their own habitat.

2. Increase in numbers of Prey and Predators- The Project Tiger was launched keeping in mind to increase the number of tigers and at the same time, control the dwindling of tiger decrease. But for the survival for tigers, a significant amount of prey is required for the predator to fill their hunger and at the same time maintain the food web. So, while giving the tiger a safe harbour to survive in its habitat, they are provided with enough preys like deer, etc. This helped to prevent the tiger to migrate from their reserves to find food in human settlement, thus preventing human-tiger conflict. According to the latest report as released by the Indian Government, In 2006, there were 1,411 tigers which increased to 1,706 in 2010, 2,226 in 2014 and 2,967 in 2018. The Indian increase played a big role in driving up global populations as well; the number of wild tigers globally rose from 3,159 in 2010 to 3,890 in 2016 according to World Wildlife Fund and Global Tiger Forum.

Table showing the Rise of Tigers in India as compared to Asian countries



3. Efficient allocation of Funds- The Indian Government provides amount of money at the right time to provide the NTCA so that it will help them to look after the development for the survival of Tigers. Medicines, Preys, Surveillance- all are maintained through this money as provided by the government and the best thing is that there is a one-way travel of money from Government to NTCA without any taking a “middle path”. Thus there is a negligible amount of corruption takes place.

4. Scientific collection of Data- Project Tiger enabled NTAC to collect data about the number of tigers present in reserves every year. Such scientific collection of data is required to take necessary steps for their development in their habitat. Tiger population, flora-fauna ratio, Fertility Ratio, etc. helps NTAC authorities and officers to take adequate steps for protection, preservation and conservation of Tigers.

SETBACKS OF PROJECT TIGER

- Project Tiger and NTAC directorate is a guiding authority having no judicial power.
- There is an immense lack of coordination among the bodies dealing with Project Tiger
- Funds are released by the centre on time but this funds are extremely insufficient and as a result, many of the activities remain suspended due to lack of adequate funds.
- The Forest department has not maintained a good relation with communities inhabiting the peripheries of the reserves. Often they were forced to be “relocated” in order to maintain a significant distance from the tiger reserve, but without their consultation.
- Field Staff, being the backbone of the project, was not provided with proper training of new recruitments.
- A stringent legal system that provides very harsh punishment in a quick trial for Poaching and hunting needs to be established.

CONCLUSION

Project Tiger has been undertaken by more than fifty national parks, and every park is putting an equal effort to save the endangered species. Increasing four thousand tigers in the past few years is one of the landmark achievement of the project. Humans have stopped hunting and illegal trading of tiger skin to a very large extent. The project has made sure that tigers do not have to suffer because of selfish human needs. All the other animals that were depleting because of human interference has stopped. The national parks are taking initiatives to save and conserve every animal. People have become more aware of the wildlife problem and have taken steps to stop them from decreasing. However the above mentioned setbacks are the ones which is reducing the speed of development of increase in number of tigers. Although India boasts nearly 3,000 tigers across the length and breadth of its forests, the country has witnessed a major spike in poaching during the lockdown period enforced by the government to stem the spread of coronavirus.

According to the wildlife trade monitoring network Traffic, 88 poaching incidents have been reported in the post lockdown period from March 23-May 3, almost double the number reported during the six weeks before lockdown. This is because people were forced to do this illegal activities as their livelihood has been affected badly. In order to earn bread, they restarted this practice. An official data suggests that India has lost 110 tigers in 2019, one-

third of them due to poaching. Over the last eight years, 750 tigers have died in the country, most of them fell to the bullets of poachers, said the government data. Through this we can understand, that the path to real success is still far. But we can't lose hope after coming to this path.

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ENVIRONMENTAL LAWS.

What is Environmental Laws?

Environmental law is a collective term encompassing aspects of the law that provide protection to the environment. A related but distinct set of regulatory regimes, now strongly influenced by environmental legal principles, focus on the management of specific natural resources, such as forests, minerals, or fisheries.

Objectives:

The main job of environmental law is to protect human health as well as the environment. It is all about making balance. The role of the environment is to ensure that the practices used in the environment do not cause harm to the environment, human or animal health.

ENVIRONMENTAL LAWS IN INDIA.

The need for protection and conservation of environment and sustainable use of natural resources is reflected in the constitutional framework of India and also in the international commitments of India. The Constitution under Part IVA (Art 51A-

Fundamental Duties) casts a duty on every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures. Further, the Constitution of India under Part IV (Art 48A-Directive Principles of State Policies) stipulates that the State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country.

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

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

sector.

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

The National Green Tribunal Act, 2010

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

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

The Environment Protection Act, 1986

The Hazardous Waste Management Regulations, etc.

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

The National Green Tribunal Act, 2010

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

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

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

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

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

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

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

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

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

The Environment Protection Act, 1986

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

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

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

Hazardous Wastes Management Regulations

Hazardous waste means any waste which, by reason of any of

its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics, causes danger or is likely to cause danger to health or environment, whether alone or when in contact with other wastes or substances.

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

Hazardous Wastes (Management, Handling and Transboundary) Rules, 2008, brought out a guide for manufacture, storage and import of hazardous chemicals and for management of hazardous wastes.

Biomedical Waste (Management and Handling) Rules, 1998, were formulated along parallel lines, for proper disposal, segregation, transport, etc, of infectious wastes.

Municipal Solid Wastes (Management and Handling) Rules, 2000, aim at enabling municipalities to dispose municipal solid waste in a scientific manner.

In view of the short-comings and overlapping of some categories causing inconvenience in implementation of the

Biomedical Waste (Management and Handling) Rules, 1998 as well as the Municipal Solid Wastes (Management and Handling) Rules, 2000, the Ministry of Environment, Forest and Climate Change has formulated the draft Bio-Medical Waste (Management & Handling) Rules, 2015 (Draft BMW Rules) and the draft Solid Waste Management Rules, 2015 (Draft SWM Rules) and sought comments on the draft Rules.

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

E - Waste (Management and Handling) Rules, 2011 have been notified on May 1, 2011 and came into effect from May 1, 2012, with primary objective to reduce the use of hazardous substances in electrical and electronic equipment by specifying threshold for use of hazardous material and to channelize the e -waste generated in the country for environmentally sound recycling. The Rules apply to every producer, consumer or bulk

consumer, collection centre, dismantler and recycler of e-waste involved in the manufacture, sale, purchase and processing of electrical and electronic equipment or components as detailed in the Rules.

Batteries (Management & Handling) Rules, 2001 deal with the proper and effective management and handling of lead acid batteries waste. The Act requires all manufacturers, assemblers, re-conditioners, importers, dealers, auctioneers, bulk consumers, consumers, involved in manufacture, processing, sale, purchase and use of batteries or components thereof, to comply with the provisions of Batteries (Management & Handling) Rules, 2001.

Other Laws Relating to Environment

In addition, there are many other laws relating to environment, namely –

The Wildlife Protection Act, 1972

The Wild Life (Protection) Act, 1972 was enacted with the objective of effectively protecting the wild life of this country and to control poaching, smuggling and illegal trade in wildlife and its derivatives. The Act was amended in January 2003 and punishment and penalty for offences under the Act have been made more stringent. The Ministry has proposed further amendments in the law by introducing more rigid measures to strengthen the Act. The objective is to provide protection to the listed endangered flora and fauna and ecologically important protected areas.

The Forest Conservation Act, 1980

The Forest Conservation Act, 1980 was enacted to help conserve the country's forests. It strictly restricts and regulates the de-reservation of forests or use of forest land for non-forest purposes without the prior approval of Central Government. To this end the Act lays down the pre-requisites for the diversion of forest land for non-forest purposes.

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, recognises the rights of forest-dwelling Scheduled Tribes and other traditional forest dwellers over the forest areas inhabited by them and provides a framework for according the same.

The Indian Forest Act, 1927 consolidates the law relating to forests, the transit of forest-produce and the duty leviable on timber and other forest-produce.

Public Liability Insurance Act, 1991

The Public Liability Insurance Act, 1991 was enacted with the objectives to provide for damages to victims of an accident which occurs as a result of handling any hazardous substance. The Act applies to all owners associated with the production or

handling of any hazardous chemicals.)

The Biological Diversity Act, 2002

The Biological Diversity Act 2002 was born out of India's attempt to realise the objectives enshrined in the United Nations Convention on Biological Diversity (CBD), 1992 which recognises the sovereign rights of states to use their own Biological Resources. The Act aims at the conservation of biological resources and associated knowledge as well as facilitating access to them in a sustainable manner. The National Biodiversity Authority in Chennai has been established for the purposes of implementing the objects of the Act.

Coastal Regulation Zone Notification

The Ministry of Environment and Forests had issued the Coastal Regulation Zone Notification vide Notification no. S O. 19(E), dated January 06, 2011 with an objective to ensure livelihood security to the fishing communities and other local communities living in the coastal areas, to conserve and protect coastal stretches and to promote development in a sustainable manner based on scientific principles, taking into account the dangers of natural hazards in the coastal areas and sea level rise due to global warming.

ADVANTAGES AND DISADVANTAGES OF ENVIRONMENTAL LAWS.

Health and Safety

Environmental laws protect the health and safety of humans and the environment. For example, the Clean Air Act limits emissions of pollutants, and the Marine Protection, Research, and Sanctuaries Act prohibits dumping of waste into U.S. ocean waters without a permit. (See References 1 and 4) Without such laws, businesses and individuals might do whatever was most convenient or cost-effective for them, rather than acting for the good of society and the environment.

Innovation

Stricter environmental laws tend to increase innovative environmentally friendly technology, writes Frank Wijen in "A Handbook of Globalization and Environmental Policy." (See Reference 5, Page 216) The demand for sustainable technology rises as companies and individuals must follow stricter environmental regulations, leading researchers and clean energy entrepreneurs to focus on developing such technologies. Ultimately, this increases the prominence of sustainable technologies, making them more accessible.

Costs

Businesses may see certain environmental laws in a negative light if they must adapt their practices and increase spending to comply with regulations. Individuals may feel inconvenienced by particular laws as well, such as a new law against fishing in a favorite spot. Conducting a cost-benefit analysis of environmental laws often proves challenging, as negative effects of not implementing these laws -- such as death, illness and ecosystem destruction -- cannot always be easily quantified in monetary terms. (See Reference 2) However, becoming more environmentally friendly may actually save businesses and individuals money in the long term, particularly by reducing waste and energy usage, despite the cost of the initial investment.

Oversights

Environmental laws that impose regulations without considering their impacts on local communities come with a serious disadvantage: lack of local support. For example, a law that commands people to stay out of a protected natural area, without recognizing that people rely on this ecosystem for their own daily needs, may not only constitute a human rights violation, but may actually backfire, says the Center for International Forestry Research. Community participation in ecosystem management helps to ensure compliance with regulations, reports CIFOR.

3rd YEAR (1+1+1 SYSTEM)

ENVS PROJECT

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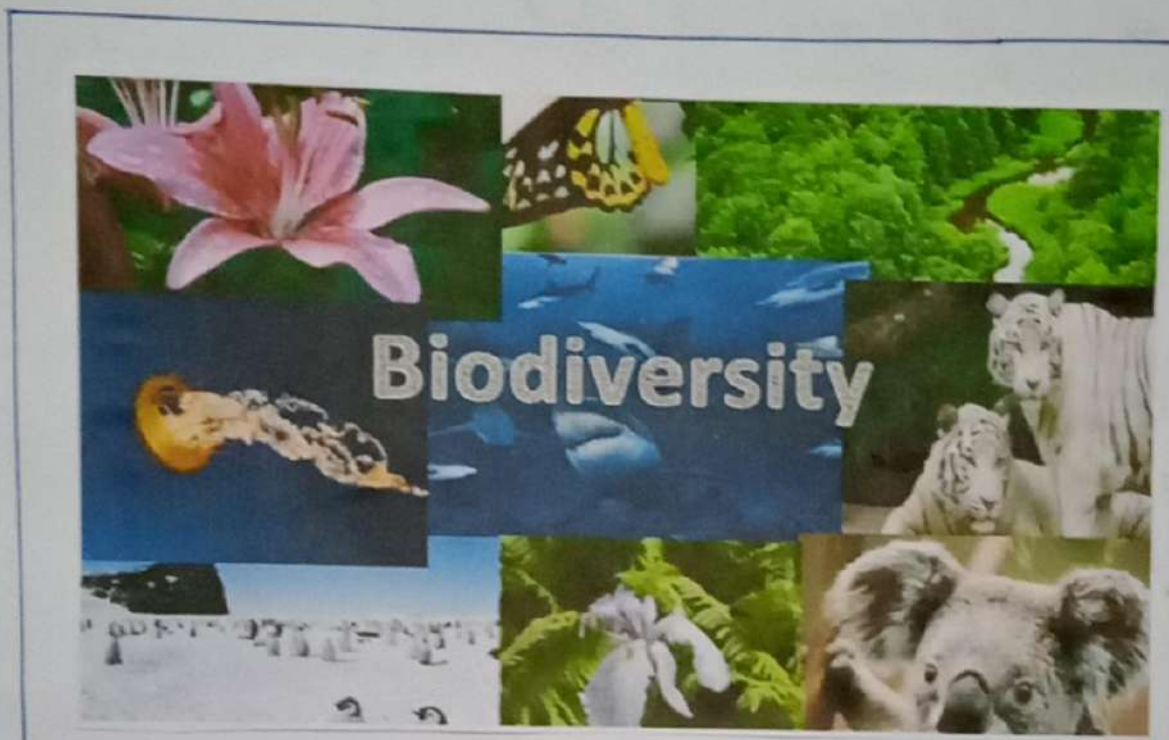

Biodiversity

INTRODUCTION

What is biodiversity ?

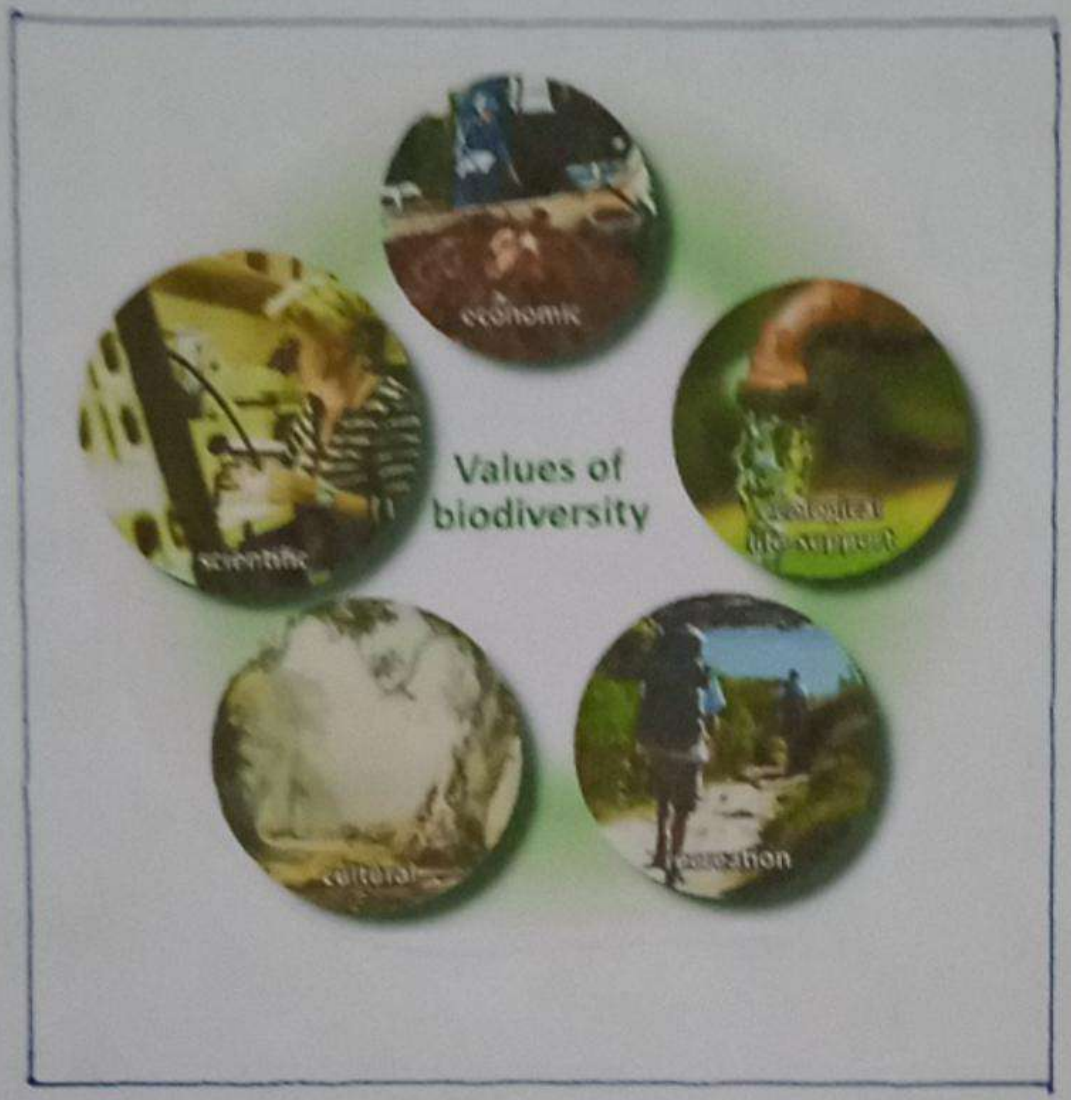
The word biodiversity comes from combination of two words 'Bio means living' and 'diversity means variation'. Hence in simple words the variation among the living beings is called biodiversity. The living beings range from very small size microbes to large size mammals. However, whether small or large organism, each plays a unique role and is important for ecological balance and environment.

IMPORTANCE OF BIODIVERSITY (VALUES)

Biodiversity is essential for preserving ecological processes, such as fixing and recycling of nutrients, soil formation, circulation and cleansing of air and water balance within ecosystems, watershed protection, maintaining stream and river flows throughout the year, erosion control and local flood reduction. Food, clothing houses, energy, medicines are all resources that are directly or indirectly linked to the biological variety present in the biosphere.

Consumptive use value :-

These are direct use values where the biodiversity products can be harvested and consumed directly eg: fuel, food, drugs, etc.


economic
scientific
Values of
biodiversity

Productive Use Value :-

It refers to the commercial value of products that are commercially harvested for exchange in formal markets, such as game meat, timber, fish, ivory, medicinal plant. They are included in national income accounts like the GNP.

Social Use Value :-

It includes aesthetic, recreational, cultural and spiritual values. To this can be added health benifits resulting from recreational and other activities.

Ethical and Moral Values :-

It is related to biodiversity conservation are based on the importance of protecting all forms of life against illegal activities like cloning of animals, smuggling of valuable

biodiversity instances, bio-piracy, illicit trade, etc.

Aesthetic Value :-

The beauty of our planet is because of diversity. Biological diversity adds to the quality of life and provides some of the most beautiful aspects of our existence. It is also responsible for the beauty of a landscape.

Option Value :-

It is the value of knowing that there are biological resources existing on this biosphere that may one day prove to be an effective option for something important in the future. Thus, the option value of biodiversity suggests that any species may prove to be a miracle species some day.

BIODIVERSITY HOTSPOTS

Hotspots comprise different regions on Earth which are biologically rich as well as deeply endangered and are characterized by forest and other remanant habitats which have at least 1,500 vascular plants as endemics. Any area with 30% or less of its original natural vegetation left is characterized as a hotspot. Around the world, 35 areas have been identified.

Biodiversity Hotspots in India :-

i. HIMALAYA – Includes the entire Indian Himalayan region (and that falling in Pakistan, Tibet, Nepal, Bhutan, China and Myanmar).

Biodiversity Hotspots

- Four regions that satisfy these two criteria exist in India viz.

The Western Ghats & Sri Lanka

- The Eastern Himalayas
- Indo Burma

Sundaland

ii. INDO - BURMA - Includes entire North-eastern India, except Assam and Andaman group of Islands (and Myanmar, Thailand, Vietnam, Laos, Cambodia and southern China).

iii. SUNDALANDS - Includes Nicobar group of Islands (and Indonesia, Malaysia, Singapore, Brunei, Philippines).

iv. WESTERN GHATS and SRI LANKA - Includes entire Western Ghats (and Sri Lanka).

THREATS TO BIODIVERSITY

- Habitat Related (Loss, degradation, fragmentation).
- Pollution (chemical, Light, Noise).
- Overexploitation.
- Invasive Species.
- Anthropogenic climate change.
- Disease (lesser threat to most taxa).
- UV radiation (primarily threats to amphibians).
- Synergistic Effects of Threats.
- Cascade Effects.

BIODIVERSITY CONSERVATION

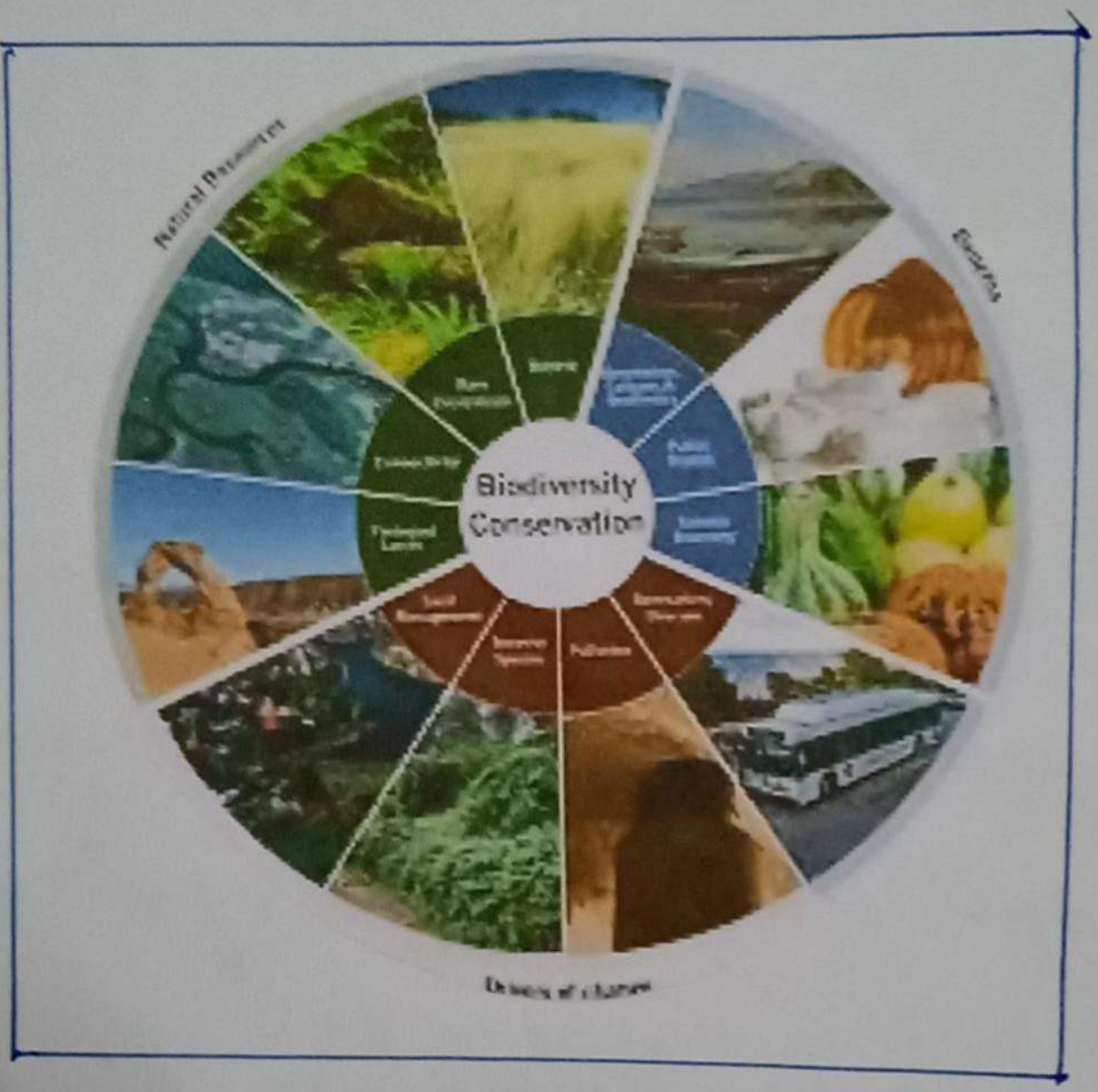
Biodiversity conservation refers to the protection, preservation, and management of ecosystems and natural habitats and ensuring that they are healthy and functional.

Conservation are as follows :—

- To protect and preserve species diversity
- To ensure sustainable management of the species and ecosystems
- Prevention and restoration of ecological processes and life support systems.

Two Methods of Conservation of Biodiversity :—

IN SITU CONSERVATION — It refers to the preservation and protection of the species


Biodiversity Conservation

in their natural habitat. In situ conservation involves the management of biodiversity in the same area where it is found. Different methods of In-situ conservation include biosphere reserves, national parks, wildlife sanctuaries, biodiversity hotspots, gene sanctuary and sacred groves.

EX SITU CONSERVATION — It means conservation of life outside of their natural habitat or place of occurence. It is the method in which part of the population or the entire endangered species is taken from its natural habitat which is threatened and breeding and maintaining of these species take place in artificial ecosystems. Artificial ecosystems could be zoos, nurseries, botanical gardens, etc.

CONCLUSION

Biodiversity is the pillar that allows ecosystems to function and humans to thrive. Without biodiversity in an ecosystem we would not have the many plants and animals we find in our world, including us. Biodiversity has played an important role in creating the planet we live on and continues to help us improve our lives. So, the real value of biodiversity is beyond anything our mind can even imagine.

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CULCATTA UNIVERSITY

SCOTTISH CHURCH COLLEGE

ENVS PROJECT

Natural Resources

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Ronald zik tlau and my friends for helping me a lot in Collection of study materials and finalizing the Project.

INTRODUCTION

Natural resources that are found in the environment and are developed without the intervention of humans. Common examples of natural resources include air, sunlight, water, soil, stone, plants, animals and fossil fuels.

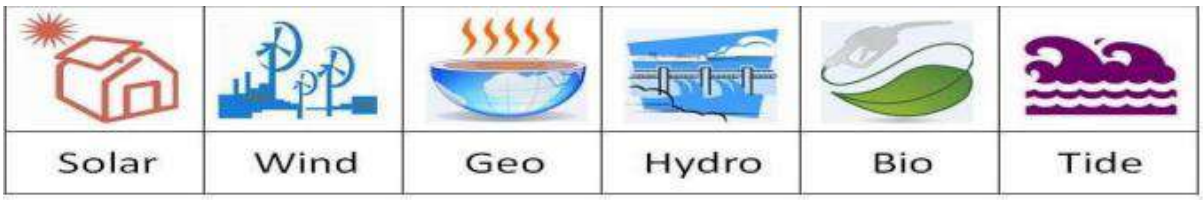
Natural resources are naturally occurring materials that are useful to man or could be useful under conceivable technological, economic or social circumstances or supplies drawn from the earth, supplies such as food building and clothing materials, fertilizers, metals, water and geothermal power. For a long time, natural resources were the domain of the natural sciences..

➢Renewable Resource

• Renewable energy is energy which is generated from natural sources
i.e. sun, wind, rain, tides and can be generated again and
againas and when required.

• They are available in plenty and by far most the cleanest sources of energy available on this planet.

•Solar Energy, Wind Energy, Geothermal Energy, Biomass Energy From Plants, Tidal Energy are the examples of Renewable resources.



➢Non Renewable Resource

• A non renewable resource is a natural resource that cannot be re-made or regrown at a scale comparable to its consumption.

•Non-renewable sources are not environmental friendly and can have serious effect on our health.

• They are called non-renewable because they cannot be re-generated within a short span of time.

• Non-renewable sources exist in the form of fossil fuels, natural gas, oil and coal.

➢Forest Resources

• Scientists estimate that India should ideally have 33% of its land under forests. Today we have only about 12%. Thus we need not only to protect existing forest but also to increase our forest cover.

➢Uses of Forest Resources - direct uses

- Timbers
- Raw materials
- Edible products
- Natural habitats
- Manual and fuel wood
- National income
- Medicinal plant
- Tourism
- Employment opportunities

➢Uses of Forest Resources - indirect uses

They stop the rain-bearing winds and cause the rainfall.

• They increasethe moisture content in the atmosphere and

thereby provide additional precipitation(i.e., rainfall) in the locality

• They minimize the extreme variation in climatic condition and make

the climate more equable.

• They control floods during heavy rain by absorbing excess rain

water.

• They prevent soil erosion by checking the force of flowing of water.

• The thick roots of the trees absorb large quantity of water thus, forest help in the flow of rivers and streams.

➢ Reasons for the large scale depletion of forest

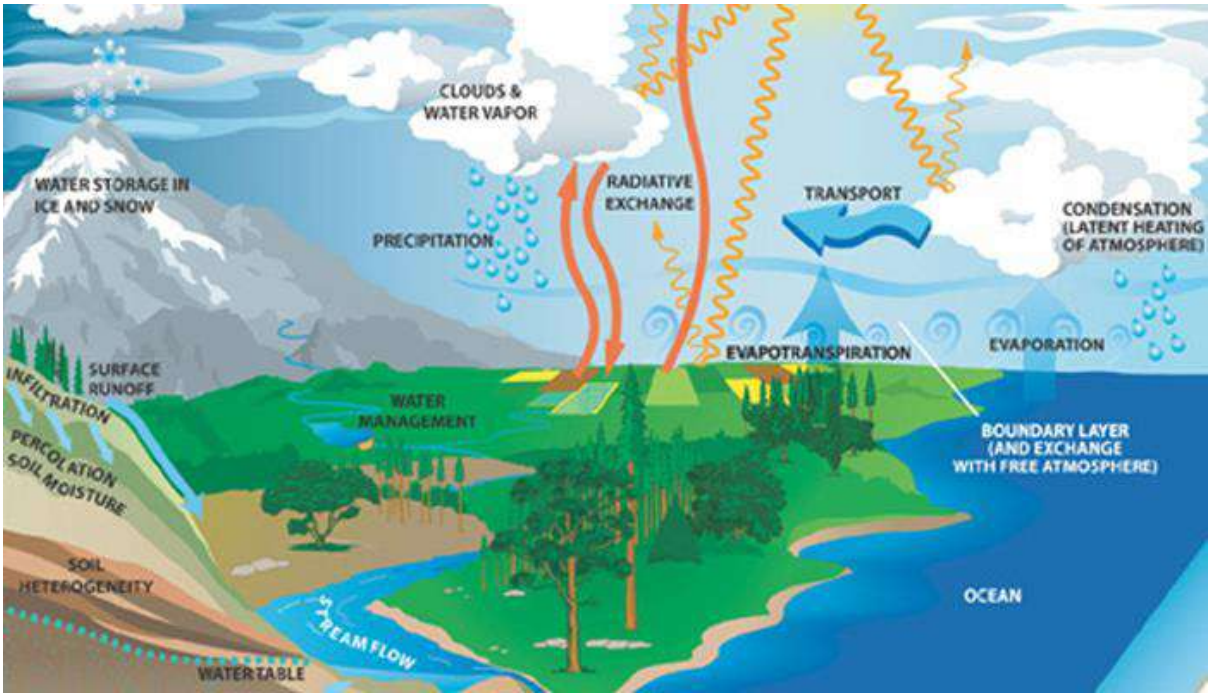
• Expansion of agriculture, more foresthave been cleared for
agriculture.
• Large area of forestlands have been cleared for urbanization
and human settlement.
•Commercial exploitation of forest .
• Forest fires.
• Mining activities in forest areas.
• Forest diseases are also partly responsible for depletion forest.

➢ Adverse effect of depletion of trees

• It has contributed to rise in temperature.
• It has contributed to lesser precipitation.
• It is responsible for increased rate of soil erosion.
•It is responsible for increase in the frequency and volume of floods.
•It has lead to loss of soil productivity.
•It is responsible for loss of biodiversity.
• It has lead to extinction of several species of plants and animals
•It has caused imbalance in ecosystem.

➢ Water Resources

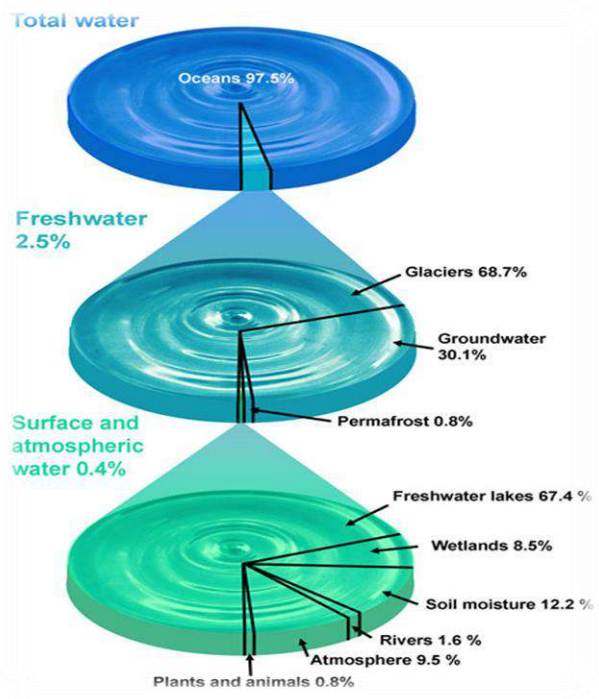
While 67% of Earth's surface is covered by water, only less than 2.7% of global water is freshwater. Most of the freshwater (2.05%) are locked in ice caps and glaciers. Only less than 0.7% is available for human use. Knowing how water cycles through the environment can help in determining how much water is available in different parts of the world.

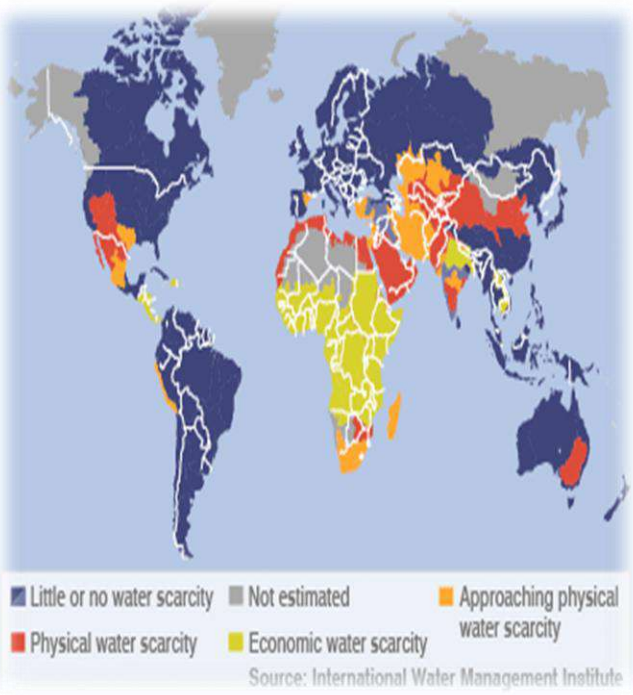


➢ Sources of water

- Groundwater
- Aquifers-Confined
- Unconfined aquifers

About 60% of the water that is taken from the ground is used for farming in arid and semi-arid climates, and between 25% and 40% of the world's drinking water comes from underground. Hundreds of cities around the world, including half of the very largest, make significant use of groundwater. This water can be especially useful during shortages of surface water.





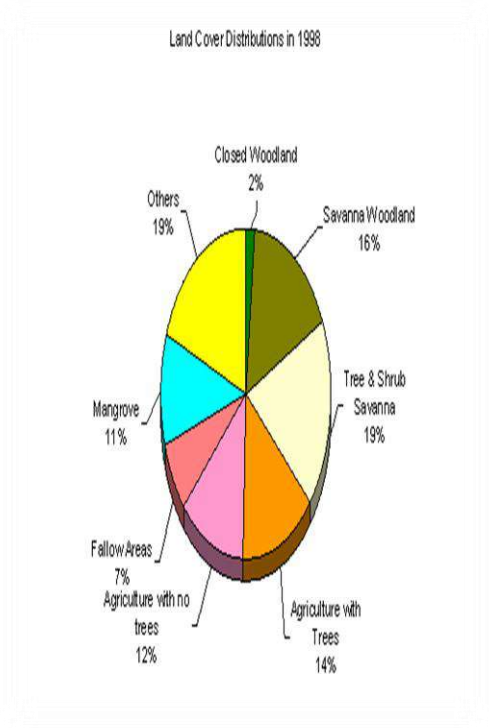
Water resources are under pressure. More reliable information is still needed regarding the quality and quantity of available water, and how this availability varies in time and from place to place. Human activities affect the water cycle in many ways, which needs to be understood and quantified to manage water resources responsibly and sustainably.

It has become evident that.

- Changes in climate are affecting water availability
- Pollution, water diversions and uncertainties about the abundance of water are threatening economicgrowth,
- Underground water is often being overexploited and polluted.

➢ Land Resources

- Man needs land for building homes, cultivating food, developingindustries for providing goods, and for creating towns and cities.
- Thus a rational use of land needs careful planning. One candevelop most of these different types of land uses almost anywhere, but it is very important to protect wilderness area in the form of national parks and sanctuaries.
- If land is utilized properly it can be considered as renewable resources.
- Land is also converted into a non renewable resources when highly toxic industrial and nuclear wastes are dumped on it.



• Land Resources include.

1. Hills 2.Valleys Plains 3.River basins 4.Wetland.

Land is a finite natural resources

➢ Role of Individual in conservation of natural resources

1. INDIVIDUALS ROLE IN FOREST CONSERVATION

•The measures to conserve forests ,save trees, and planting new trees include- Not felling the trees in forests ,farms,roads,or houses if they are green.
•Not uprooting the existing trees while constructing a house but planting fast growing plant species in open area of the house.
•Planting herbs,shurbs,or suitable trees in and around the house.
•Maintain lawn and garden in open place in your house ,if possible.
•Participating in community plantation programmes.

2. INDIVIDUALS ROLE IN WATER ECONOMY

The measures to conserve water resources include
•Not keeping water taps running.
• Check water leak and repair.
•Adopt minimum water use patterns.
• Installing water saving toilets that use optimum water per flush.
• Adopting rain water harvesting devices in your house to conserve
water for future use.
• Collect waste water in your home and use it for watering kitchen
garden.

3.1NDIVIDUALS ROLE IN ENERGY CONSERVATION AND SAVING ENERGY

Some of the measures are
• Turning off lights ,fans, or other electric appliances when not in use.
• Replacing tube lights with CFLs and LED s.
• Construct buildings in such a way that maximum amount of sunlight
can be obtained.
•Try to dry cloths in sunlight instead of drier of washing machine.
• Using solar cookers for cooking food.
• Buying energy efficient appliances, always checking energy consumption figure.
• Minimise use of automobiles by using bicycles, public transport, carpooling etc.

4.INDIVIDUALS ROLE IN SUSTAINABLE AGRICULTURE AND SOIL PROTECTION

Some of the measures are
• Reducing use of chemicals such as fertilizers and pesticides to check
soil pollution.
• Using bio fertilizers.
• Using biological control measures for pest control.
• Avoid over irrigation without proper irrigation to prevent water logging
• Discouraging monoculture practise in agriculture.
• Adopting mix cropping.
• Adopting drip irrigation to avoid washing out soil nutrients.
• Observing December 23 as world farmers day.
• Observing June 17 as a day to combat desertification and deserts.
• Observe November 21-27 as national land resource conservation week.

CONCLUSION

In 1982, the United Nations saw the need for environmental protection and preservation of natural resources. The World Charter for Nature lists the measures to be taken to prevent depletion of natural resources. It also states the importance of environmental protection and the need to create laws on the same subject. Other organizations like the International Union for Conservation of Nature (IUCN) and the World Wide Fund for Nature (WWF) have also led in the push for protection of natural resources. The organizations have funded scientific studies like Conservation biology where scientists research on ways to conserve the natural resources found in the environment. At the local level, countries have established protected areas to conserve natural resources from exploitation. Conservationists also encourage the use of renewable natural resources such as wind and solar energy instead of non-renewable resources which are at risk of extinction. Additionally, most countries have government departments that oversee the extraction and use of natural resources. These departments create rules on management of natural resources like precious metals, rare metals, and energy sources. They also provide licenses to companies involved in the production and sale of such resources.

TOPIC - BIODIVERSITY
ENVS PROJECT

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COLLEGE ROLL NO - A-205

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This project of ENVS has helped me to widen my knowledge. I express my deep sense of gratitude and thanks to Professor Ridhi Ma'am, Professor Sreemoyee Ma'am and other ENVS teachers who has guided me to prepare the project based on the poem 'Autumn'.

I do want to extend my heart felt thanks to my parents and others who have helped me in various ways. Thus, biodiversity taught me the importance of different types of diversity in biosphere in reality.

Abhisikta Mondal
(Department of History)

INTRODUCTION

The word biodiversity means, this word comes from combination of two words 'Bio means living' and 'diversity means variation'. Hence in simple words the variation among the living beings is called biodiversity. The living beings range from very small size microbes to large size mammals. In the most widely used system of classification these have been divided into 5 main kingdoms: Monera, Protista, Fungi, Plantae and Animalia based on certain common features and are further subdivided into many categories. However, whether small or large organism, each plays a unique role and is important for ecological balance and environment. As per specific scientific estimates, a large number of organisms have extinct from the earth since its formation due to antropogenic activities or natural processes but in last 100 years the rate of extinction increased due to antropogenic activities. Keeping in view the extreme importance of biodiversity, it is important to save it. The current note of biodiversity are vast.

IMPORTANCE OF BIODIVERSITY

Biodiversity is important to humans for many reasons. Biodiversity is also considered by many to have intrinsic value — each species value to exist whether known or not to humans. This was looked by Commonwealth Scientific and Industrial Research Organisation (CSIRO).

ECONOMIC- biodiversity provides humans with raw materials for consumption and production. Many livelihoods, such as those of farmers, fishers and timber workers, are dependent on biodiversity.

ECOLOGICAL LIFE SUPPORT- It provides functioning ecosystems that supply oxygen, clean air, water, pollination of plants, pest control, wastewater treatment and many ecosystem services.

RECREATION- many recreational pursuits rely on our unique biodiversity, such as birdwatching, hiking, camping

and fishing. Our tourism industry also depends on biodiversity.

CULTURAL – the Australian culture is closely connected to biodiversity through the expression of identity, through spirituality and through aesthetic appreciation. Indigenous Australians have strong connections and obligations to biodiversity arising from spiritual beliefs about animals and plants.

SCIENTIFIC – biodiversity represents a wealth of systematic ecological data that help us to understand the natural world and its origin.

FLORA

There are about 100 plant species, which have been recorded in and around the East Calcutta Wetlands. This include Sagittaria montividensis, cryptocoryne ciliata, Cyperus spp, crotichum aureum, Ipomoea Aquatica etc. The Sunderbans used to extend up to Latuli in the 1950s.

Several kinds of water hyacinths grow across these wetlands. Local farmers and fisher folk use water hyacinth to create a buffer between land and water to minimise erosion.

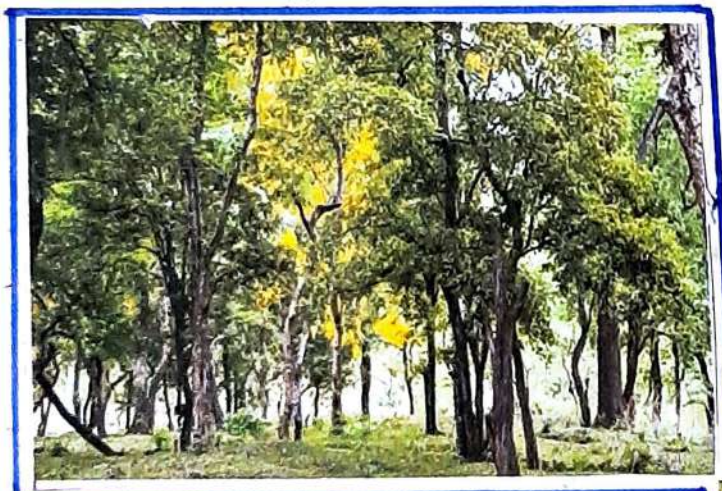
The area is also home to large numbers of coconut and betel nut trees. Many varieties of vegetables are farmed here, including cauliflower, eggplant, pumpkin, sunflower and sacred basil. Tracts of land are dedicated to paddy cultivation as well.

NEEM

SACRED FIG (PEEPAL)

SAL

COCONUT TREE



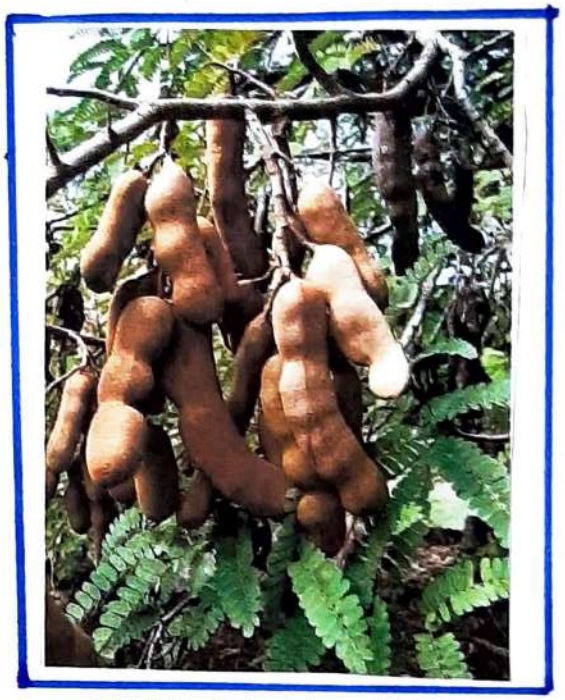
SANDALWOOD TREE

BANYAN TREE

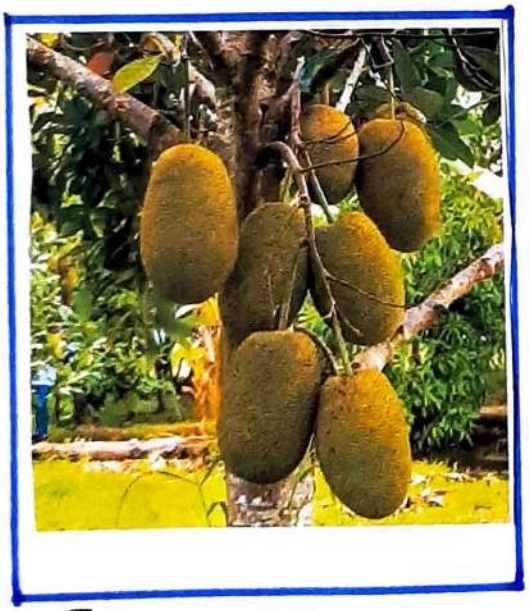
MANGO TREE

ASHOKA TREE

GULMOHAR TREE



TAMARIND TREE



JACKFRUIT

BABUL TREE

AMLA TREE

Common Name	Scientific Name
Neem	Azadirachta Indica
Sacred Fig (Peepal)	Ficus Religiosa
Sal	Shorea Robusta
Coconut	Cocos Nucifera
Banyan	Ficus Benghalensis
Sandalwood	Santalum Album
Mango	Mangifera Indica
Ashoka	Saraca Asoca
Gulmohar Tree	Delonix Regia
Tamarind	Tamarindus Indica
Jackfruit	Artocarpus Heterophyllus
Babul Tree	Vachellia Nilotica
Amla Tree	Phyllanthus Emblica

FAUNA

A number of endangered animals live in the forests of the Dooars (a montane forest of Northern West Bengal), like Bengal tiger and rhinoceros. Other animals are Indian elephant, chital (spotted or axis deer), sambar, Indian muntjac, White-bellied musk deer, and many more. Its areas of protected places cover 4% of the State area. Forest makeup 14% of the geographical area of West Bengal, which is lower than the national average of 23%. West Bengal has a wide variety of fauna, including Bengal tigers, Indian leopards, sloth and Himalayan black bears, chital and sambar (deer); etc, are there. A huge montane forest, Dooars is situated in the Northern West Bengal districts of Alipur Duar, Darjeeling and Kalimpong. Part of the world's largest mangrove forest, Sundarbans, is located in southern West Bengal. There are 6 national park and 15 wildlife sanctuaries in West Bengal.

TIGER

MONKEY

COW

COCK

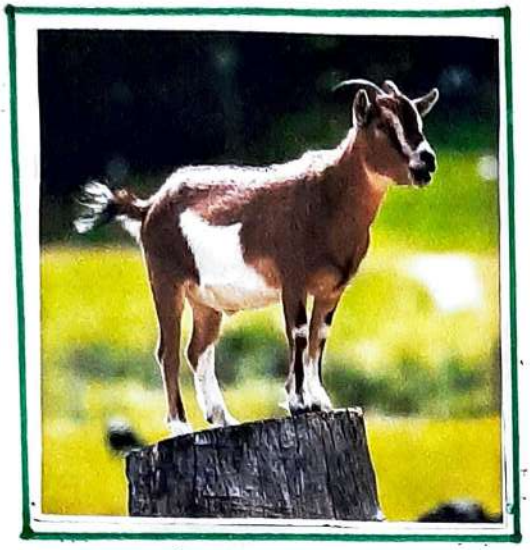
EAGLE

PIGEON

SPARROW

CROW

DOG



GOAT

RAT

CAT

Common Name	Scientific Name
Tiger	Panthera Tigris
Monkey	Simiiformes Catarrhini
Cow	Bos Taurus
Cock	Gallus Gallus Domesticus
Eagle	Accipitridae
Pigeon	Columbidae
Sparrow	Passeridae
Crow	Corvus
Dog	Canis Lupus Familiaris
Goat	Capra Aegagrus Hircus
Rat	Rattus
Cat	Felis Catus

TYPES OF BIODIVERSITY

Biodiversity deals with the degree of nature's variety in the biosphere. This variety can be observed at three levels; the genetic variability within a species, the variety of species within a community and the organisation of species in an area into distinctive plant and animal communities constitutes ecosystem diversity. There types of biodiversity are :-

SPECIES DIVERSITY- The number of species of plants and animals that are present in a region constitutes its species diversity. This diversity is seen both in natural ecosystems and in agricultural ecosystems. Some areas are more rich in species than others. Eg : Natural undisturbed tropical forests have a much greater species richness than plantations developed by the Forest Department for timber.

ECOSYSTEM DIVERSITY – Ecosystem diversity can be described for a specific geographical region, or a political entity such as a country, a State or a district. Distinctive ecosystems include landscapes

such as forests, grasslands, deserts, mountains, etc, as well as aquatic ecosystems such as rivers, lakes and the sea. Each region also has man-modified areas such as farmland or grazing pastures. An ecosystem is a community of living organisms (biotic) along with the non-living components (abiotic) of their environment, interacting as a system. These biotic and abiotic components are linked together through nutrient cycles and energy flows.

GENETIC DIVERSITY — Genetic diversity is the variation in the genetic composition among individuals of a population, a species, an assemblage, or a community. Diversity on a genetic level is a reflection of the similarities and differences in the genes (segments of DNA on chromosomes) of individuals. These variations can evolve as a result of many different processes, such as mutation and physical or behavioral isolation of populations. It is one of the four of the components of Marine Biodiversity; the three other components are Ecosystem diversity, Species diversity and Functional diversity.

CONSUMPTIVE USE VALUE

The direct utilisation of timber, food, fuelwood, fodder by local communities. The biodiversity held in the ecosystem produce products provided by forest dwellers with all their daily needs, food, building material, fodder, medicines and a variety of other products. They know the qualities and different uses of wood from different species of trees and collect a large number of local fruits, roots and collect a large number of local fruits, roots and plant material that they use as food, construction material that they use as medicines as well. Fisherfolk are highly dependent on fish and know where and how to catch fish and other edible aquatic animals and plants.

PRODUCTIVE USE VALUE

The biotechnologist uses biorich areas to "prospect" and search for potential genetic properties in plants or animals that canbe used to develop better varieties of crops that are used in farming and plantation programs or to develop better varieties of crops that are used in farming and plantation programs or to develop better livestock. To the pharmacist, biological diversity is the raw material

from which new drugs can be identified from plant or animal products. To industrialists, biodiversity is a rich store-house from which to develop new products. For the agricultural scientist the biodiversity in the wild relatives of crop plants is the basis for developing better crops.

Genetic diversity enables scientists and farmers to develop better crops and domestic animals through careful breeding. Originally this was done by selecting or pollinating crops artificially to get a more productive or disease resistant strain. Today this is increasingly being done by genetic engineering, selecting genes from one plant and introducing them into another. New crop varieties (cultivars) are being developed using the genetic material found in wild relatives of crop plants through biotechnology.

Even today, species of plants and animals are being constantly discovered in the wild. Thus these wild species are the building blocks for the betterment of human life and their loss is a great economic loss to mankind. Among the known, species only a tiny fraction have been investigated for their value in terms of food, or their medicinal or industrial potential. Preservation of biodiversity has now become essential for industrial growth of economic development.

SOCIAL VALUE

While traditional societies such which had a small population and required less resources had persue to preserved the biodiversity of life supporting resource, modern man has rapidly depleted it even to the extent of tending to the irreconerable loss to the extinction of several species.

ETHICAL AND MORAL VALUES

Ethical values related to biodersity conservation are based on the importance of protecting all forms of life. All forms of life have the right to exist on earth. Man is only a small part of the Earth's great family.

OPTION VALUE

Keeping future possibilities open of their use is called option value. It is impossible to protect which of our species or traditional varieties of crops and domestic animals willbe of great use in the future.

AESTHETIC VALUE

Biodiversity preserve wildlife from killing.

CONCLUSION

The biodiversity of West Bengal is vast. The famous Royal Bengal tiger that stalks the prey with legendary cunning in the Gangetic delta of famous Sunderbans. The forest of this state has a rich assemblage for diverse biological and vegetation designated with the help of eight different forest types. The diverse fauna and flora of West Bengal possess the combined characteristics of the Himalayas, sub-Himalayan and Gangetic plain. Diversity is further reflected in different types of ecosystem available here like mountain ecosystem of the north, forest ecosystem extending over the major part of the state, freshwater ecosystem, semiarid ecosystem in the western part, mangrove ecosystem in the south and coastal marine type of climate along the shoreline.

BIBLEOGRAPHY

There are many spheres from which I have taken information. They are :-

- Internet.
- ENVS study material from google classroom
- Book - Environmental Studies by Mahua Basu. (Fundamentals of Environmental studies.

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3. SOLID WASTE MANAGEMENT: CAUSES, EFFECTS & CONTROL MEASURES OF URBAN & INDUSTRIAL WASTE
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INTRODUCTION

Pollution is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals and human beings. The changes in the physical, chemical and biological characteristics of air, water or land that may or will harmfully affect human life or that of various species, the industrial processes, living conditions and cultural assets. This occurs when only short-term economic gains are made at the cost of the long-term ecological benefits for humanity. No natural phenomenon has led to greater ecological changes than have been made by mankind. During the last few decades we have contaminated our air, water and land on which life itself depends with a variety of waste products.

Pollutants include solid, liquid or gaseous substances present in greater than natural abundance produced due to human activity, which have a detrimental effect on our environment.
The nature and concentration of a pollutant determines the severity of detrimental effects on human health. An average human requires about 12 kg of air each day, which is nearly 12 to 15 times greater than the amount of food we eat. Thus even a small concentration of pollutants in the air becomes more significant in comparison to the similar levels present in food. Pollutants that enter water have the ability to spread to distant places especially in the marine ecosystem.

From an ecological perspective pollutants can be classified as follows:
Degradable or non-persistent pollutants: These can be rapidly broken down by natural processes. E.g.: domestic sewage, discarded vegetables, etc.
Slowly degradable or persistent pollutants: Pollutants that remain in the environment for many years in an unchanged condition and take decades or longer to degrade. E.g.: DDT and most plastics.

Non-degradable pollutants: These cannot be degraded by natural processes. Once they are released into the environment they are difficult to eradicate and continue to accumulate. E.g.: toxic elements like lead or mercury.

The sources of pollution caused by man-made actions can be grouped under four categories.
Mobile transport: motor cars, motor bikes, aircrafts, ships, vapourization of gasoline.
Stationary/immobile combustion: domestic, business sources, steam power-driven and thermal power plants.
Factories and industry processes: metal and non-metal extractions, paper and pulp, oil refineries, synthetic chemicals, food processing industries.
Disposal of solid wastes: domestic and mercantile refuse, refuse from coal combustion, burning of agricultural refuse.

AIR POLLUTION

Types of air pollution

Indoor air pollution: It is caused by burning of wood, animal dung, agricultural residues and coal used for food preparation and heating within the closed walls. Most of the victims of indoor pollution are women and girls, who owe the prime task of cooking and tending the home.

Outdoor air pollution: Industrial enterprises and automobiles are primary sources of atmospheric (outdoor) pollution. Increasing industrialization and urbanization has created growing demands to use the outdoor atmosphere as a medium of waste disposal.

SOURCES OR CAUSES OF AIR POLLUTION

A. Natural sources:

The atmosphere is polluted due to various natural processes, some of which are wind-blown dust, smoke, fly ash, gases from forest fires, gases and odours from swamps and marshes, pollen, fungi spores from microorganisms, salt spray from the ocean, fog in humid low-lying areas, anaerobic decomposition of organic matter, atmospheric reactions and natural terpene hazes from pine trees in mountainous region. Volcanic eruptions release great amount of sulphur dioxides. Anaerobic decomposition of organic matter generates methane gas which upon oxidation in the air gives out carbon monoxide. Organic substances decay to produce stinking gases like H2S too. Photo oxidation of marine organic substance and biological oxidation by oceanic organisms generates carbon monoxide on the ocean surface which diffuses in the air.

B. Anthropogenic or man-made sources:

Along with natural pollutants, there are pollutants of anthropogenic origin too. Bulk of the air pollution sources are linked to anthropogenic activities, an endowment of

modern lifestyle. The multiple use of fossil fuels for transportation in vehicles, for industrial uses, for conservation of energy, for heating and for cooling as well as the treatment of industrial and municipal wastes, all add to air pollution.

Domestic: Coal combustion generates enormous amount of, smoke, soot, dust, CO, SO2, NOx. However burning of LPG releases fewer amounts of pollutants comparatively.

Automobiles: Motor vehicles play an important role in air pollution (automobile emission).

C. Industries:

i. Fertilizer plants - They generate sulphur oxides, nitrogen oxides, hydrocarbons, PM and fluorine.

ii. Thermal plants - fly ash, soot, SO2, CO, NOx.

iii. Textile industries - cotton fibres and dust, NOx, chlorine gas, naphtha vapours, smoke and SO2.

iv. Steel plants and metallurgical operations - carbon monoxide, carbon dioxide, sulphur dioxide, phenol, fluorine, cyanide, particulate matter, copper, lead, zinc etc.

v. Petroleum - Fossil fuels include petroleum and coal; emission are mainly sulphur dioxide. Additionally, carbon monoxide (CO), carbon dioxide (CO2), nitrogen oxides, hydrocarbons, particulate matter and traces of metals are produced.

vi. Paper and pulp - PM, SO2, H2S, methyl mercaptan.

vii. Food processing - often releases dimethyl sulphide and various types of odour.

D. Agriculture - mainly pesticides and herbicides like chlorinated hydrocarbons, phosphates, nitrates etc.

EFFECTS OF AIR POLLUTION

Global Warming: The term 'greenhouse gases' refers to the atmospheric gases that absorb the spectrum and emit them back within the thermal range of infrared radiation. These gases can significantly affect the global temperature. CO_2, water vapour, methane, CFCs and nitrous oxide are such greenhouse gases. They trap solar radiation, which ultimately leads to an increase in the surface temperature of the Earth. This is known as greenhouse effect. The temperature keeps on rising due to pollution and the increasing concentration of greenhouse gases. This is referred to as global warming.

Photochemical smog: Under suitable conditions smoke and sulphur dioxide (burning of coal) combined with fog to produce industrial smog. It can be extremely poisonous to humans and other living organisms. Burning of fossil fuels like petroleum and diesel can produce photochemical smog. It is a situation occurring when the primary pollutants like NO_2 and VOCs react in presence of sun rays, forming a mix of many diverse and harmful chemicals known as secondary pollutants.

CONTROL OF AIR POLLUTION

A. At source: (in the industries)

Raw material substitution such as replacing of high sulphur containing fuel with low sulphur fuels, substituting toluene for benzene, titanium for lead and calcium phosphate for beryllium.

Process modification: Pollution reduction can be achieved by new or modified processes. Dipping process instead of spraying can be implemented.

Equipment alterations: Newer types of equipment that are less pollution-prone, can cut down air pollution.

Removal of pollutants at source: Using of air pollution control devices such as cyclones, scrubbers, electrostatic precipitators, bag house fabric filters plays a vital role in controlling of air pollutants at source.

B. In vehicles:

Discarding of old vehicles: The car companies should sell or dispose of technologically obsolete vehicles.

Catalytic converters: Catalytic converters are fitted between the engines and the tail pipe, and convert most of the exhaust into less damaging gases via a chemical reaction.

Improving fuel quality: The quality of fuel used in automobiles is also an important factor in curbing air pollution.

Unleaded petrol: Unleaded petrol is where lead has been removed from the petrol by adding aromatic compounds.

Alternative fuels: Alternative fuels like ethanol, methanol, CNG, LPG highly reduces air pollution. Even bio fuels like biodiesel or soy diesel play a vital role in curbing air pollution.

Efforts are made for developing and popularizing electric vehicles.

Fuel cells: The hope of the future are vehicles where hydrogen reacts with oxygen to produce electricity in a cell. It's only by-product is water vapour.

Vehicular emission check: Continuous checking of vehicular emission for permissible limits and Pollution Under Control (PUC) certificates, strict enforcement of law and periodical survey of the emission control equipment is absolutely necessary for controlling air pollution.

C. Legal and policy measures:

The government must impose taxes and levies on industrial units that contribute to maximum level of air pollution. The government has enacted the Air Act, 1981 and EPA, 1986.

D. Green vegetation:

To reduce the spreading of air pollutants emanating from industrial sources, growing green vegetation around the industry has been recommended by scientists.

The neem tree is reported to be helpful in checking atmospheric pollution caused by vehicular and industrial emission.

WATER POLLUTION

Types of water pollution

A. Based on water bodies:

Surface water pollution - The most evident type of water pollution affects surface waters like huge oceans, lakes, rivers and streams.

Groundwater pollution - Water that is stored in underground in aquifers is the groundwater. Fertilizers applied in the fields often seeps into the soil and contaminate the waters.

B. Based on source:

Point source - If pollutants are discharged from one place or spot, the pollution from such a source is known as point source pollution.

Non-point source - A prodigious amount of water pollution also happens from variety of speckled sources. This is called non-point source pollution.

C. Based on chemical composition:

Soft water - water with little or no dissolved salts of magnesium and calcium.

Hard water - In contrast to soft water, hard water has high mineral

content. It primarily consists of calcium (Ca^{2+}), and magnesium (Mg^{2+}) metal cat ions, and dissolved compounds such as bicarbonates and sulphates.

SOURCES OF WATER POLLUTION

A. Domestic: Domestic sewage is wastewater generated from the household activities. Organic materials are food and vegetables waste, excreta, faecal matter whereas inorganic materials such as phosphates and nitrates come from soaps and detergents. Usually people have a habit of dumping household wastes in the nearby water source, which leads to water pollution. Sewage carries industrial contaminants and an increasing tonnage of paper and plastic refuse.

B. Agriculture:

i. Pesticides: Any chemical utilized in controlling pests is a pesticide. It can be in the form of insecticides, fungicides, herbicides,etc. Pesticides can cause a number of diseases like lungs malignancy, chronic liver damage, cirrhosis and chronic hepatitis, hormonal and gonadal disorders, immune-suppression, cytogenic effects, breast cancer, polyneuritis,etc.

ii. Biological insecticides: Entomo-pathogenic fungi, nematode and virus are effective bio-insecticides.

C. Industries:

i. Mining industries: The process of extraction of minerals exposes heavy metals and sulphur. The act of rainwater on the tailings contaminates the freshwater bodies. Cyanide is deliberately dispensed on mines piles in the gold mines for the extraction of gold contaminate the close by water.

ii. Oil refineries: Oil spill is a leading issue in the aquatic system. Oil seeps from the oil tankers and offshore oil refineries into the water. It kills aquatic animals and plants and disturbs the ecosystem balance.

iii. Radioactive waste: High concentrations can be lethal, whereas

low concentrations of radioactive substances can cause malignancy and various forms of sickness.

D. Rain drainage: Rain drainage carries substances like highway debris, oil, chemicals from vehicular exhausts, sediments from public road and house construction, acids and radioactive wastes into the freshwater systems as well as into marine systems. Animal waste, chemicals, Pesticide and fertilizer residues also add to aquatic pollution via rain drainage.

EFFECTS OF WATER POLLUTION

Eutrophication - It refers to the enrichment of freshwater bodies by inorganic nutrients like nitrates, phosphates which may occur naturally but more readily as the result of human activity. A eutrophic water body has high primary productivity due to excessive nutrients and hence favours the growth of algal blooms resulting in poor water quality.

Bioaccumulation is the accretion of substances like pesticides, metals and various organic compounds into the body of living organism over a period of time. This can occur either because the chemical gains entry faster than it can be utilized, or because the chemical cannot be metabolized by the organism.

Bio concentration is a more precise term that refers to uptake and accumulation of a chemical substance from water alone.

Bio-magnification, also known as bio-amplification or biological magnification, on the other hand is the amplification in concentration of a substance up the trophic level. This occurs in a food chain as a result of it being persistent; energetics of food chain; and low rate of internal metabolism and excretion of the substance.

Biological pollution of water or water-borne diseases are caused by pathogens. Microbes can also be the source of food-borne diseases through consumptions of contaminated food. Amoebiasis, Cryptosporidiosis, Cyclosporiasis, Giardiasis, Microsporidiosis are the most common water-borne diseases.

Occupational health hazards

A. Itai-itai disease: It was produced by cadmium poisoning and was characterized by severe pains in joints and vertebral columns.
B. Chisso-Minamata disease: The root cause of such disease is mercury poisoning.
C. Blackfoot Disease (BFD): It is an endemic disease and is caused due to arsenic toxicity.
D. Methaemoglobinemia - Excess release of nitrates from fertilizers enters the human body and are transformed into nitrites which reacting with blood haemoglobin forms methaemoglobin. It deprives the body's oxygen supply. The syndrome is called blue baby syndrome.

CONTROL OF WATER POLLUTION

Awareness - Creating mass awareness is the foremost step towards preventing and controlling water pollution. Many NGOs have campaigned against over harvesting of fish and pleaded for tough penalties against the industries and factories dispensing effluents in the water bodies.

Legislation - The countries that suffer has stringent environmental legislation and elevated environmental standards. The environmental laws make a situation difficult for the people to foul, but it is more difficult to make such laws practically operative as they need to be implemented across national and international borders.

The GOI has enacted the following legislations:

The Water (Prevention and Control of Pollution) Act, 1974 further amended in 1988.

The Water (Prevention and Control of Pollution) Cess Act, 1977, last amended in 2003.

Economics - Most environmentalists have the opinion of tackling pollution through the polluter pays principle as stated in Rio Declaration.

In 1993, WHO had given the guidelines for potable water standards; this acts as an international reference point for setting the standards and safety for potable water.

SOIL POLLUTION

When the natural soil is contaminated by xenobiotic (man-induced) chemicals, the result is soil pollution.

CAUSES OF SOIL POLLUTION

A. Coal ash: The ash generated by burning coal, primarily in thermal power stations is one of the major causes of land pollution. The lead and zinc from the coal slag causes miseries to the ecosystems and serious health hazards to the humans.

B. Sewerage: The contamination of groundwater by untreated sewerage and the effect they have on the land is of serious concern. Treated sewerage, often termed as sludge is used as fertilizer, carries a number of heavy metals and contaminants and has a long-term detrimental effect on the land.

C. Pesticides and herbicides: Intense cultivation has forced to use more chemical fertilizers and bio-engineered introduction leading to drastic falls in crop yields, the cropping pattern and ultimately to the carrying capacity of land, making them barren.

EFFECTS OF SOIL POLLUTION

Erosion - Soil erosion can be defined as the movement of surface litter and topsoil from one place to another. Human activities such as farming, construction, overgrazing by livestock, burning of grass cover and deforestation accelerates soil erosion. It affects the fertility of soil and also leads to loss of aquatic life.

Excess salts and water - Irrigation water contains dissolved salts and the accumulation of these salts is called salinization, which stunts plant growth, lower yields and eventually kill the crop and render the land useless for agriculture.

CONTROL OF SOIL POLLUTION

Continuous contour trenches can be used to check soil erosion.

Gradonies can also be used to convert waste-lands into agricultural lands.

Live check dams which barriers created by planting grass, shrubs and trees across the gullies can be used for this purpose.

A bund constructed out of stones across the stream can also be used for conserving soil and water.

An Earthen checkbund is constructed out of local soil across the stream to check soil erosion and flow of water.

A Gabion structure and an Underground bandhara functions as barrier to check the ground water movement.

MARINE POLLUTION

CAUSES OF MARINE POLLUTION

Toxic organic and inorganic chemicals including heavy metals and radioactive wastes are discharged in to the oceans and seas from the industries and factories located along the coastal regions that may alter the pH and composition of the water at the point of discharge. The sewage from the municipal wastes and agricultural runoff containing pesticides and fertilizers also gains entry into the marine waters.

Climate change, global warming and the windblown dust increase the crisis of the marine environment.

EFFECTS OF MARINE POLLUTION

Discarded fishing nets or fishing nets lost in the ocean entangle the marine animals. Life on sea is threatened from ingestion of plastic which cause suffocation or even death.

The toxic chemicals from the industries, farmland and municipalities acts as endocrine disruptors.
Oil spills have devastating effects and are extremely difficult to clean up.

CONTROL OF MARINE POLLUTION

Eating sustainably; Do not throw away plastic goods. Keep the beaches clean; Ban all types of developmental activities along the coast. Run off from pollution sources and sewage effluents should not be allowed in the marine water. Spread awareness in the community and go for eco-friendly option to lessen damage to marine ecosystem. Response mechanisms are employed for controlling oil spill.

NOISE POLLUTION

SOURCES OF NOISE POLLUTION

A. Natural sources:

The natural sources for noise pollution are thunder, earthquakes and loud volcanic eruptions.

B. Anthropogenic (man-made sources)

i. Industrial source: Various machine in different factories,

industries and mills generate noise.

ii. Transport noise (traffic noise): Hooting of trains creates strain on ear, Air traffic noise caused by speeding jet aircrafts damage human hearing permanently. Mechanized automobiles like motors, scooters, cars, motorcycles, buses, trucks, sirens of ambulance and fire engines produce tremendous noise pollution.

iii. Neighbourhood noise: Shrieking of loud speakers at the place of worship or during festivals. The reckless use of household gadgets are also responsible for causing noise pollution.

EFFECTS OF NOISE POLLUTION

A. Auditory impacts: Hearing loss, Acoustic trauma and Tinnitus.

B. Non-auditory impacts: Speech interference and sleep interference. Physiological effects on human beings, nervous breakdown, tension and even insanity. It affects health efficiency and behaviour. It affects the pregnant women. It causes bickering, loss of working efficiency, ill temper and violent behaviour.

C. Impacts on human properties: The non-living things undergo physical damages.

CONTROL MEASURES

A. Source level control: Substitution of highly noise-generating machines with quieter machines, usage of vibrations isolated mountings, reduction of external surface of vibrating parts.

B. Path level control through modification: Modification of the path along which the noise is propagated is highly effective in noise control.

C. Receiver level control: 'Ear-plugs' which can protect the receiver against noise pollution. Job rotation of the worker can restrict the exposure to hazardous noise level.

D. Buffer zones by green cover: Trees are capable of absorbing enormous amount of noise.

E. Government control methods: Banning the use of horns, loudspeakers, bursting crackers in and around educational institutions, hospitals and wild life sanctuaries and national parks. Imposing huge fine on vehicles generating noise (Environmental Protection Act, 1986 and Motor Vehicles Act, 1988).

THERMAL POLLUTION

SOURCES

Heat from thermal power plants, nuclear power plants, iron and steel refineries,etc.

EFFECTS

It kill the flora and fauna, alters the metabolic activities of several organisms; hampers the migration, breeding and spawning of fishes. It decreases dissolved oxygen content of water and affects physical, biological and chemical characteristics in a water body. The elevated temperature may change the solubility of the pollutants in water.

CONTROL

Use of cooling ponds, spray ponds or cooling towers.

NUCLEAR HAZARDS

CAUSES

Cosmic rays; nuclear radiation for example, radon; nuclear fuel production; nuclear power plants; use of radionuclides in industries and domestic sources like television; nuclear disposal; uranium, thorium and plutonium mining; and diagnostic purpose - iodine.

EFFECTS

Radioactive substance can cause damage to sensitive regions, such as the skin, gonads, and intestine. It can damage DNA and RNA, proteins which may cause cancer and congenital defects. Gases and particles produced by the radioactive materials can be carried by the wind and the rain as nuclear fallout. Radioactive materials contaminating the land and water adversely affect the aquatic animals. They are absorbed by plants and ultimately enter the food chain.

SOLID WASTE MANAGEMENT

CAUSES OR SOURCES

Domestic - Kitchen residues, paper, plastics, garbage, ashes, glass and metals from the residences and accommodations.
Industrial - Hazardous wastes, food wastes, old machine parts, packaging materials and fibre from the food processing industries, construction sites, chemical plants, tanneries and garment factories.
Commercial - Paper, glass, food waste, ashes, discarded spare parts and organic wastes from stores, business premises, restaurants, markets, fruit vendors, hotels and motor repair shops.
Agricultural - Bio-degradable components from dairies, poultry farms, livestock and other agricultural wastes including vegetable and fruit cultivation.

EFFECTS

Groundwater contamination by leaching; Offensive odour and outbreak of vectors, carriers, pests, rodents; Production of inflammable gases like methane; Surface water contamination by the run-off; Erosion problems in places with slopes; Epidemics through stray animals; Change of pH, like acidity; Greenhouse gas emission.

CONTROL MEASURES

A. Waste generation: These are the materials that are indentified to be no longer valuable.
B. Waste handling, categorization, storage and processing at the source: This involves the actions related with management when the wastes are first kept in storage containers for the purpose of collection. Waste handling also comprises the transit of truckload to the collection venue. Categorization of the waste ingredients is the most important step towards handling and stockpiling of waste at source.
C. Collection and transportation: The step involves assembling the solid residue and recyclables in the collection vehicles to the site to empty it. The emptying site can be a dispensation centre, a landfill dumping site or a transfer spot.
D. Segregation, dispensing and transformation: Segregation of wastes is generally done in the recovering sites, transfer stations and dumping places. Waste can be separated by size, manual separation, and separation of ferrous from non-ferrous metals. Organic content can be transformed biologically or thermally; often aerobic composting and incineration are used as biological and thermal control methods respectively.
E. Transfer and transport: This comprises the relocation of waste materials from the smaller collection vehicles to the large transport system. They are then subsequently transported over longer distances to the place of disposal or processing.
F. Disposal: The scientific disposal of garbage can follow various technologies like incineration, landfilling, pyrolysis, composting,

biomethanation, pelletization, etc.

ROLE OF INDIVIDUALS IN POLLUTION PREVENTION

A. The Power Saver Mode - all devices have in built 'power saver mode' that automatically gets turned off when left unused for a chosen period of time. Switch on to the mode and there would be an unbelievable and drastic reduction in energy consumption.

B. Unplug and switch off - once the charging is over, people simply jack off their gadgets, not switching off the power source which culminates into a huge loss of energy. Be responsible, switch off.

C. Turn off the tap - the amount of water we waste is humongous. By being water savvy, by turning on the tap for just the amount we need and by curbing wastage, we can all make a huge difference.

D. People should use their own tea or coffee mug - every time people have a cup of tea or coffee, they are either supporting the destruction of rainforests (paper cups are made from wood pulp sourced from trees) or adding to heaps of plastic waste.

E. Hold that print - don't press that print button for every mail that one gets. Try to read from the screen. By printing, one is contributing to the denudation of trees.

F. Pool resources - people should use public transportation as frequently as they can. It is good for one's health and for the health

of the planet. As more the people walk the less energy they use.

H. Plant a tree - Plant a tree and water it regularly.

I. Switch to energy saving devices - Switch over to energy compliant devices. They may cost a little but effective over the long run.

J. Spread the word/ embrace green products - There are many products that are recycled or eco-friendly. Try embracing them or spread the word.

POLLUTION: CASE STUDY OF OUR LOCAL AREA

Chandannagar , a city in the Hooghly district of West Bengal, located on the western bank of Hooghly River, was a former French colony of India. Though the town is situated in the greenery with natural water bodies like ponds and far away from intensely polluted areas like metropolitan Kolkata and industrial Howrah, still due to the increase in the demographics of the area and the constant development or urbanization of the city leads to various types of pollution.

Air pollution is caused due to release of air pollutants, gases and smoke from the nearby jute mills like the Gondalpara Jute Mill and

the Samnugger Jute Mill. Fly ash or thermal ashes from the Bandel Thermal Power Plant also causes air pollution. With the increasing population of the city, the number of increase in automobiles and transportation has also lead to air pollution of the area.
Water pollution is caused in the area due to discharge of industrial wastes from the mills and factories. Dumping of domestic wastes like garbage from the locality into the Hooghly river or ponds also lead to water pollution. Wastes from sewage also gets discharged into the river causing severe pollution of water. Offerings to various pujas and festivals like Chhath and immersion of Jagadharti idols also add to water pollution of the area.
Soil pollution is caused due to the enormous pile of daily garbage and solid wastes from households, local markets, factories, agricultural lands, etc. Deforestation, excessive farming and accumulation of solid wastes also leads to soil pollution.
Noise pollution is caused due to the increase in automobiles and local transportation. The factories or mills also add to noise pollution. Festivals like Diwali and Jagadharti Puja also cause tremendous amount of noise pollution.

The Chandannagar Municipal Corporation has taken proper and adequate steps to check water pollution in the Hooghly river and ponds by stopping people to throw garbage into the river and water bodies. Daily collection of household wastes and their management has been necessary in reducing pollution. The Chandannagar Police Commissionerate has tried to curb the pollution of the area by declaring the Chandannagar Strand Road locality constituting the French Institute Museum, the Sacred Heart Church and the Dupleix College currently known as Chandannagar Government College as a 'green zone'. Chandannagar Paribesh Unnayan Samity, a registered non-governmental organization is working in the field of Environment and natural resource management. It works towards

the promotion of sustainable development.

CONCLUSION

This Environmental Studies Project has been an educative and informative experience as it helps us students to understand as an individual to realise the environmental problems and responsibly taking steps towards an eco-friendly and sustainable community.

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